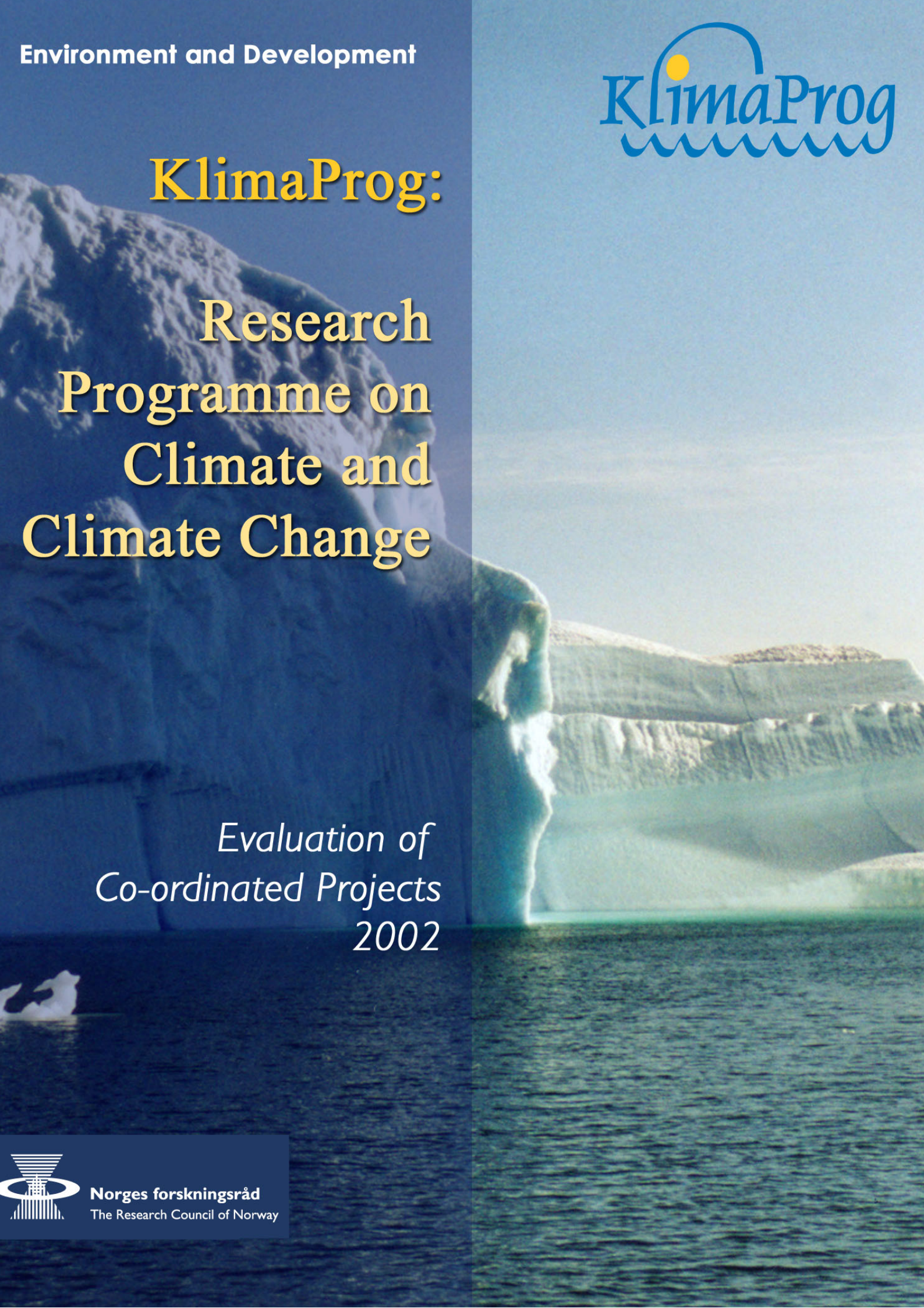
Environment and Development

KlimaProg

KlimaProg:

Research Programme on Climate and Climate Change

Evaluation of Co-ordinated Projects 2002



Norges forskningsråd
The Research Council of Norway

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The Research Council of Norway
P.O. Box 2700,
St. Hanshaugen
NO-0131 Oslo,
Norway

Phone: +47 22 03 70 00
Telefax: +47 22 03 70 01

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KlimaProg - *Research Programme on Climate and Climate Change* (2002-2011) is a continuation of the *Research Programme on Changes in Climate and the Ozone Layer* (1997-2001).

Overall objective

- KlimaProg shall ensure Norwegian climate research in natural sciences at the highest international level. The programme shall enable the researchers to conduct research leading to substantial research breakthroughs on at least three of the prioritised research challenges in the Programme Plan.

Specific objectives

- *KlimaProg* shall support targeted research on the prioritised research challenges outlined in the Programme Plan.
- *KlimaProg* shall ensure production of results that are applicable for research on effects of climate change as well a s for users in management, trade and industry.
- *KlimaProg* shall ensure a good national division of labour such that the best national expertise in the various research areas is utilised.
- *KlimaProg* shall ensure effective dissemination of results.
- *KlimaProg* shall ensure recruitment of talented climate researchers.

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Environment and Development

KlimaProg – *Research Programme on Climate and Climate Change*

Evaluation of the co-ordinated projects RegClim, NORPAST, COZUV and NOClim

Ulla Hammarstrand, Terje Mørland, Elin Dahlin (ed.)

http://program.forskningsradet.no/klimaprog

Norges forskningsråd

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Background

KlimaProg - Research Programme on Climate and Climate Change (2002-2011) is a continuation of the *Research Programme on Changes in Climate and the Ozone Layer* (1997-2001). Year 2002 represents a transition between the former and the current programme, and the majority of ongoing research projects end in 2002, including four large coordinated projects. To get a better basis for the planning and organisation of research activities in the coming four-year period, 2003-2006, the Programme Committee organised an evaluation of the coordinated projects in 2002. The results of this evaluation are described in this Evaluation Report.

Organising climate research in large coordinated projects was an innovative approach of the Programme Committee of KlimaProg's predecessor program, and projects have previously not been carried out in this manner within the Research Council of Norway. The intention with the coordinated projects has been to bridge research groups within priority research areas and stimulate joint work towards common overall research goals. Coordinated projects have been established in research areas where it has been considered likely that it would be both difficult and take more time to reach applicable results through a collection of small independent projects, and where one has seen potential for synergy effects between various disciplines through closer collaboration. Extensive exchange of tools, knowledge and results between the participating groups are meant to make the work as effective and successful as possible.

Frode Stordal

Chair of the Programme Committee

Summary

A main conclusion of the evaluation is that the coordinated projects have to a large extent been successful, and that important scientific results have already been delivered despite the relatively short period that most of the projects have been in operation. It is found that organised coordination between research groups in large projects has considerable advantages and should be continued within *KlimaProg*. As expected, given the innovative aspect of the coordinated projects, a considerable potential for improvements is identified. The evaluation panels have pointed to several areas were actions are needed to optimise the synergy and collaboration, as well as organisation of research tasks in and between the projects. The judgment of the evaluation panels differs between the various projects. Nonetheless, many important conclusions and recommendations are common for all projects:

- The funding generally covers too many tasks and groups. Each project should concentrate on fewer tasks.
- The projects are organised in a very democratic fashion. The Programme Committee should consider measures to give the leaders, and thereby the projects as a whole, more support when hard decisions/priorities must be made.
- The number of reports and applications to be written by the projects is too large and takes too much time from the scientists research work. Simpler reporting procedures are needed.
- Funding periods have been too short. Coordinated projects have to be given periods of several years to be able to plan their work in an appropriate way and to work concentrated towards the given goals. Longer funding periods (3-4 years) are recommended.
- Future coordinated projects should include more recruitment positions.

General advantages and disadvantages with coordinated projects are listed in Table 1.

The overall results of the evaluation, as well as the individual results for each of the four projects are described in this report.

Table 1: General advantages and disadvantages with the coordinated projects

Advantages	*Disadvantages*
• practical and technical work can be optimised • syntheses and compilations of varied data sets are easier to achieve • modelling efforts can be more effective if the same models are used by several groups • competence and knowledge can be shared between the groups • the public outreach can be stronger.	• important new ideas and innovative break through seldom occur in large well organised projects, working towards predefined goals • the resources for each of the tasks can be too small to make it possible to undertake the research applied for • administrative work done by the project leaders is resource demanding.

1. Introduction

1.1 About the co-ordinated projects

During the years 1997-2000 the programme committee of *KlimaProg's* predecessor programme *Changes in Climate and the Ozone Layer* established four large co-ordinated research projects. The rationale for establishing these projects was to gather competence from different disciplines in focused projects where researchers from different institutions collaborate towards common objectives. Technically one institution and one project leader has been given the responsibility to co-ordinate the research activities and to distribute funds to the various sub-projects through sub-contracts with the other institutions involved in the project. The four projects differ in size and nature. The funding from the Research Council's climate programmes varies from about 2,5 mill. NOK to about 7 mill. NOK per annum. Own contributions from the involved institutions, mainly in the form of salaries to senior staff and use of infrastructure come in addition. Further, many of the scientists involved in the co-ordinated projects are also involved in other projects that scientifically overlap the co-ordinated projects. As a consequence, the total value of the research that is in some way or another linked to the co-ordinated projects is generally much higher than the contribution from the Research Council.

The co-ordinated projects have been established in problem areas where it has been considered likely that it would be both difficult and take more time to reach applicable results through a collection of small independent projects, and where one has seen potential for synergy effects between the various disciplines through closer collaboration. An additional rationale for establishing the projects has been that large projects of this kind has potential of becoming a national knowledge base that makes the research more visible and makes communication of synthesised and applicable results to authorities, other researchers and the general public easier.

The four co-ordinated projects that have been established are:

- *Regional Climate Development under Global Warming (RegClim)* with an overall goal to estimate, by statistical and dynamical methods, probable changes and uncertainties in the regional climate in Northern Europe, bordering sea areas and major parts of the Arctic given a global climate change. Processes determining sea-surface-temperature and sea ice cover in the Nordic Seas, and processes related to radiatively active atmospheric contaminants with a regional distribution (direct and indirect aerosol effects, and tropospheric ozone) are included in the project. The partners are DNMI, HI, NERSC, NILU, UiB and UiO, with DMNI as coordinator. Current funding period 010797-311202. Total funding from the Research Council: 34,8 mill. NOK.

- *Past Climates of the Norwegian region* (*NORPAST*), which investigates natural climate archives (including marine sediments, lake sediments, speleothems, glaciers etc.) from terrestrial and marine sites in the Norwegian region. A main objective is to identify patterns and frequencies of natural climate variability in this region and contribute to the understanding of the mechanisms behind this variability. The project is coordinated by NGU and include partners from UiB, UiT, NLH and DNMI. Current funding period 010199-311202. Total funding from the Research Council: 12,4 mill. NOK.

- *Co-ordinated Ozone and UV Project (COZUV*), which deals with changes in the stratospheric ozone layer and the UV radiation at the ground. It is aimed at studying processes leading to ozone depletion in the Arctic and at mid-latitudes during winter and

spring, improving predictions of the ozone layer due to climate changes and changes in ozone depleting substances, and understanding the distribution of UV radiation under different atmospheric conditions. The project is coordinated by NILU and includes contributions from UiO, NTNU and FFI. Current funding period 010199-311202. Total funding from the Research Council: 10,0 mill. NOK.

- *Norwegian Ocean Climate Project (NOClim), which* focuses on the stability, variability and monitoring of the Nordic Seas and the adjacent regions. Proxy climate parameters, instrumental observations are used to study the circulation and thermodynamics in the region. The institutes involved are DNMI, HI, NERSC, NP, UiB, UiT and UNIS, with UiB as coordinator. Current funding period 010700-311202. Total funding from the Research Council: 15,0 mill. NOK.

1.2 The need for an evaluation

KlimaProg and its programme committee has taken over the responsibility for all projects established under its predecessor programme *Changes in Climate and the Ozone layer*, and in 2002 71% of *KlimaProg's* total budget for science projects is allocated to the four co-ordinated projects. This class of projects is thus a major undertaking of the programme. In the new Programme Plan for the period 2002-2010 it is stated that co-ordinated projects should continue to be a major part of *KlimaProg*. Like most of the projects taken over from the former climate programme, the funding period for all the ongoing co-ordinated projects ends on 311202. In connection with the preparation of an action plan for the period 2003-2006 *KlimaProg* will consider continuation and possible restructuring of its project portfolio. To get a better basis for the planning and organisation of research activities in the coming four-year period the programme committee decided to initiate an evaluation of its co-ordinated projects.

1.3 About the evaluation procedure

The co-ordination of research from different disciplines and institutions into one joint effort has been a novel approach of organising Norwegian research, and to the evaluation panels' knowledge there are no direct counterparts in other countries. The first years have been a learning period for the scientists as well as for the programme committee, and we have now reached a stage where we can gather knowledge about how these large projects work, and how they should be planned and organised in the future. The evaluation was therefore designed not only to deal with the scientific content of the projects, but also with the way the projects have managed to co-ordinate research from different institutions and between different groups. The main focus has been on each co-ordinated project as a whole, but in order to do this the evaluation panels have also looked at the different sub-tasks. It should be emphasised that some projects have only been going on for a short period. Due to the long time lag between initiation of research activities and publication of results, this has strong implications especially regarding evaluation of scientific content and results. This fact has of course been taken into account by the evaluation panels and should also be born in mind by readers of this report.

The evaluation was undertaken in January and February 2002 by four separate evaluation panels, one for each of the co-ordinated projects. Each panel consisted of two external experts and one non-Norwegian representative from the programme committee, cf. Appendix A.1. The basis for each evaluation was an extensive progress report, a selection of publication (selected by the projects) and the original project descriptions. In addition the panels were given the opportunity to ask for any other material they might find necessary and also to undertake interviews. The four panels were given the exact same mandate for the evaluation, cf. Chapter 1.3.1, but quite reasonably they still had different ways to approach their tasks, and the resulting evaluation

reports differ in content as well as in appearance. The evaluation reports also reflect the large differences between the projects, most of all the duration of the projects; from a little more than a year (NOClim) to more than four years (RegClim). The individual evaluation reports are presented in Chapter 3.

Following the completion of the individual project reviews, a common synthesis group consisting of the representatives of the programme committee in each evaluation panel met to prepare an overall synthesised and harmonised summary of major conclusions and recommendations. The common summary report is presented in Chapter 2.

The projects were given the opportunity to comment on possible mistakes and misunderstandings in the individual evaluation reports. Direct mistakes have been corrected for in the individual evaluation reports, and the synthesis group has considered the more general remarks when preparing the common summary report (Chapter 2). The projects' comments to their respective individual evaluation reports can be found in Appendix 2.

1.3.1 Mandate of the evaluation panels

The four evaluation panels were given the following mandate, described in a letter dated 21 December 2001:

The panel is asked to write an evaluation report, preferably not exceeding 10 pages, addressing the following issues:

- Scientific results obtained through the project and contribution to advancement of the field. Please comment on each tasks and the project as a whole.
- The accomplishment of the project with respect to the goals, sub goals and milestones that were announced in the project plan. Please comment on each tasks and the project as a whole.
- Publication record (scientific publications) with respect to quality, number and in relation to available resources. Please comment on the specific tasks where appropriate.
- Public outreach efforts with respect to plans and in relation to available resources.
- International collaboration.
- If appropriate, recruitment of new scientist to the field through doctoral and post doctoral fellowships.
- Internal and external relationships within the project. The evaluation committee's views on the following issues would be particularly useful for the programme committee when planning and organising the continuation of this research:
    - Has this way of organising research (as opposed to providing smaller grants to individual researchers/institutions) aided advancement within the field?
    - If relevant, to what degree are some tasks more important and central than others. Could some tasks with advantage have been organised outside the project?
    - The project's relationship to, collaboration with, and division of labour with the other coordinated projects organised by the programme.
    - Recommendations for the future. How should research in this area be organised in the future? On the basis of the above, any recommendations regarding both scientific content (continuity, new challenges etc.) and organisation (e.g. coordinated projects vs. individual smaller projects, division of labour between projects) of research in this area would be appreciated.

The deadline for finalizing the evaluation report was 14 February 2002.

2. Common summary and recommendations

This summary has been prepared by a synthesis group consisting of the representatives of the programme committee in each evaluation panel. Despite the fact that the four co-ordinated projects differ in nature and maturity, and that the project evaluations have been carried out by four separate panels, the evaluation panels agree on many essential points, and several important common conclusions and recommendations can be drawn. The main task of the synthesis group was to prepare an overall synthesis of major conclusions and recommendations with emphasis on elements common for all projects.

2.1 Summary of the evaluations

2.1.1 Brief summary of the individual evaluation reports

RegClim

The overall aims of the project are to estimate probable changes in the regional climate in Northern Europe, bordering sea areas and major parts of the Arctic, given a global climate change, and to quantify, as far as possible, the significance of regional scale climate forcing pertaining specifically to this region.

Achievements in relation to goals

The evaluation panel feels that RegClim has considerably strengthened Norwegian climate modelling research. Many parts of the project have produced research results that are internationally well visible and acknowledged. This is particularly true within the research areas statistical downscaling and radiative forcing due to greenhouse gases and aerosols.

Closer links between research groups in meteorology, oceanography and numerical modelling have been established. This is particularly true for the groups within Bergen. There seems to be less interaction between the scientific communities in Bergen and Oslo.

The original aims of the project have partly been achieved.

The dynamically based downscaling research has technically been successful, but there still remains much work to be done in the interpretation and use of results for impact studies. Future use of the model tools will potentially lead to a fulfilment of the goal. The evaluation panel is of the opinion that production of regional climate change scenarios, to be utilised by groups working with impact oriented research, is an important and central goal.

In order to reach the goals set out originally some re-organisation of the research activities is required. It is unclear how this re-organisation should be related to other large research projects funded by NFR.

Realism of the goals

The character of the main goals is such that they can never be completely fulfilled. They are relative and therefore also moved forward when new results from research become available. The more specific goals for the sub-tasks have mainly been achieved.

NORPAST

NORPAST's overall aim is to focus and co-ordinate Norwegian palaeoclimate research by developing multi-parameter stratigraphical records at a limited number of ocean and land key-sites along stratigraphically sensitive transects, by focusing on selected time periods, and by emphasising quantification in palaeoclimatology.

Achievements in relation to goals

The evaluation panel is of the opinion that NORPAST has put much effort into an integration of different research groups at Norwegian research institutes and universities and that the co-ordinated palaeoclimate project is now well established. As such, the project can be regarded as a novel approach representing most of the Norwegian terrestrial and marine paleoclimatic researchers as common platform internationally. Although a large number of publications have been finalised under NORPAST, most of these have emanated from earlier activities. The aims of the different tasks and sub-tasks could only be partly achieved and one of the major issues, i.e. age control and correlation between sites and different archives is not resolved.

Climate modelling has not yet been performed in NORPAST. It would have been very useful if contacts with the modelling community could have been established during an earlier stage to perform data-model comparison. A future project should involve or interact with modelling from the beginning.

The low funding has been a problem. As a result the limited resources have been divided by too many tasks and subtasks. Concentration on a few larger tasks, with goals central to the overall aims, the possibility to reach the goals would have increased.

Realism of the goals

The objectives of the individual tasks and sub-projects were set too high to be achieved given the short project period and the low amount of running costs and much effort had to be placed into obtaining financial support from other sources.

COZUV

The overall aims of the project are to increase the understanding and improve the quantification of processes leading to stratospheric ozone loss in mid- and high northern latitudes and to understand the related changes in the UV radiation. Modelling, measurements, and analysis are included to understand the present distribution of ozone and UV and to predict the future developments.

Achievements in relation to goals

In all of the nine tasks reasonable progress has been made and most milestones have been reached. Seen as individual projects the tasks are generally performing well and important results have been obtained in some of the tasks, although several of the tasks seem to be in a transition phase between the technical development of model or equipment and the scientific utilisation of these. However, the evaluation panel feels that the co-operative effort is too weak in particular between the UV and ozone tasks, but also in general between the modelling and observational parts.

Realism of the goals

The overall goals seem achievable and they are described to a reasonable level of detail.

NOClim

The overall objectives of the project are to contribute to understanding of rapid changes in the thermohaline circulation, ocean and ice processes related to climate, and mechanisms causing significant variability in the hydrography, circulation and ice cover, as well as to maintain time series for early detection of climate change in the Norwegian seas.

Achievements in relation to goals

Since the project has only been underway for about 1.5 years there are few scientific results at this stage, which is natural. The project appears to be largely going according to plan and in a satisfactory fashion.

Realism of the goals

As stated in the objectives, there are numerous, quite fundamental problems that should be solved in the study. The evaluation committee notes that a little too much was promised regarding the relatively few man-hours that are available for some of the tasks.

2.1.2 Summary of important common findings

General

A main conclusion of the evaluation is that the coordinated projects have to a large extent been successful, and that important scientific results have already been delivered despite the relatively short period that most of the projects have been in operation. It is found that organised coordination between research groups in large projects has considerable advantages and should be continued within *KlimaProg*. As expected, given the innovative aspect of the coordinated projects, a considerable potential for improvements is identified. The evaluation panels have pointed to several areas were actions are needed to optimise the synergy and collaboration, as well as organisation of research tasks in and between the projects. The judgement of the evaluation panels differs between the various projects. Nonetheless, many important conclusions and recommendations are common for all projects.

Achievements in relation to goals and realism of goals

Common for the main goals of the projects is that they are very ambitious and that the scientific objectives are hard to fulfil. They are goals to be worked towards rather than to reach within a given time period and with limited resources. Some of the milestones are more specific but may still be hard to reach. In this first period much of the results have to a large extent been of a technical nature than of direct scientific importance. Examples are that numerical models, measuring techniques and tools for analysing long data records have been developed. But important scientific results have also been produced in the projects that have lasted for several years.

Advantages and disadvantages with co-ordinated projects

The main purpose of the co-ordinated projects is that all groups within the projects should work towards the same overall goal and exchange tools, knowledge and results between the groups to make the work as effective and successful as possible. A large potential exists in the co-ordinated projects, but this potential is not yet fully utilised. Without close collaboration between the tasks, a co-ordinated project would not serve its purpose and individual tasks could rather be solved in independent projects or possibly within another coordinated project.

One obvious positive effect is that practical and technical work can be more effective if duplicate development can be avoided. An example is fieldwork that can be more effectively planned if several research groups work together, uses the same logistics and platforms. Such co-ordinated campaigns have been performed and are planned in the frame of NOClim.

Syntheses and compilations of various data sets are easier to develop since the groups, responsible for the different data sets, work closer together.

Modelling efforts can also be more effective if the same models are used by several groups; new model development, experience from running the models and evaluations can then be shared between the groups. This advantage has only partly been utilised since many of the sub tasks in the projects have been process-oriented and different models have been chosen as the optimal tools for the research.

Competence and knowledge could also be shared between the groups since the expertise in the large co-ordinated projects includes most or all Norwegian competence within the respective fields. This competence that comes from different institutions and all parts of the country are both multi- and inter- disciplinary. Examples of this can be found in both RegClim and NOCLIM where statistical expertise from one task has been utilised for statistical evaluations of results in other subtasks. There are also interesting multidisciplinary aspects such as joining sediment records with observational data (NOClim).

Public outreach is an area where a large project has much advantage over a small one. E.g. the successful press conference, arranged by RegClim in 2002, could not have been arranged by the participating groups separately. Neither can a permanent arrangement, such as the regular pages in Cicerone, be managed by a small research group.

There also exist disadvantages with the large projects. One is that the administrative work done by the project leaders is large. This is especially true when a lot of applications and reports have to be written and presented.

Another disadvantage may be that important new ideas and innovative break through seldom occurs in large well organised projects, working towards a predefined goal, but rather in small projects run by one or just a few scientists.

In a co-ordinated project, there may be tasks and research groups that are not as qualified as the others. Since the program committee handles and evaluates the application for a co-ordinated project as a unit, such tasks may get funding even if their standard is not high enough.

A co-ordinated project consists of several tasks and the ways the resources are divided between the tasks are usually an internal decision by the participating groups. With limited funding there is a risk that the resource for each individual task is too small to make it possible to undertake the research applied for. The task will therefore depend on funding from other sources to reach its goals. Under such circumstances it will also be difficult to finance PhD students or post docs.

The most important general advantages and disadvantages with coordinated projects are summarised in Table 1.

Table 1: General advantages and disadvantages with the coordinated projects.

Advantages	*Disadvantages*
• practical and technical work can be optimised • syntheses and compilations of varied data sets are easier to achieve • modelling efforts can be more effective if the same models are used by several groups • competence and knowledge can be shared between the groups • the public outreach can be stronger.	• important new ideas and innovative break through seldom occur in large well organised projects, working towards predefined goals • the resources for each of the tasks can be too small to make it possible to undertake the research applied for • administrative work done by the project leaders is resource demanding.

International contacts

The large projects have better possibilities to get good international contacts and also to be more visible in the international science community. E.g. by the EC, COZUV is seen as an important national program contributing to and being linked to stratospheric ozone research in Europe. Several international contacts have been established in the coordinated project, but there is a potential for further strengthening of international collaboration. NOClim was started as a result from Norwegian-UK agreement. RegClim has good contacts with both MPI-Hamburg and the Hadley Center and also takes part in a Nordic co-operation. Within the NORPAST project international cooperation is not very evident, but it is obvious that all NORPAST scientists have wide international contacts and collaborations and are involved in a number of international projects, which touch upon the objectives of NORPAST task groups.

The evaluation panels have also pointed to the almost unused possibility to have an international exchange of post doc fellows within the projects.

Publications

The research groups have been very active in publishing and there are many publications in well-known international scientific journals as well as popular articles in Cicerone, daily newspapers etc. The publication records are thus generally good but it is uneven and there are tasks and subtasks that have very weak records.

The evaluation panels have commented that it was sometimes hard, or even impossible, to judge the publication records of the projects since some of the listed papers are fruits of other projects where the same scientists have been involved. In some cases it is obvious that papers have been published a short time (less than a year) after the initiation of a project, in other cases the subjects are weakly linked to the project and seem to be part of other, related projects.

2.2 Recommendations

The evaluation panels generally find that organised co-ordination between research groups in large projects has great advantages and should be continued within KlimaProg.

The panel for NOClim recommends a continuation of the project. It has only lasted 1.5 year and has therefore not had any real possibility to produce scientific results but is well under way. The evaluation panel for RegClim recommends continued funding provided important remarks and recommendations in the evaluation report are taken into account. The NORPAST panel is slightly more critical and has more comments and suggestions for a possible continuation of the research organised as a co-ordinated effort in this area. The COZUV panel recommends a significantly more focused project with stronger efforts to solve the given tasks by co-operation.

It is important to identify the main area of each project and define its overall aim. The main goals are not necessarily achievable within the time period of the project but set a frame and give a vision of the area where the project belongs. In addition to this main goal it is recommended that the co-ordinated projects be given sub-goals that are more apprehensible and achievable within the time period and resources of the project. The sub-goals should be of help when organising the project, especially when resources are limited and have to be concentrated on central tasks. They will also be useful when progress is reported and evaluated.

It will be important to identify areas where scientific overlap may exist between the different co-ordinated projects and also other large projects and research groups. The program committee has to be attentive and act to make research as effective as possible in such areas. Moving tasks between the co-ordinated projects, creating new projects and closing old ones should be considered. If a co-ordinated project is finished the research activities can be continued as independent e projects or be a part of other large projects.

There seems to be too many models in use within the program. It is recommended that the number of models be reduced in order to ease the co-ordination of results across tasks and projects. There are also examples where the same models (CTM2, MICOM) are utilized by specific tasks in two or more co-ordinated projects. The possibility to re-organize the projects (move tasks) to make them more efficient should then be considered.

Problems arise when the limited resources of a project are divided into too many parts. Then there is little chance for anyone to concentrate on the work within the project and it also becomes impossible to have a PhD student financed within a sub-task. For some projects it would be better if the resources were concentrated to a smaller number of central tasks even if this implies that groups have to be excluded from the co-operation.

The project leaders sometimes have a difficult task keeping the projects together and make the different subgroups work together towards the common goal. Actions should be taken by the program board to give the leaders, and thereby the projects as a whole, more support when hard decisions have to be taken, for instance if the funding is reduced. One suggestion is that external advisory or steering bodies are established for the co-ordinated projects.

The number of reports and applications to be written by the projects is too large. It takes too much time from the scientists research work.

The groups have to be given periods of several years to be able to plan their work in an appropriate way and to work concentrated towards the given goals. Longer founding periods, 3-4 years, is therefore recommended.

There has been remarkable little recruitment within the co-ordinated projects. This is mainly a result of the fact that some projects were specifically asked to set aside the normal standard goals of recruitment in order to produce applicable results as rapidly as possible. Future co-ordinated projects should have a better balance between result-oriented research and capacity building by including more PhD students.

3. Individual evaluation reports

3.1 Evaluation report for *Regional Climate Development under Global Warming (RegClim)*

Summary

The evaluation panel feels that RegClim has considerably strengthened Norwegian climate modelling research. Many parts of the project have produced research results that are internationally well visible and acknowledged. Some project parts, however, have been less productive from a scientific point of view and a strengthening of the publication activity in these parts is required. The panel recommends future funding of Norwegian regional climate modelling activities provided that the critical remarks and recommendations in this report are taken into account.

General aspects

The RegClim project has considerably strengthened the Norwegian research network in the field of climate modelling. Closer links between research groups in meteorology, oceanography and numerical modelling have been established. Important research results, well recognised on the international research arena have been obtained. This is particularly true within the research areas statistical downscaling and radiative forcing due to greenhouse gases and aerosols. However, the original aims of the project,

1. Estimate a probable regional climate change over Northern Europe

and

2. Quantification of uncertainties.

have only partly been achieved. Only one example of a dynamically downscaled scenario is available while the statistical downscaling results are available for a 17 model ensemble in addition to the single scenario used for the dynamical downscaling. The dynamically based downscaling research has technically been successful, but there still remains much work to be done in the interpretation and use of results for impact studies. The first five years of RegClim should be viewed as a build up period where modelling tools are established and evaluated against present climate observations. Future use of the model tools will potentially lead to a fulfillment of the goals given above.

Publications

The project as a whole has a good publication record, many of the published papers have appeared in prestigious, internationally recognised scientific journals. There are, however, some tasks where publication of research results is not satisfactory. Please see the more detailed comments on each task separately (Enclosure). The ratio between peer reviewed publications, technical reports and conference abstracts is quite reasonable for the project as a whole. There is clear evidence of active conference participation and the number of conference presentations is quite adequate. For some tasks, however, peer reviewed publications are lacking or the publications quoted have very weak links to the goals of RegClim. It appears that some groups have been in other projects at the same time and have included publications that are more

relevant to these other projects. Some of the RegClim groups have had a significant impact on the most recent IPCC report, they are to be congratulated for this.

Public outreach

Even if the project was not originally charged with the task of having a high profile in public outreach, they have succeeded in creating considerable media attention around their research topics. They have been helped by the recent general interest in climate change questions, but their ability to respond properly to this opportunity is commendable. A large number of media interviews, newspaper articles and popular science papers have appeared. It seems that quite a number of RegClim scientists have taken part in these activities. The individuals involved are both senior scientists (for example T. Iversen, T.E. Nordeng and S. Grønås) as well as younger scientists (for example R. Benestad). S. Grønås has been very active in promoting and contributing to CICERONE, a widely distributed popular science magazine, while R. Benestad and others have taken a number of initiatives to write debate articles in the daily and weekly press.

International collaboration

The international collaboration is in general extensive. Contacts with the most prominent European climate research groups have been established and also on a Nordic basis there has been considerable co-operation. The joint Nordic paper on regional climate scenarios deserves to be mentioned. Some RegClim scientists have spent extended visiting periods abroad, T. Iversen worked at ECMWF in England and J.E. Kristjanssen at NCAR in the US. Both visits have resulted in joint research work of direct interest to RegClim.

The dynamical scenarios are only based on global simulations from one climate model, namely the ECHAM model from Hamburg. It would have been desirable to also have results from the Hadley Centre model and it appears that such investigations are planned for the future. It is also a bit surprising that RegClim is not actively involved in some recently started EU projects on regional downscaling, for example PRISM and PRUDENCE.

Recruitment

The recruitment to RegClim is almost exclusively from within the Norwegian research community. Postdocs from abroad have not been recruited actively, it rather appears that postdocs from Norway continue at the research institute where they obtained their PhD degree, employed with RegClim resources. We find this a bit surprising, in many other countries postdocs are required to find employment at another institute when they complete their PhD, preferably in another country. Even if the RegClim programme has not included any "doktorgradsstipend", a few PhD theses have emerged as a result of project activities. This we find to be extremely important, if Norwegian climate modelling research is to continue to develop in the future a new generation of climate scientists have to be educated and brought into the international research community.

Interaction within the project

The RegClim project has certainly contributed positively to the interaction between Norwegian research groups involved in climate model research. The regular meetings and other more informal contacts between the groups have given rise to opportunities that otherwise may not have been found. One positive effect is the increased co-operation between the groups in Bergen dealing with modelling of atmosphere and ocean.

We have, however, found a few aspects of the interaction within RegClim to be surprising. One aspect is the interaction between the research groups working on ocean modelling in Bergen and in Oslo. There appears to be competing ideas regarding model choices and parameterisation schemes. Although RegClim decided that one ocean model should be adopted, duplicate development work in the area of ice modelling continued. Furthermore, the atmospheric modelling in Oslo and Bergen seems to be done separately with considerable duplication of effort. If this effort was leading to new basic research results the situation would be all right, but the goal is rather to establish a common model framework for climate scenarios. There is no clear evidence from the publications that this duplicate work is necessary. Another puzzling area is regional forcing of aerosols and greenhouse gases. The groups in Oslo working on radiative forcing aspects work closely together, but there is very little interaction with the groups working on dynamical modelling of the atmosphere in Oslo and Bergen.

Interaction with other projects, climate scenarios

There is no clearly visible interaction with other co-ordinated projects under the Norwegian Climate program. The contacts that exist are mainly on the personal level within the same institute or very directly if the same scientist is involved in more than one project. In the documentation provided we found very little evidence of interactions and on a direct question the project leader responded that interaction with other projects is not the responsibility of RegClim.

From the start RegClim was assumed to build on the competence available in Norway and to use existing model tools for climate scenario research. This has led to a situation where a number of different models have been used and developed for a variety of climate simulation purposes. An underlying objective for many of the modelling groups is to develop a model system that can be used for climate scenario studies. We find it difficult to understand how the present approach can lead to a scenario production that can be used effectively by research groups outside RegClim interested in climate change impacts. Using different model tools for similar purposes also limits the possibilities for research co-operation between the groups involved in RegClim. For example, radiation and cloud parameterisations differ substantially between the atmospheric models used in tasks 1 and 4. That makes it very difficult to include results from the basic research done in tasks 5 and 6 where still another atmospheric model is used. The ocean modelling groups in tasks 2, 4 and 7 suffer from similar problems although an attempt has been made to unify the model used. Where shall impact oriented research groups outside RegClim obtain their scenarios? The statistical downscaling group in task 3 has started to establish contacts with impact study groups and results from task 1 are being used or will be used in impact oriented research. In the future impact studies must rely on information both from statistical and dynamical downscaling results. It remains to be clarified how the activities within RegClim can lead to an efficient interface towards impact oriented research.

Future plans

The evaluation group is of the opinion that RegClim has been a successful start for Norwegian climate model research, but in order to reach the goals set out originally some re-organisation of the research activities is required. It is unclear how this re-organisation should be related to other large research projects funded by NFR; NOClim, ChemClim, the Bjerknes Collaboration and possible future centres of excellence all have overlaps with RegClim activities.

In general, process oriented studies could be a part of a more overarching climate research programme while production of climate change scenarios for impact studies requires a more dedicated effort, preferably located at one physical research unit. The RegClim group must decide what model system to use for such scenario production and to seek collaboration with climate scenario production groups in Europe. The goal of quantifying the uncertainty in climate

change projections requires substantial simulation efforts and can only be successfully undertaken in a network of climate modelling centres. We believe that the RegClim group can make valuable contributions to such a network.

Project management

The evaluation group has not been asked to comment on project management, but in our discussion some remarks were made which we feel could have some relevance to the future planning of RegClim like activities. The present management structure really gives more co-ordination than leadership to the research project. The project leader, Trond Iversen, has done a good job of keeping the project tasks reasonably coherent and working towards a common goal, but he has very limited power if he wants to reshape parts of the project or implement decisions that may not please everyone involved.

Another serious limitation has been the very short time periods of funding. Almost every year a considerable effort has been spent on re-applying for funding and motivating the importance of RegClim to NFR. The panel feels that a renewal of RegClim funding should cover at least a four-year period.

The panel also recommends that NFR establishes an external advisory or governing group/board to the project, this helps in monitoring project progress and additionally makes it easier for the project management to conduct project leadership.

Comments on each task separately

PT1. Dynamical downscaling

Scientific results obtained through the project and contribution to advancement of the field

This task deals with the application of an existing regional, atmospheric climate model to regional downscaling over Norway and a surrounding area. The group has shown that they are able to set up and run the model over an extended integration time, but the documentation of results from the experiment made so far must be extended and improved. The application of the climate model has not resulted in any new scientific ideas, but there is a potential for using results from the model for impact studies. An example of such an impact study on ocean waves and storm surges has been undertaken by PT7 based on the results produced by PT1. Impact studies on hydrological aspects such as snow processes and flooding would be relevant future uses of dynamically downscaled climate scenarios.

The accomplishment of the project with respect to the goals, sub goals and milestones that were announced in the project plan

The group has accomplished what they originally set out to do, namely to perform numerical integrations with a regional climate model. Technically they have successfully done what they intended to do. They have actually made runs over time intervals that are longer than originally promised. However, a serious scientific evaluation of their results is still lacking. The evaluation panel is also unable to find a promised evaluation of the results through comparisons with satellite data.

Scientific publications

One peer reviewed publication in co-operation with regional climate modelling groups in Sweden and Denmark has emerged. The purpose of this publication is to show how similar the results of the different climate models are, giving added credibility to the projected regional

climate change signals. A peer reviewed publication on the results from the PT1 group would have been reasonable to expect. This manuscript is still in preparation.

PT2. Basin scale ocean modelling of the Nordic Sea

Scientific results obtained through the project and contribution to advancement of the field

A version of the Miami Isopycnic Coordinate Ocean Model MICOM has been implemented, improved and extended at NERSC. The model uses a new flexible co-ordinate system with a variable grid spacing. The model has been run with observed atmospheric forcing fields. Validation performed so far indicates that the model is robust and realistic. The interpretation of these model results has not yet been published. The model is a component of the coupled model used in PT4. There seems to be little interaction with task PT7.

The accomplishment of the project with respect to the goals, sub goals and milestones that were announced in the project plan

Most work seems to have been completed according to plans.
Scientific publications

Five papers have been published in peer reviewed journals, but only two are relevant to RegClim goals. Four more papers have been submitted. A large number of reports and presentations are listed in the progress report.

Popular publications are not abundant (2 in CICERONE). This is unfortunate, because the North Atlantic circulation has received much attention, also in the media.

PT3. Empirical downscaling

Scientific results obtained through the project and contribution to advancement of the field

The statistical downscaling group at DNMI under the leadership of Eirik Førland has been very active and their work has resulted in a number of international, peer reviewed publications. So far only monthly averaged simulation data have been used, this makes the results less applicable to extreme events such as flooding and storm surges. It is not clear if the methods developed by the group can be carried over to daily data, however the group has shown that they are working with statistical downscaling methods that are of interest to the international scientific community (their papers are cited in the IPCC TAR). The original contributions from this group include the application of the common EOF approach to regional climate research as well as multi-model downscaling for the Nordic region.

The accomplishment of the project with respect to the goals, sub goals and milestones that were announced in the project plan

The work has proceeded according to plans, the delays encountered are well justified.

Scientific publications

The group has a very good publication record, five peer reviewed articles published and another five submitted. In addition a large number of technical reports and conference abstracts have been produced.

PT4. The Role of the Nordic Seas: Atmosphere-Ocean Feedback

Scientific results obtained through the project and contribution to advancement of the field

For studies of the coupled climate system a coupled Atmosphere- Ocean- Sea-Ice model has been implemented, the so-called Bergen Climate Model (BCM). This model uses the MICOM version from PT2 which is coupled to a French global atmosphere model.

A control run of 300 year has been performed using standard resolution. The model needs flux corrections. Despite these flux corrections, the model has a modest long term drift at the surface. More problematic is a serious drift in the deep ocean towards a warmer and fresher state, due to a net surface input enforced by the flux corrections. Apart from these shortcomings the model produces a realistic climate also in and over the North Atlantic. It seems that the model compares fairly favourable with other models in the Coupled Model Intercomparison Project although this could not be verified.

The accomplishment of the project with respect to the goals, sub goals and milestones that were announced in the project plan

The technical goals have mostly been fulfilled according to plan. However, the scientific analysis has not been completed and still needs to be written up.

Scientific publications

Results from the model run have not yet been published. Other parts of the task have been more productive. These papers deal with advanced analysis of observations in the North Atlantic and are certainly relevant for later analysis of model results.

PT5. Indirect effects of aerosol

Scientific results obtained through the project and contribution to advancement of the field

The magnitude of the forcing dealt with in this PT is shown to be significant for the global as well as the regional climate. PT5 has contributed to frontline research in this area. The development of appropriate parameterisation schemes is an important part of climate research but much work and many tests of these schemes are required before they are ready to be part of climate simulation runs with a fully coupled model.

The accomplishment of the project with respect to the goals, sub goals and milestones that were announced in the project plan

Some delays have arisen. This is due primarily to changes of the techniques used to parameterise the cloud-aerosol microphysical processes, in particular the cloud droplet number concentration, compared to the original plan. The focus of the PT has also been shifted from cloud condensation schemes towards aerosol-cloud-climate effects.

The impression is that the original plans for the PT were over ambitious. The interactive modelling of the total effects of ozone and aerosols has also been delayed.

Scientific publications

The publication record is very good.

PT6. Direct climate effects of regional contaminants

Scientific results obtained through the project and contribution to advancement of the field

This PT deals mainly with further development and testing of a CTM. Much work has been directed towards constructing and implementing a detailed chemical interaction scheme. A simplified version of the CTM for implementation in an AGCM has also been developed, tested and compared to results from runs with the more detailed scheme.

The climate forcing results of the group are clearly visible within the international climate community and they have had a significant impact on the IPCC Third Assessment report (TAR).

The accomplishment of the project with respect to the goals, sub goals and milestones that were announced in the project plan

There were some delays in phase I but in phase II tasks 6.1-6.5 have progressed according to plan. Task 6.6, the interactive modelling of the total effects of ozone and aerosols, has also been delayed. This delay has arisen since different numerical models have been used in PT5 and PT6 and merging the aerosol and ozone parts has been problematic. Therefore, the direct and indirect effects of aerosols have not yet been merged.

Scientific publications

The scientific publication list from this PT is excellent. A weaker point is the popular publications, only two in Cicerone.

PT7. Air-ice-ocean interface processes and sea state modelling

Scientific results obtained through the project and contribution to advancement of the field

A major goal within this task is the development of a regional coupled atmosphere-ocean-sea-ice model. The progress of this task does not look very consistent. First a version of the Princeton Ocean Model (POM) was implemented and modified. Later a switch was made to MICOM. Similar switches were made with the sea-ice model. The new sea-ice model also serves as a coupler between the atmosphere and the ocean. The progress report mentions that this is a very attractive property of the new model system, but no published evidence is provided.

Tests have been performed using atmospheric forcings from ERA-15 and MPI-GSDIO. It appeared that very different sea-ice distributions were obtained. In general different coupled climate models differ greatly in their representation of the Arctic climate.

The accomplishment of the project with respect to the goals, sub goals and milestones that were announced in the project plan

In all the task seems to suffer from too many switches of plans and of people. Some parts of the project show delays. There seems to be little interaction with PT2 and PT4.

Scientific publications

There are no publications in peer reviewed journals. One paper on future winds and storm surge climate has been submitted. This work is based on input from PT1. Only one popular article has been published.

PT8. Data for model evaluation

Scientific results obtained through the project and contribution to advancement of the field

This PT is not scientific in its character. It is not clear if data from PT8 is actually utilized in the other PTs.

The accomplishment of the project with respect to the goals, sub goals and milestones that were announced in the project plan

The work with data for model evaluation has been completed as far as RegClim is concerned and is now supported in another project outside RegClim (NoSerC).

Scientific publications

PT8 is mainly a service task for the other PTs and no scientific publications should be expected. Two reports have been written.

PT9. Advanced analysis and interpretation of climate model results and observations

Scientific results obtained through the project and contribution to advancement of the field

This is a newly established task and it covers a variety of activities. It is difficult to find a clear and well-focused scientific goal of these activities. One aspect is completely new and very interesting, namely the investigation of singular forcing vectors. Only preliminary results are shown and they remain to be written up. The technique offers a promising way of interpreting the interaction between radiative forcing and large scale dynamics. Other activities in this task include statistical analyses of various results from other tasks. We see no reason why this analysis could not have been included in the original task.

The accomplishment of the project with respect to the goals, sub goals and milestones that were announced in the project plan

Some delays have been encountered, but considering the varied nature of the task it is difficult to judge how well justified these delays are.

Scientific publications

Only technical reports and one peer reviewed contribution to a book have been produced so far. Given the short time period of the work (1.5 years) this is quite reasonable.

Stockholm 8 February 2002

Members of the evaluation committee:

Erland Källén	*Aad van Ulden*	*Ulla Hammarstrand*
(sign)	*(sign)*	*(sign)*

Based on the comments from the RegClim project group (Appendices A.2.1), we announce the following errata:

The evaluation committee is aware of the original aims of the project:

1. To estimate probable changes in the regional climate in Northern Europe, bordering sea areas and major parts of the Arctic ("our region"), given a global climate change.

2. To quantify, as far as possible, the significance of regional climate forcing pertaining specifically to our region. This includes processes determining sea-surface-temperature (SST) and sea-ice cover in the Nordic Seas, and processes related to radiatively active atmospheric contaminants with a regional distribution (direct and indirect aerosol effects, and tropospheric ozone).

3.2 Evaluation report for *Past Climates of the Norwegian region (NORPAST)*

Committee Members: **Barbara Wohlfarth** (Dept. of Geology, Lund University),
Kjell Nordberg (Earth Sciences, Göteborg University)
Hans Renssen (Institut d'Astronomie et Geophysique
G. Lemaitre, Université Catholique de Louvain, Belgium)

The evaluation committee, which met between January 23-25, 2002 in Lund/Genarp, Sweden, was asked by the Norwegian Research Council (letter from 21 December, 2001) to address the following issues in its evaluation:

#1. Scientific results obtained through the project and contribution to advancement of the field; comments on each task and on the project as a whole.
#2. The accomplishment of the project with respect to the goals, sub-goals and milestones that were announced in the project plan; comments on each task and the project as a whole.
#3. Publication record (scientific publications) with respect to quality, number and in relation to available resources; comments on the specific tasks where appropriate.
#4. Public outreach efforts with respect to plans and in relation to available resources.
#5. International collaboration
#6. If relevant, recruitment of PhD and Postdoctoral students
#7. Internal and external relationships within the project:
    - Has this way of organising research (as opposed to smaller grants to individual researchers or institutions) aided advancement within the field?
    - To what degree are some tasks more important and central than others? Could some tasks with advantage have been organised outside the project?
    - Relationship to, collaboration with, and division of labour with the other coordinated projects organised by the programme.
    - Recommendations for the future. How should research in this area be organised in the future? On the basis of the above, any recommendations regarding both scientific content (continuity, new challenges etc.) and organisation (e.g. coordinated projects vs. individual smaller projects, division of labour between projects) of research in this area would be appreciated.

The committee had the following documents at its disposal:

(i) Project application, June 1998
(ii) March 2001 Project Update
(iii) Third Report NORPAST, December 2001
(iv) Selected articles relating to NORPAST (submitted with the Third Report)
(v) Additional information for Task 5.1.1. was submitted after request (List of radiocarbon dates, publication in the state of being submitted, detailed reference list)
(vi) Documentation on the NORPAST Homepage

NORPAST started as a coordinated and NFR financed palaeoclimate project in May 1999 and will continue until December 2002. Final results were, therefore, not available for the present evaluation.

NORPAST's overall aim is to provide high-resolution, quantified climatic reconstructions for the past c. 30 ka years based on a correlation of different palaeo-archives from climatically sensitive geographical regions in Norway and the adjacent ocean. This is motivated by the need to improve the understanding of the impact and underlying causes of rapid climate fluctuations in the past and the importance of making palaeoclimatic research visible beyond the palaeoclimatic

community. To achieve these goals it was necessary to strengthen and optimise research links between the palaeoclimatic community in Norway and with meteorologists and to work on the development of a database.

Since the start of the project, two full workshops have been held; task 5.3. had two workshops, tasks 5.1. & 5.4 held five informal meetings, task 5.5 had three workshops and task 5.6 two workshops. One joint meeting with other NFR funded, coordinated projects was held in autumn 2001.

Evaluation Procedure

We first address issues #2 to #6 and comment on each task, including its individual sub-projects, according to the questions asked by the Research Council. For some tasks and sub-projects the original objectives/aims of the project were slightly modified during the course of the project as compared to the first and second project application, due to major budget cuts or other unforeseen events. In order to be consistent, we therefore focused mainly on the objectives stated in the Third NORPAST Report (December 2001), but also considered the deliverables stated in the March 2001 Project Update. In the second part of the evaluation we comment on the project as a whole and address #1 and #7.

The publication records seems to comprise all articles published by NORPAST researchers during 1999-2001, independent of the fact whether or not the material for these articles has a direct relation to NORPAST. It would have been desirable to only list articles, which are directly NORPAST related. Given the present situation, we thus judged the general publication activity of the different groups, independent of the fact if these articles relate to NORPAST or not.

#2 - # 6 Comments on the different tasks and individual sub-projects

5.1 Lakes and other terrestrial archives/5.2. Instrumental/Historic climate records (leader: Atle Nesje)

5.1.1 Holocene glacier and climate variability in Norway reconstructed from high-resolution, multi-proxy lacustrine sedimentary records

Objectives/major aims

1. Reconstruction of continuous, high-resolution records of Holocene glacier variations in southern Norway at a regional and local scale.
2. Development of improved methods for reconstructing past glacier and climate variations from glacio-lacustrine and glacio-fluvial sedimentary sequences.
3. Synchroneity between maritime and continental glaciers during the Holocene.
4. Combine reconstructed glacier ELAs with independent biological proxies for summer temperature to reconstruct variations in Holocene winter precipitation.
   Deliverables (March 2001): Annual (in the case of varved sediments) to centennial reconstruction of Holocene glacier variations along a west-east and a north-south transect in Norway. Reconstruction of summer temperatures, winter precipitation and palaeo wind directions.

This project mainly focuses on a study of lake sediments in the catchment of former or present glaciers and its basic rationale is that glacier advances/retreats are registered by low loss on

ignition values in the sedimentary sequence. Holocene glacier fluctuations could be reconstructed for 10 glaciers in southern Norway and two distinct early Holocene glacier advances were recognised. The results obtained are highly interesting, since precipitation reconstructions are still scarce and have thus a high potential for the evaluation of climate models. However, the robustness of the results needs to be tested by independent methods and error estimates should be provided for the reconstructions. Also, the present chronology of the individual sites is too weak to provide resolution on centennial time scales.

The group, which includes 1 PhD student, has a good and continuous publication record and is also active regarding public outreach.

Comments/Suggestions

Given the low amount of running costs, it may have been better to adopt a more co-ordinated approach (see also the other sub-projects), where fewer sites could have been studied with a better chronology and including a multi-proxy approach. For such an approach, advantage could have been taken of the knowledge of other scientists involved in task 5.1. It would be important for future research to integrate and compare the obtained results with other records, from which quantitative climate estimates are available in order to test the robustness of the reconstructed data set. In this respect it would also be good to apply the same statistics to derive appropriate age models.

5.1.2 Lake sediments as archives of past climate along a north-south gradient in coastal Norway; High spatial and temporal resolution, multiproxy reconstructions of Late Weichselian and early Holocene climate

Objectives/major aims

This project is divided into 3 sub-projects, of which 2 mainly focus on chronological issues (marine reservoir effect, a new high-resolution chronology for Kråkenes). The 3rd sub-project addresses the spatial and temporal variability of Late Weichselian and early Holocene climates (including smaller oscillations) along a N-S transect. Climate changes during these time periods will be reconstructed using a multi-proxy approach and the results will be compared to marine investigations.

Deliverables (March 2001): Quantitative reconstructions of mean summer temperature of the late-glacial and early Holocene (12,000-9000 BP) at 2 sites with 50-100 year resolution, but only one site will have ^{14}C AMS dates and hence have any chronology.

Results for the two chronology sub-projects are delayed and hampered due to low running costs, but are in progress. A high-resolution chronology necessitates a large number of high quality (but expensive) radiocarbon dates. For the N-S transect, 2 sites are being investigated and preliminary multi-proxy analyses are presented or are in progress. The multi-proxy approach adopted in the study is very good and should serve as an example for other projects. However, such an approach is time consuming and expensive.

The group has a very good publication record, but limited public outreach. No recruitment of PhDs or Postdoctoral students.

Comments/Suggestions

If only one site will have a chronology, how will it be possible to reconstruct the development along a N-S climatic gradient as stated in the project aims? Also given the low running costs and hence so little money for dating, how will it be possible to achieve a 50-100 year time

resolution? Until the northern site has been fully investigated, the study of the southern site seems to some extent to be a repetition of the Kråkenes study. To achieve the objectives of the project, a complete study of the northern site is absolutely crucial.

In a next step it would be desirable to achieve higher temporal and spatial resolution, possibly with a more detailed focus on short-term and abrupt changes (Intra-Allerød cold phases, sub-division of the Younger Dryas, early Holocene events) and their spatial variability and expression.

5.1.4. Quantitative reconstruction of Holocene climate: An Oslo to Trondheim transect

Objectives/major aims

Pollen analytical study of 10 carefully chosen and critically positioned lakes along a SE-NW transect and quantitative reconstruction of the Holocene climate history (50-150 years resolution) along the transect, with sample-specific error estimates, using modern pollen-climate transfer functions developed by the group in NFR-KILO (1993-96) and Setesdal (1996-1999) projects. The spatial and temporal patterns of climate change will be analysed to detect if the position of the two major climatic regions has shifted during the Holocene.

Deliverables (March 2001): Quantitative reconstructions of mean July and January temperatures and annual precipitation for 8 sites from Oslo to Trondheim, with 50 year resolution for the entire Holocene (0-10,000 BP), but only 3 sites will have ^{14}C dates and hence have chronologies.

The project did not start until January 2000 and long sequences from 6 out of 15 sites have up to now been analysed in great detail. The remaining coastal sequences are being analysed during 2002. Temperature (January, July) and mean annual precipitation for the analysed sequences have been reconstructed based on weighted-averaging partial least squares regression and the modern pollen-climate calibration set, and show long-term changes during the Holocene. Also the reconstructed vegetation indicates an interesting ecological development of certain tree species.

The group has a high publication profile, but limited public outreach. No PhD or Postdoctoral student.

Comments/Suggestions

Similar to sub-projects 5.1.1. and 5.1.2., the chronology of the studied sequences is a major problem, since only few sites have been dated by relatively few radiocarbon dates. This fact hampers a temporal comparison of the reconstructed parameters and also a climatic reconstruction on the desired time resolution of <150 years. Will the studied sites in the future also be used for multi-proxy studies (e.g., stomata/plant macrofossils, diatoms, $\delta^{18}O$, tephra)?

Sylvia Peglar who seems to be an important part of the project and who is to 75% paid by NFR as researcher is not visible as publishing independent scientist.

5.1.5. Natural variability in extreme weather events and climatic effects on avalanche and flood hazards

Objectives/major aims

Estimate the natural variability of extreme weather events (snow avalanches, major floods, etc.) in different parts of Norway; assess the impact of climatic changes on avalanche and flood activity in the future.

Deliverables (March 2001): Reconstruction of natural variability of extreme weather events in different parts of Norway.

This sub-project is only partly funded by NORPAST and has very low running costs. However, there are some discrepancies between the accounts for the years 2000 and 2001.

Year 2000: March 2001 report: 39 k NOK; Third Report, December 2001: 122 k NOK
Year 2001: March 2001 report: 40 k NOK; Third Report, December 2001: 76 k NOK.
The obtained results show how difficult it is to perform such a study, i.e. reconstruct extreme weather events, since many of these are very local and not controlled by regional weather conditions.

The group has a limited publication record and limited public outreach, one PhD student.

Comments/suggestions

A reconstruction of extreme weather events based on e.g., lake sediment studies is a very difficult task, because a large number of different variables are involved, which make straightforward interpretations almost impossible. The stated objectives/aims were probably too optimistic and the relevance of the project may be doubtful for NORPAST. Maybe it would be more useful to concentrate on a limited region (with more background information), which could be monitored over a longer time span. Similar investigations have e.g. been performed in Switzerland following the 1987 disasters.

5.1.6. Palaeoclimate information from speleothems. Original title (June 1998): Focused multi-proxy comparison of Holocene climate: The Svartisen region

The original project never started; Project 5.1.6. is not mentioned in the March 2001 Project Update, no budget is given anywhere, but a short summary of a speleothem project is added in the Third Report (see below).

Objectives/major aims

Compare annual laminae and $\delta^{18}O$ on a speleothem from northern Norway.

The results show that the thickness of the presumed annual laminae may be related to climate conditions during summer (proxy for summer temperature/humidity changes).

Since the project does not seem to be directly funded by NORPAST, no comments are given on publications, recruitment etc.

Comments/suggestions

This is an interesting terrestrial record, which deserves attention and which should be compared to historical records and tree rings. It is however difficult to evaluate this sub-project because not enough background information is available. The study has a potential for NORPAST and could strengthen the planned synthesis regarding late Holocene climate reconstructions.

5.2.1. Establishing and analysing composite climate proxy series

Objectives/major aims

Establish long-term temperature series based on historical documentary sources (cereal harvest/farmers diaries) and instrumental observations. Test and adjust instrumental series.
Deliverables (March 2001): Homogenized climate data for the reconstruction of annual/monthly temperature and precipitation for the historic and instrumental periods.

Originally the project aimed at long-term temperature reconstructions (instrumental data, historical sources) in different geographic and climatic regions, covering the whole of Norway. Work regarding documentary sources has mainly been performed in southern Norway (3 climatic regions) and all possible harvest documents were found; the longest record extends back to 1749. New findings are rather unlikely.

It is difficult to evaluate what is NORPAST research, what has been done earlier and what is financed through other sources. The publication is limited and public outreach is good. No recruitments of PhDs or Post doctoral students.

Comments/suggestions

Testing and adjustment of instrumental series and extending them through historical records is very important for the calibration studies in NORPAST and for future studies. The study also highlights problems associated with reconstructions based on historical sources. Is the full potential of historical archives already explored (church books, diaries etc.)?

Summary for task 5.1/5.2

Collaboration with M. Edwards, Trondheim is mentioned in the original application (1998), but seems not to have been followed up later on.

No visible interaction is seen between the different sub-projects 5.1.1. and 5.1.4. and to some extent 5.1.2.

Chronological problems for sub-projects 5.1.1., 5.1.2., 5.1.4. need to be urgently solved in the very near future.

5.3 Ice sheet dimensions (leader Jon Landvik)

5.3.1 The geometry of the last Svalbard/Barents Sea and Scandinavian ice sheets

Objectives/major aims

Observation-based reconstruction of the lateral extent and surface geometry of the northwestern margin of the Late Weichselian Barents Sea/Svalbard ice sheet.

Deliverables (March 2001): Reconstruction of the lateral extent and surface geometry of the western part (over Svalbard) of the Late Weichselian Barents ice sheet. Operational ice sheet data base

This task focuses on the hypothesis that the Late Weichselian glaciation of western Svalbard was characterised by low gradient ice streams that drained through the major fjords and troughs. Progress in this task is good, as geomorphological fieldwork has shown that the higher plateaux of Svalbard were ice-free during the Late Weichselian and that the fjords in western Svalbard were filled with glaciers until the Late Glacial, thus confirming the hypothesis. Additional exposure-age dates will provide for further fine-tuning.

Comments/suggestions

In the Third Progress Report it is suggested that the discussed hypothesis has been developed within the NORPAST project, but this idea has been published already some years ago.

It is strongly recommended to compare the findings of this task with studies of the marine and terrestrial environments around Svalbard. For instance, marine records from the Nordic Seas that cover the Late Weichselian could be compared with the produced reconstruction of the glaciation history, possibly leading to a better understanding of the coupling between ocean circulation and glaciation. Here a link could be established with task 5.4.3, which studies heat fluxes in the eastern Nordic Seas during the LGM. Likewise, it would have been a good thing to involve coring of lakes that were deglaciated during the Late Weichselian, so that quantitative palaeoclimatic reconstructions could be included in this task.

5.3.2. The vertical extent and downwasting of the western part of the Scandinavian ice sheet

Objectives/major aims

Reconstructions of the lateral extent and surface geometry along two profiles of the Late Weichselian ice sheet.

Deliverables (March 2001): Reconstruction of the lateral extent and surface geometry along two profiles of the Late Weichselian Scandinavian ice sheet. Operational ice sheet data base

Fieldwork has been almost finished and interesting results on ice sheet fluctuations and configurations on ice domes are provided. The research along the transect has confirmed the different timing of the ice sheet advance during the LGM.

Comments/suggestions

It is confusing that the March 2001 Update mentions ice-sheet modelling as an activity within this task, whereas this is no longer the case in the December 2001 report, where it is only an activity in task 5.6.2. In the March 2001 Update there is a discrepancy between the aims and the deliverables, and also a confusing subdivision between data and modelling. It would be much more straightforward to include the ice-sheet modelling in task 5.3.2.

General comments task 5.3

The interaction between tasks 5.3.1 and 5.3.2 is good, but links to other parts of NORPAST are not clearly visible. Although it is acknowledged that ice sheets are an important part of the climate system, it is in the present report difficult to see how they fit in the overall picture. Therefore, it is suggested to put more effort into establishing links with terrestrial and marine studies.

Publication record and public outreach is good, although it is hard to judge which publications are based on NORPAST research. No recruitment of PhDs or Postdoctoral students.

5.4 Marine archives (leader: Morten Hald)

5.4.1 High-resolution palaeoclimate from the Last Glacial Maximum to the present on the European Arctic Margin

Objectives/major aims

Reconstructions of late Holocene ocean temperatures from three fjord/shelf records off Norway. Calibration of core tops to instrumental records.

These goals do not fit with the title of the project and in an earlier application the focus was upon the time span LGM to present. The focus has thus been changed to the latest part of the Holocene, i.e. the last few hundreds or possibly the last 2000 yrs.

Deliverables (March 2001): Reconstruction of upper Holocene ocean temperatures from maximum 3 fjord/shelf records off Norway

The group has analysed stable isotopes on benthic foraminifera from Malangen fjord with annual or bi-annual temporal resolution between AD 1970 - 1995. Dinoflagellate cysts from two cores from Malangen have also been analysed and analyses from two additional cores, from more northerly areas, are in progress. This is an important and novel field of research, which is very promising, but needs to be explored more (i.e., tools have to be refined/developed for benthic foraminifera, dino cysts and instrumental records). Also, a very good temporal control is essential.

Publication record and public outreach are good. Recruitment, 1 post-doc.

Comments/Suggestions

It is a bit problematic to evaluate the results so far and the report should have given more background information. Why not show a correlation between instrumental BWTs and reconstructed temperatures based on stable isotopes? The BWT record is not presented and no information is available about the temperature record (annual, monthly, seasonal values?). Are the reconstructed bottom water temperatures seasonal or annual? Since the correlation is so high (r^2 =0.83), it would have been nice to also illustrate this with curves. Were the dino cysts also compared with instrumental temperature curves? The foraminiferal species used are not mentioned. Have H.J.B. Birks' statistics been used for the calibration effort? The chronological approach is not made clear.

There is a risk that the data at the present stage may be over-interpreted, given the difficulties that the relation between proxies and climatic parameters are still not well established. It is difficult to follow the text descriptions and the illustrations and some of the conclusions in the text could not be recognised in the figures.

5.4.2. PASTNOMA

Objectives/major aims

Quantitative reconstructions of upper Holocene ocean variability in temperature and salinity in 3 shelf/fjord records from mid and southwestern Norway; development of a recent benthic foraminifera data base from UK to Svalbard; benthic foraminifera transfer functions.

Deliverables (March 2001): Quantitative reconstructions of upper Holocene variability in temperature and salinity in 3 shelf/fjord records from mid and southwestern Norway. Recent benthic foraminiferal data base from UK to Svalbard and benthic foraminiferal transfer functions.

Stable isotopes in benthic foraminifera in two fjords representing a few hundred years have been analysed. A database has been established for the area Ireland to Svalbard, including several fjord and coastal areas. Transfer functions have been applied to five sites, representing the last 120,000 yrs (temperature reconstruction). In addition a dino cyst database has been established. This is a highly interesting and novel field of research, which is very promising, but needs to be

explored more (tools need to be refined/developed for benthic foraminifera, dino cysts and instrumental records) and needs a very good time resolution to achieve its overall goals.

The publication record and public outreach are very good. Recruitment: one PhD student.

Comments/suggestions

Instrumental/hydrograpic data likely exist from the fjords and could be used in the study. The implied correlations between air temperature and reconstructed summer temperatures and salinities are difficult to see in Fig. 5.44. Error margins for the salinity reconstructions would have been very useful.

The relation between proxies and climatic parameters needs to be explored in greater detail until further reaching conclusions can be drawn. In addition the chronology needs refinement.

A close collaboration with sub-projects 5.4.1 and 5.4.3 would be recommended and 5.4.2 has also obvious links to task 5.3.

5.4.3. Oceanic heat flux in the eastern Nordic Seas – variability during different forcing conditions

Objectives/major aims

Reconstruction of oceanic heat flux during the LGM (new data sets for SSTs for N Atlantic and Nordic Seas north of 50º N for the LGM); provide data sets with decadal resolution documenting SST variability along the NW European margin during the last 2000 years; reconstruct the amplitude and variability of oceanic heat flux in eastern Nordic Seas during the Holocene optimum and glacial conditions.

Deliverables (March 2001): a) New planktic foraminiferal reference core-top data set for the eastern Norwegian Sea, with inclusion of small-sized foraminifera. Statistical evaluation of the spatial distribution of climate sensitive species and the predictive capability (for SST reconstruction) of this new core-top data set.
b) Estimates of ocean heat flux, amplitude and variability during the LGM (21-18 BP) from a time slice reconstruction for the entire Nordic Seas and during the early Holocene temperature optimum (8-6 ka BP) based on 3 downcore records in the eastern Norwegian Sea.

Sediments from the Vøring Plateau are under investigation and the CLIMAP-data sets have been re-evaluated, providing new reconstruction of latitudinal temperature and salinity gradients, ice-cover, and surface ocean circulation patterns. Detailed results are not presented in chapter 5, but are compiled with other results in Chapter 6, which makes it difficult to obtain an overview of the work going on under this sub-project.

Publication record and public outreach are good. Recruitment: 1 Post-doc.

Comments/Suggestions

It is not easy to compare the information given in the text with the figures. No legend is provided for Fig. 5.45. Too little information is provided for a thorough evaluation.

Overall comments on task 5.4

More cooperation between the sub-groups would aid the advancement of the overall objectives.

5.5 Transfer functions (leader: H.J.B. Birks)

5.5.1 Transfer functions for quantitative palaeoclimatic research in Norway

Objectives/major aims

1) To extend existing transfer function data-sets based on pollen, chironomids, marine diatoms and stomatal density of *Salix herbacea* leaves, (2) to develop transfer functions based on benthic foraminifera and (3) to develop software and documentation to implement statistical methodology for transfer functions and palaeoclimatic reconstructions.

Deliverables (March 2001): Modern climate proxy data calibration data-sets for several climatic parameters and user-friendly computer software for transfer functions and palaeoclimatic reconstructions.

The progress of aim (1) is very good, since the various data-sets have all been extended significantly. Aim (2) is different in the Third Report (December 2001) compared to the original project description. In the latter it was planned to develop a lake-ice-cover-sediment transfer function. In the December 2001 report this transfer function is replaced by one based on benthic foraminifera. It is based on a very good statistical approach, with a quantification of the errors involved. The progress of aim (3) is good, as the development of the software is advancing well. This software is very important for the international palaeoclimate community.

Publication record is very good, but no visible NORPAST publications are listed yet. Public outreach is poor. Recruitment: no PhD or Postdoctoral student.

Comments/suggestions

This is interesting and promising work. It is felt that the systematic approach is very important for the advancement of the field. However, it is hard to judge the validity of the transfer function based on benthic foraminifera, as limited information is provided.

5.6 Modelling and data synthesis for modelling (leader: H.P. Sejrup)

5.6.1. Synthesis of NORPAST palaeoclimatic data for climatic modelling

Objectives/major aims

Construction of a Database/GIS for data from NORPAST and other palaeoclimate projects funded by NFR.

Deliverables (March 2001): A relational data-base/GIS of NORPAST and related palaeoclimatic data in a form directly accessible to national and international climate modelling groups.

Progress in this task is good, as the structure of the database has been completed.

Comments/suggestions

It is a good thing that this database includes primary, secondary and meta-data, and data from other NFR projects and it is essential that all tasks make data available to the database, as this is an important tool for the integration. This database will be an important source for climate modelling studies, which can also be used to test the validity of NORPAST palaeoclimatic reconstructions.

5.6.2. LGM Ice Sheet Modelling

Objectives/major aims

a) Data synthesis for ice sheet modelling, b) time-dependent modelling of the Scandinavian ice sheet, c) modelling of former shorelines, sea level and crustal stress evolution.
Deliverables (March 2001): Synthesis of ice sheet data for modeling.

Only aim (a) is funded by NORPAST, as the other aims are financed by external sources. The data synthesis is progressing well; a database has been established and is partly filled with data.

Comments/suggestions

In the December 2001 report it is stated that the ice sheet model is tuned with geological input data (topography, bedrock lithology, etc.). It is not clear what is meant here. Presumably the model is initialised with these data instead of tuned.

Overall comments on task 5.6

This is a service task, and no publications are to be expected yet.

Comments on the project as a whole

#1 Scientific results obtained

NORPAST can be regarded a novel project because it integrates on a national basis palaeoclimatic research from the Last Glacial Maximum to present and covers palaeorecords obtained from marine (ocean, shelf, coastal regions, fjords) and terrestrial archives (lakes, glaciers) and, to a limited extent also historical & instrumental records. It extends over different geographic regions and climatic zones.

An important part of NORPAST is the step from a qualitative palaeodata production to a quantitative assessment of the palaeodata through careful scrutinizing of available statistical methods and application of high-quality transfer functions. The development of a relevant database is in progress and will serve both NORPAST members and the palaeo community. Data input for climate modelling and interactions with modellers are planned for the future.

The project also encompasses as many research groups as possible and pulls together expertise available at different universities (mainly Bergen and Tromsø) and government agencies (mainly NGU and NMI). However, research groups at other universities and at the Polar Institute in Tromsø are so far only weakly associated with the project.

The preliminary synthesis of the data set, which is presented in the Third Report, is arranged according to different time slices. However, the committee found it difficult to evaluate some of these time slices, because no figures are provided which could illustrate the descriptions made in the text (6.1 “Last 100-200 years”) or because the synthesis is based almost entirely on pre-NORPAST research (6.2 “Holocene time slice: 0-11500 cal yr BP”). For chapter 6.2, we think that a satisfactory stage of integration of the data set is not yet reached. The presented correlations are interesting, but because of the large uncertainties in the chronology, they remain highly uncertain.

The synthesis in chapter 6.3 (“Late-Glacial time slice: 14000-11500 cal yr BP) is a very good and an elegant first step to integrate quantitatively marine and terrestrial palaeoclimatic data sets. The different maps with summer and winter temperatures and precipitation are nice examples of how climatic gradients can be illustrated. However, also for this synthesis most of the data is

derived from pre-NORPAST investigations, although new and improved transfer functions were applied to the marine records. Again, the chronology needs refinement in order to make geographical comparisons and correlations.

The "Last Glacial Maximum" is viewed in Chapter 6.4. from a terrestrial and marine perspective (results also partly obtained during a pre-NORPAST period and in conjunction with other projects) and provides a revision of the CLIMAP SST estimates for the Nordic Seas and the northern North Atlantic, showing open ocean convection, indicating that the ocean was an effective moisture source for the North European ice sheets. The spatial and temporal differences in the maximum extent of the Scandinavian ice sheet and the observation that the geometry of the ice sheet over Svalbard was much more diverse than previously assumed, are new findings. The data input of the LGM reconstructions can now be used for different modelling approaches.

A critical discussion on transfer functions and their application back in time (chapter 6.5 "Synthesis of transfer functions") illustrates the difficulties encountered, especially regarding precipitation reconstructions. This very self-critically assessment would be a very useful reading for many palaeo researchers eager to obtain quantitative results. Interesting observations, based on the different pollenanalytically studied transects (also mainly pre-NORPAST work), are the temporal and spatial climatic differences in respect to the so-called Holocene climatic optimum. These results are very interesting to test climate models and it would have been very useful if contacts with the modelling community could have been established during an earlier stage to perform data-model comparisons.

Remarks on budget and structural organisation

- Money to NGU for running costs is never specified and it is unclear what it includes
- Olson's engagement in task 5.3 is unclear
- Lauritzen's engagement in 5.1.6. is unclear
- Table 5.2 is a bit confusing. Nordli is mentioned as supported researcher for projects 5.2.1. and 5.6.3., but the latter project is not mentioned anywhere.

- There is a discrepancy between Appendix 2 and Table 5.2, as the latter states that no researchers are funded by NORPAST, whereas Appendix 2 mentions the salary of Larsen/Stalsberg. It is not clear who Stalsberg is (i.e. Martha Stalsberg or Knut Stalsberg). What is the research task of Martha Stalsberg, who is listed as a stipendiat (partly) in Table 5.2?
- We know that almost all NORPAST researchers have an extensive international network and that there is involvement of scientists from outside Norway in NORPAST, but this was not made obvious in the report.

#7 Future recommendations

The last 12 months of the current NORPAST project

- Task 5.1: Collaboration between sub-projects 5.1.1., 5.1.2. and 5.1.4 could be optimised
- Task 5.3: Better integration with sub-projects 5.4.1. and 5.4.3.
- Task 5.4: Integration and collaboration between different marine sub-projects needs to be improved.

Future (post-2002) research directions

- Chronology: It is recommended that, in the case of a future continuation, more effort and funding should be devoted to establishing high-quality chronologies. This is considered more important than the exploration of new sites. Without good chronologies, it becomes virtually impossible to obtain first-class palaeoclimatic reconstructions.
- Integration: It is suggested to give the integration of the various disciplines a higher priority, as this should provide the surplus value of a large co-ordinated project like NORPAST compared to smaller projects involving individual persons or institutions. This integration is essential to realize three of the main objectives of NORPAST (i.e. 3, 4 and 5). Interaction can be stimulated in a future project by, from the start, designing tasks that fully integrate e.g. marine and land records, instead of designing tasks (as in NORPAST) that focus on one particular discipline. It is important that within a large project like NORPAST, there should be no competition between different groups.
- Involvement of climate modelling: A future project should involve climate modelling from the beginning. Climate model simulations for the time-periods considered could be compared with the palaeoclimate reconstructions from the various domains (marine and terrestrial). This is a powerful method to stimulate integration and it provides insight into the physical feasibility of the reconstructions. Moreover, climate models are ideal tools to test hypotheses that come up along the way. For instance, different ice sheet configurations can be used to drive the climate model, after which the resulting air and sea temperatures can be compared with reconstructions to see which ice sheet configuration is most likely.

Concluding remarks

- Quality assessment
  For future coordinated projects we suggest that scientists first submit short pre-proposals (letter of intent), which are evaluated for their scientific relevance by an executive committee. In a second round, full applications for each sub-project should be prepared and these are then scientifically evaluated by external reviewers, instead of evaluating the co-ordinated project as a whole. Such a procedure would increase the scientific quality of individual contributions/sub-projects.

- Report writing
  The Research Council's rules and procedures in respect to report writing, annual reports and progress reports seem very strict and bureaucratic for an outsider. E.g., annual reports had to be submitted only a few months after the start of the project. The amount of work dedicated to report writing is such that researchers have little time left to perform actual science.

- Our overall impression is that the Third Report has been compiled in a hurry, some parts are rather sloppy presented, which makes reading and evaluating difficult for the committee. The report would have been easier to read if it had had page numbers; the structure is rather heavy with a large number of repetitions. For persons not familiar with Norway's geography and place names a more detailed map than Fig. 6.1 with the location of all studied sites and transects would have been very useful.

- Coordinated vs smaller/individual projects
  A coordinated project certainly has the potential to aid advancement in the field. Large co-ordinated projects may however be a risk if too much money is allocated to such projects and only little funding is made available to smaller projects/independent researchers. Important scientific break-through has often been achieved by smaller groups.

The evaluation committee members are not experts in all fields covered by NORPAST and misunderstandings may therefore arise. However, we believe that these – if they arise - can be clarified in a later stage through comments and feedbacks from NORPAST researchers.

Overall, the coordinated palaeoclimate project has been a highly ambitious task, and the evaluation committee is of the opinion that the group, within only 3 years, is well under way.

Lund/Genarp 25, January, 2002

Kjell Nordberg	*Hans Renssen*	*Barbara Wohlfarth*
(sign)	*(sign)*	*(sign)*

Based on the comments from the NORPAST project group (Appendices A.2.2) we announce the following errata:

In the evaluation report we wrote under 5.1.2. “The group has a very good publication record, but limited public out reach”. NORPAST commented that “results from this project were presented in NRK ‘Schrødingers Katt’ seen by over 1 million people in Norway”.

We acknowledge that we may have missed this, but would like to clarify that we meant the whole group and public out reach in general, including publications.

3.3 Evaluation report for *Coordinated Ozone and UV project (COZUV)*

Introduction

The review of the Coordinated Ozone and UV project (COZUV) was carried out in January-February 2002. The review group consisted of Bo Christiansen (DMI), Paul Eriksen (DMI), and Martin Dameris (DLR). The group met in Copenhagen 28-29 January, 2002.

The basis for the review was the report produced in December 2001 by COZUV and the revised project proposals (or work programmes) for the first (1999-2000) and second (2001-2002) phase of the project.

Norway hosts strong research groups in both the ozone and UV fields. In particular the efforts done on ozone modeling is well known internationally. A main purpose of the project is to combine the ozone and the UV research.

The report has a nice graphical appearance and includes important results. However, it seems to be compiled from the contributions from the different groups without much coherence. The different tasks are not presented the same way, e.g., only for some tasks the report includes an introduction. The way section 1 (progress) and section 2 (scientific achievements) are separated makes it difficult to read, in particular as the division of "progress" and "achievements" is not clear.

It is the opinion of the review group that the lack of coherence in the report reflects a basic problem of the project. Although progress has been made in all tasks and important results have been obtained in several of the subtasks the collaborative effort seems weak.

Task 1: 3-d modeling of atmospheric chemistry

Both modeling groups, based on the CTM2 and the SCTM respectively, are well established in the international community. There has been considerable work done on development and testing the CTM2 - in particular in phase 1. However, the progress seems to have been limited to model development while progress in the use of the model, inter-model comparison, and comparison to observation is limited.

There is an effort to compare CTM2 with observations from other tasks. Figures 2.1.1.1 to 2.1.1.4 compare CTM2 to observations by satellites, sondes and lidars. But the comparison is very superfluously and critical discussions are lacking. In Fig. 2.1.1.1 observations and models are presented with different color scales. Why not present the difference between observations and modeling? The panels in Fig. 2.1.1.2 look similar but there is no discussion to which extent this is due to dynamics or chemistry. The difference between the lidar and the model in early December (fig. 2.1.1.4) is not mentioned.

How far is the SCTM in the 1980-2000 experiments? Different information is given on pp. 16, 63, and 90. The delay in this experiment could be important as task 9 depends on these results. Actually, this is the only link between task 9 and modeling.

Is Fig. 2.1.1.2 a result of this project? We could not find any reference to such experiments with the 2-d model in the work programme. Figure 2.1.2.1 shows the changes in ozone between 1980 and 1970 as simulated by the SCTM. This result should have been compared to respective analyses of observations. Data are available to check if trends are realistic. At least a reference to Fig. 2.6.3.5 could have been included. Why is only April 1 shown and not a monthly or seasonal mean?

Activity 1.4 and 1.5 seem to disagree on whether or not meteorological data have been provided for 2000 and 2001 (pp 16-17).

A couple of developments promised in the work programme seem not to have happened but this is not commented on in the report. Reading only the report it looks like all milestones have been reached.

- SCTM runs are not based on CTM2 as promised in the work programme for phase 2 (p. 6). SCTM now use initial fields provided by the Oslo-2d model for the long-term calculations.
- The year 1997 should have been modeled by now by both the CTM2 and the SCTM. Why are these simulation not compared in the report?

Some important work has been done in this task regarding both models but there seem to have been only little interaction between the two modeling groups. Also, the number of publications from this task is relatively low.

Task 2: Dynamical studies

The outcome of this task in both project phases seems to have been an undisputed success, both from a scientific point of view and from the point of view of integrating modelling and observations from different parts of the project. In phase 1 a Lagrangian model has been used to reconstruct ozone profiles from ALOMAR and the model was coupled to chemistry from Oslo. In phase 2 this model was used for calculating global maps of several species, which has been delivered as input to Task 6. The progress and the results are clearly presented in the report and the milestones have been reached. The interesting results have been published in peer-reviewed journals.

The work on ozone mine-hole events has attracted much attention. However, the statistical significance of the results in Fig.~2.2.3.1 is not discussed. It seems to be a general rule in COZUV that statistical considerations and indications of error-bars are left out. Also, the influence of the strong filtering leaving only time scales between 2-10 days needs more attention.

Task 3: Ozonesonde observations

This task was planned as support for other tasks. Problems in Ørland have been overcome by a replacement of equipment. Some details about the number of launches are given in section 1 of the report. However, we miss a description of the accuracy of data and of possible changes in method and instruments. Some overview plots could have been shown of ozone and temperature as was done for the lidar measurements in task 5. This could also be helpful for other groups to identify interesting situations. Information about the availability of the data and on how these can be obtained is missing.

Task 4: DOAS measurements

The milestones have been reached, except for an apparent delay in the AMF calculations. A total of six reviewed papers are listed, but at least the first and last paper have been submitted before the start of this project. Also, it is hard to see how many of the other papers that are directly linked to this project.

Considerable work on ozone AMF is claimed in task 2.4.4, but only very few results are presented. Some details about NO2 AMF are given but a detailed discussion of its effect and implications are missing.

Characteristically, most of the comparisons with models have been done with SLIMCAT and not with CTM2, although now some results seem on way. A critical discussion is missing regarding Fig. 2.4.2.1. It is not enough to mention a general "good agreement" between model and observations. Figure 2.4.2.2 could be compared to GOME data.

A few comments about Fig. 2.4.3.1. BrO is very badly measured and error-bars of 25% are to be expected. This should have been mentioned. Why is mid-February 1999 mentioned as an exception? Model and observations compare much worse in the second half of 1998. Some discussion should have been included here. Is it the model or the data that we should trust? Is these months dominated by special meteorological conditions? Could the CTM2 simulate that episode?

Task 5: Ozone lidar measurements

For this task all milestones have been reached. The report contains a couple of very nice presentations of results (Fig. 2.5.1.2, 2.5.1.2, 2.5.4.1). Such profiles could help modelers to identify interesting episodes. This task has delivered data to the comparison with models in task 1 and the analysis in task 2. The lack of ozone trends in the high stratosphere is interesting if it holds with further analysis. It would be interesting to compare these observations with the SCTM simulations when available.

Task 6: Analysis of ozone change

This is the key task of the project as it involves modeling and observations in a joint effort to analyze ozone change. The description of the results is well organized, although it is puzzling that results from activity 6.1 are given in section 1 and not section 2. It is a little disappointing that no papers have been submitted to reviewed journals at this stage.

Regarding the milestones it would seem that this task will be very busy in the final year. It is not clear how much activity 6.2 is behind the work-plan and if the delay will be possible to catch up. The work plan is not specific on the time-plan for calculation of ozone loss for the winters 88-89 to 99-00. A few of the panels of Fig. 2.6.2.5 were already presented in the work programme, so it would seem that this task will have to produce 4-5 times as much work in 2002 than it did in 2001. We worry if the promised analysis on the rest of the levels can be completed in time.

The fact that Figs. 2.6.3.1 and 2.6.3.2 are plotted with different color scale gives the impression that the different groups only communicate when compiling the reports. The analysis presented in Fig. 2.6.2.5 is very interesting and the graphical presentation useful. The discussion is good, although a comparison with the results of MATCH or Müller is missing. The trends in Fig. 2.6.3.5 should be compared to observations. Only if indications are found that the trends are real, sensitivity experiments should be performed. It seems that the SCTM is already behind schedule and additional experiments will only cause further delays.

Activity 6.3 is very important and should be given high priority in 2002. This task could be the center of a real joint effort. Regarding the plan described on p. 40 we think that CTM2 and SCTM should be compared for the same period and with the same observations.

Task 7: Ground-based UV measurements

This task is important in its own right, but it seems isolated from the rest of the project. Interesting results have been obtained and the task has a nice publication rate with two published reviewed papers and three in preparation.

We have serious concerns about the interactions between this task and the rest of the project. The interaction was weak from beginning according to the workplan with only two links to task 8 and 9, respectively. In reality, the interaction seems to have been even weaker as neither of these tasks seem to have made use of data from task 7. As mentioned in section 1.0.3 some of the milestones in this task have not been reached. The development of the tracking system has apparently been more ambitious than expected. Several delays seem to have appeared in this task. In task 7.4 a model activity was promised in the work programme (p. 57) to be completed in 2001. However, we could not find this effort mentioned in the report.

The description on p. 47 of the problems regarding man-power and budget cuts are not clear. Is the cancelled campaign at Andøya due to a budget reduction within this project? It is said that the campaign will be merged with the EU project INSPECTRO. Will the same project be "sold" twice? How will the cancellation and the merging influence the rest of the project?

Task 8: Airborne UV measurements

This task has been attacked by a series of delays of technical nature and further delays are foreseen (p. 50). The delays are due to filter problems and a malfunctioning balloon. This is all well described in the report and such delays are hard to forecast and impossible to avoid. We do however miss a description of how the delays will interfere with other parts of the project. As for the previous task the links to other tasks are few and weak. In the work programme indirect links to task 1, 3, 5 and 7 are mentioned. We have not been able to read from the report to what extend these links have been realized or to what extend they are expected to be realized in 2002.

The comparison between model and measurements in Fig. 2.8.1 seems very impressive. The authors use the word "excellent" but give no indications if this is better than other in situ measurements. The advances of this system compared to other strategies should have been described.

Regarding the link to task 1 it would have been interesting to know how the UVSPEC model is related to the radiative codes used in the CTMs. Are the calculated photo-dissociation rates different from standard rates and will the new values impact the chemistry modeling in Task 1? Such questions would have been natural to address in a project like COZUV.

Task 9: UV modelling

Due to lack of data the original goals for phase 1 were changed and the task totally redefined for phase 2. Phase 1 was finished satisfactorily with the publication of a reviewed paper. Phase 2 now deals with the generation of UV-maps for Norway and is supposed to link the UV and ozone parts of COZUV.

It seems from the work programme that the generation of UV-maps for the future should have been completed by now (although there is some confusion about the numbering of subtasks). According to the report the use of the SCTM for this purpose is only on a planning state. The comparison of UV-maps with measurements has been speeded up, but where is the promised input from task 7?

UV-maps like that presented in Fig. 2.9.2.1 are useful and represent a product that can be delivered to the community. However, we do not believe that such maps for the future has much reliability, as the cloud-cover in the future climate is unknown. The problem with clouds are not discussed in the work programme or in the report (it is briefly mentioned in the section "The way ahead"). Even for clear-sky situations one should remember that future ozone is badly predicted on the northern hemisphere. Furthermore, also surface albedo could possibly change in the

future. Sensitivity experiments, where the UV-maps dependence on such parameters is investigated, are required.

Forecasts of UV-maps a few days ahead are also possible. But for this purpose ozone can be treated just a passive tracer and CTM simulations are not necessary.

General

The project has recruited 1.5 Phd, 0.5 postdoc and 3 master students. This is relatively little compared to the budget and in particular considering the number of groups involved and the number of different tasks. The number of reviewed publication is moderate. We recognize interesting and original papers in particular from task 2 and 7.

The international collaboration within the project is very good. The different groups participating in COZUV collaborate with a large number of foreign institutions and contribute to many EU funded projects. A good effort has been done on public outreach.

It is difficult to judge from the report the work that is a direct consequence of the COZUV project and the work that would have been done anyway, financed by other sources such as EU programs. It is natural that a project like COZUV will interfere, and perhaps overlap, with other projects. This makes it so much more important that the results and consequences of COZUV are clearly identified.

The main purpose of a broad project like this is to initiate co-operation between the different groups. In COZUV the main borders are between the CTM groups, the analysis groups, and the UV groups. We find that COZUV is weak on the collaboration side, although some first steps are taken in this direction.

A systematic inter-comparison between models and observations is missing, although individual models are compared to some observations. Models are run for different periods and with different input-parameters, which makes comparison difficult. Too often in the report comparisons are not discussed in detail.

The UV tasks seem rather isolated from the rest of the project. Where links between the UV and ozone research have been defined in the work programme it is difficult to find them realized in the report. The lack of a clearly demonstrated co-operative effort is our main objection of the project. The success of a project like COZUV depends on the definition of a few joint actions where everybody participate. Such actions are not identified in the program. The links between tasks should have been made more clear from the start and the coordination should have been stronger.

If this would have been the final report, the project would have failed. The promise in the original proposal of "..a close collaboration between the involved groups in order to ensure a coherent effort" has not been fulfilled. On that basis we would not suggest a third phase. A stronger coordination is needed in the last year. We also suggest a concentrated effort in form of a joint activity where many tasks are involved. Such a joint effort could be based on activity 6.3. A single interesting year or season could be selected. For this period simulations from the two CTMs and the trajectory model could be compared in detail with observations from the observational tasks. Preferably, UV measurements and modeling should be included too.

We acknowledge the need for long-term, stable financing of research groups. The funding through EU programs might be an important supplement and encourage international co-operation, but it is too insecure and sporadic to form the basis for the research. Here national funding is needed to provide the stability for research groups to thrive and develop. On the question of the advantages and disadvantages of coordinated and "free" projects, we have the opinion that coordinated projects are important when joint action or close co-operation is needed. But the co-operation should be real. It is often claimed that new results are obtained when different disciplines meet. While this may be true in some cases it does not in general weaken the necessity and importance of research concentrated within one well-defined field. In COZUV, model development and the work on the NILU-Cube are examples of well defined tasks that could have been done outside a coordinated project. If close collaboration is not needed well defined smaller project should be preferred.

The report discusses several possibilities for future activities. Here we offer a few comments.

Chemistry-climate interactions: The two-way coupling of chemistry and climate are important for several reasons. But, the coupling of GCMs and chemistry schemes is a time consuming and troublesome undertaking. As this path has been taken by other research groups and in particular as the Norwegian groups are among the leading experts in CTM modeling worldwide, we suggest that future efforts be concentrated here. There is still a strong need for CTM improvements and the impending information form ENVISAT on concentration of different species will provide a new challenge for model-observation comparison.

3-d UV modeling including clouds: There is no doubt that this is an important issue as clouds have a very large impact on the UV reaching the surface. As we mentioned in the discussion on task 9, UV-maps for the future may be useless unless the possible cloud-change is included.

Monitoring: Regular monitoring on Norwegian sites is very important both regarding to ozone and UV. It should be remembered that many years of data is needed to define a trend and that the funding therefore should be stable and continuous.

Stratospheric water vapour: As mentioned in the report the recent reported trend in stratospheric water vapour might have large consequences for both the radiative forcing on the troposphere-surface system and for the understanding of the cooling in the stratosphere. Furthermore, water vapour can change the chemistry in the stratosphere. Up to now measurements are very few and any additional effort in this direction would be very important. We support the idea of water vapour measurements at Ny-Ålesund. As mentioned above, this calls for continuous funding.

Copenhagen 29 January 2002

Martin Dameris	*Paul Eriksen*	*Bo Christiansen*
(sign)	(sign)	(sign)

3.4 Evaluation report for *Norwegian Ocean Climate Project (NOClim)*

Members of the evaluation committee:

Göran Björk, Göteborg University, Earth Sciences Centre/Oceanography (speciality sea ice modelling and ocean observations)
Matti Leppäranta, Department of Physical Sciences, University of Helsinki (speciality sea ice geophysics)
Peter Killworth, Southampton Oceanography Centre (speciality climate and ocean modelling).

The NOClim project

The NOClim project started in July 2000 and is a joint project involving eight Norwegian research partners. It includes 7 major research tasks.

The overall objectives of the project are to: contribute to understanding of rapid changes in the thermohaline circulation, ocean and ice processes related to climate, and mechanisms causing significant variability in the hydrography, circulation and ice cover, as well as to maintaining time series for early detection of climate change in the Northern seas.

Task of the committee

The committee was asked to address the following issues:

1. Scientific results and contribution to the advancement of the field
2. The accomplishment of the project with respect to the goals, sub goals and milestones
3. Publication record with respect to quality, number and in relation to available resources
4. Public outreach
5. International collaboration
6. Recruitment of new scientists
7. Internal and external relationships within the project.

For issues 1-6 the committee was requested to comment on each task separately and for the project as a whole. The committee has also made some general and specific recommendations both about this specific project and about co-ordinated versus separate projects. This project has been running for only 1.5 years from the start in July 2000 until the progress report in December 2001. The project has therefore resulted in relatively few scientific results so far for natural reasons. The committee had the following material at its disposal:

- final submitted proposal
- first progress report
- project web page
- scientific papers (12).

Task 1: Rapid and dramatic changes

Number of participants within NOClim: 5
Total applied budget: 2200 KNOK (2000-2002)

Objectives (somewhat shortened)

- Forcings and linkages which produce millenial-scale climate change
- Magnitude of forcing to produce thermohaline switching
- Surface to deep water linkages
- Are shifts a response to same forcing?
- Are shifts initiated in north or south?
- What is coupling between ice sheet dynamics and ocean circulation?
- How are changes transmitted across hemispheres?

This task has a large focus on proxy data from sediment cores. There are no experts in this field within the evaluation committee and we can therefore not address scientific aspects of this part of the project (the same argument applies for task 6). We recommend that an expert in Marine Geology should take part in the final evaluation.

Scientific results

There are only preliminary results in the progress report. We expect that the data set that is under way and will soon become compiled by the group will reveal interesting results and also be of large interest for the wider scientific community.

Accomplishment of the project with respect to the goals in the project plan.

Most of the core work is finished. Some initial interpretation and analyses have been made. This is according to plan.

Publication record

The attached publication concerning task 1 does not address the aims in task 1. NOClim is not acknowledged for funding. We consider this publication not to be a result of the NOClim program.

Comments

The last three of the objectives listed do not seem to be addressed within the project as currently envisaged. Specifically, there is no approach towards looking at connections between northern and southern hemispheres (either initiation or transmission of changes), and no obvious intent to examine ice sheet dynamics. The core analysis discussions are somewhat qualitative.

Task 2: Deep water ventilation from the shelves

Number of participants: 6
Total applied budget: 1700 KNOK (2000-2002)

Objectives

- To identify and quantify the major driving forces and rate limiting factors for thermohaline exchange between a semi-enclosed marginal basin exposed to strong negative surface buoyancy flux, and adjacent deep water.
- To test the hypothesis that mild and windy winters with small ice cover in shallow areas will produce more dense brines than cold winters with much fast ice.
- To test applicability of bulk model parameterisations of entrainment and friction in an isopycnic co-ordinate model.

Scientific results

Due to the field-directed first phase of this task, of which much is just finished and not analysed, few new results have yet emerged. The combination of CTD with a lowered ADCP has a potential to give new and valuable information about plume dynamics.

Accomplishment of the project with respect to the goals in the project plan

This task involved a lot of field activities in the first phase. Most of these have been successful and one cruise in the area of the dense water plume has been accomplished. One problem is, however, that a rather critical current meter mooring was lost. This is a common problem for oceanographic mooring activities. The risk is usually reduced if several moorings are deployed (which needs more funding of course).

Publication record

The attached publications were submitted before the start of NOClim and can therefore not be considered as a contribution by this project.

Comments

This is in general an interesting process study with important aims for deep water ventilation of the major basins in the area. It is very dependent on hydrographic observations both in time and space. The observational program appears to be in difficulties. The lost mooring should therefore be replaced, if possible, since it will give valuable information of the upstream history of the plume. It would have been interesting to know if the cruise really captured the dense outflow. It is really important to process the data from the cruises rapidly so that the model group has something to work with.

Task 3: Deep water ventilation in the deep sea

Number of participants: 2
Total applied budget: 2100 KNOK (2000-2002)

The main objective is to investigate some of the processes which are candidates for effectuating direct deep water renewal in the Greenland Sea.

It consists of two major subtasks:
Subtask 3.1 Analysis of observed distribution of SF_6
Subtask 3.2 Process modeling

Scientific results

This task has not yet resulted in any direct results. The new SF_6 fields are not analysed yet and the modelling effort has just started and produced some standard runs. A potential (but not new) mixing mechanism by Submesoscale Coherent Vortices has been identified but not evaluated in any quantitative fashion.

Accomplishment of the project with respect to the goals in the project plan

The 2001 cruise with SF_6 sampling has been accomplished according to plan. The analyses are not yet finished but the new equipment for SF_6 analyses has been successfully tested.

A non-hydrostatic ocean model has been set up for the process studies and has produced preliminary results. The large-scale model is also implemented and control runs are finished. The modelling activity has proceeded according to plan but cannot wait too long for the SF_6 analyses

in order to be able to address the objectives for the process modelling (e.g. produce better understanding and new parameterisations of the mixing processes).

Publication record

The attached publication concerning task 3 was submitted before the starting date of NOClim and cannot be considered as a contribution from this project.

Comments

It seems in general that this project is a little overloaded, with far reaching and difficult objectives, taking into account that only two persons are working part time. It is not clear how the fine scale modelling differs from earlier work, e.g. Backhaus. Is the large scale model entirely appropriate for testing future parameterisations? (e.g. how would double diffusion processes fit into MICOM?). It was not clear to us that the results (Figure 2 in the progress report) from the large scale modelling were appropriate for the study.

Task 4: Cross front exchange and formation of intermediate water

Number of participants: 8
Total applied budget: 1600 KNOK (2000-2002)

Main objectives

- Describe in detail some of the major frontal processes, in particular frontal mixing and frontal subduction.
- Characterize these processes in relation to forcing and large scale characteristics

There were initially three main subtasks 4.1-4.3 of which 4.1 and 4.2 have been merged since the start of the project.

Subtask 4.1: Modelling frontal subduction in the Nordic Seas
Subtask 4.2: Modelling near surface cross front exchange
Subtask 4.3: Observational study of the Polar Front in the Nordic Seas

Scientific results

No specific results have so far emerged from this task. There are some preliminary results that the model simulations give subduction features and they also indicate that the effect of cabelling is small. The results of the field program are not fully analysed yet but show downstream variation of the frontal structure and temporal variability.

Accomplishment of the project with respect to the goals in the project plan

Idealized model experiments have been set up for two different types of models according to plan. There has also been a cruise using a SeaSoar CTD and VM-ADCP across a frontal region during March 2001. This is according to plan.

Publication record

The attached publication is not a result of the NOClim program.

Comments

The project has started out with a good speed having accomplished the field program, implementing and testing the models. It was strange to start out with field activities and modelling at separate places. This looks like a poor coordination from the beginning. It is not obvious what new features are involved in the modelling study (there have been several papers about frontal subduction). We found it difficult to understand the description of the polar front.

The science plan includes an ice module but we have not seen any evidence of that in the progress report. We are very comfortable with the combining of subtasks 4.1 and 4.2.

Task 5: Variability and signal propagation from high resolution information

Number of participants: 7
Total applied budget: 2100 KNOK (2000-2002)

Objectives/key questions

- Do teleconnections give rise to interannual variability?
- What is the seasonal and interannual variability in the AW inflow?
- What is the seasonal and interannual variability in the Arctic Ocean?
- What is the seasonal and interannual variability in the Arctic front?

The project is divided in four different subtasks 5.1-5.4.

Scientific results

There was an interesting analysis of the relation between heavy rainfalls, SST and SLP in the North Atlantic. An analysis of interannual variability in the Nordic Seas fits well with the objectives, as does an analysis of the connection between the NAC and the conditions in the northern north Atlantic.

Accomplishment of the project with respect to the goals in the project plan.

It's hard to evaluate the progress of this task since no milestones or timetable are given. It is also hard to see how far the work has proceeded in comparison with the overall objectives. However the decision to work with existing data sets has generated rapid progress towards publications.

Publication record

There are three publications. We consider this as very good progress.

Comments

The US Navy NLOM-model does not seem to us to be an ideal choice, since its representation of topography is poor and it contains essentially no thermodynamics. Task 5.3, concerning sea ice, does not seem to have progressed far.

Task 6: Co-ordinated analysis of long time series

Number of participants: 11
Total applied budget: 1900 KNOK (2000-2002)

Objectives

- Improve quantitative description and understanding of interannual to interdecadal scale variability in the Atlantic Arctic
- Integrate paleo and oceanographic time series for improved paleo calibration and reconstruction

Scientific results

The standardised instrumental and historical data set is completed and represents an important and useful result from NOClim by itself.

Some interesting results from the Icelandic pressure series and the temperature variability in the northeast Atlantic have emerged (e.g. a close correlation of surface temperature along the Norwegian coast at zero time lag).
Results from the proxy data (sediment) analysis showing links between tropical and Nordic Sea region seem rather qualitative.

Accomplishment of the project with respect to the goals in the project plan.

The instrumental and historical record is now at hand according to plan and some statistical analysis is already made on the material. The work on the sediment cores is well under way and there are also some preliminary results.

Publication record

There are two publications under NOClim.

Comments

The proxy work is largely qualitative. Connection to task 1 is unclear at this stage although one of the participants is working in both tasks.

Task 7: Long-term observations

Number of participants: 9
Total applied budget: 1500 KNOK (2000-2002)

Objectives

- Continue long-term observations of Atlantic water in Nordic and Barents Sea
- Continue measurements of sea ice and ocean volume fluxes in the western Fram Strait
- Assess how to detect ocean climate variability
- Conduct δ-O_{18} measurements in Fram Strait

Scientific results

This task is mainly about extending long time moorings. The activities within the NOClim program have generated new, and will generate more, data but there has not been enough time to fully analyse the new parts of the time series. The Svinøy section has been extended for more than a year up to October 2001 and has been analysed for the entire period from April 1995. The new current measurements in the Fugloya Bear Island section shows that an increased density of current meters was not necessary.

Accomplishment of the project with respect to the goals in the project plan

The mooring work and water sampling activity is according to plan.

Publications

The publications referred to are not work made under NOClim. The attached publications are not a result of the NOClim project.

Comments

It would be interesting to have a general strategy for the collection of long time series. How long need they be? Is there a time limit after which further observations don't give much more information? There is some work going on in the direction of trying to reduce the number of instruments by finding the ones that captures the most important part of the current fields. Statistical correlative approaches to deduce fluxes from single current meter measurements may fail if existing conditions alter; thus the value of a potentially dubious time series product needs

discussion. The same argument applies to the western Svinøy transport estimate based on level of no motion concepts. We are aware of various arguments using f/H contours, but all assume a steady state. Is the proposed method valid in time-varying situations?

Comments regarding the project as a whole

The project appears to be largely going according to plan and in a satisfactory fashion.

Advantages with this type of organized research

It provides a natural way to organize field activities. The research platforms can probably be used in a more efficient way since several subprojects can share ship time. It may also open a lot of possibilities to share instrumentation and logistic support between institutes and perform larger field activities than within a smaller project.
Modelling expertise and large computer facilities can also be used by several projects.
There are interesting multidisciplinary aspects such as joining sediment records with observational data; and requiring data specialists and theoreticians to examine the same data can only be constructive.

Disadvantages with large projects

It takes more effort to organize a large program. Highly qualified researchers spend a lot of time with organizing meetings and writing reports instead of doing research. This might be devastating especially for the PI's.
It might be hard to proceed with original ideas within a large program since much of the time is tied up by finishing already planned milestones and deliverables.

Public outreach and international collaboration

The public outreach, even so soon into the project, is excellent. The group seems to have a perfectly normal set of international collaborations.

Internal communication and relationship with other projects

There has been one kick off meeting and two project meetings during the period. There have been three meetings of the SSG. This frequency seems appropriate for the task at hand. Thus the internal communication seems fine. The project has made excellent use of material from other funded projects. We agree with the project members that lifting out the proxy data from this project would be counterproductive.

Recruitment of PhD students

We estimate that 20% of the senior staff on the project now has research students (6 out of 30). **We recommend that** NOClim takes on more PhD students, though we accept the financial difficulties to fund this increase. However, 2 students per year of a project is not a big recruitment!

General comments and recommendations

According to the project description there are numerous, quite fundamental, problems that should be solved in the study. We suspect that a little too much was promised regarding the relatively few man-hours that are available for some of the tasks. We would see no problem if some of the objectives were (by negotiation) reduced or removed for the latter half of the project. We do accept the rather rushed conditions under which the original proposal was written.

The committee felt that rather too many models were in use. Clearly no single model is adequate for the wide range of uses which this project needs (for example, MICOM cannot represent cabelling or double diffusion, yet is excellent at handling topography and along-isopycnal mixing). Nonetheless, within each task another model seemed to appear, which makes the co-ordination of results across tasks more awkward than otherwise.

The sea ice work is 'bitty' and lacks co-ordination across the tasks. **We recommend that** a member of the SSG be given the responsibility to ensure that the sea ice aspects of the project are delivered.

Because the project lacks easy access to icebreakers, **we recommend that** collaboration be made with the Swedish Polar Research Secretariat regarding ice breaking research platforms.

The publications presented to the committee were largely written before the project started. The same is true for the list of publications in the report; it is impossible to determine from the information given which publications were directly produced within NOClim. We accept, of course, that research is ongoing and that publication lag times are usually longer than the current project has run. However, **we recommend that** technical reports, talk abstracts, etc. which *do* relate to ongoing work be supplied to future committees, as these will give a more accurate impression of the work status.

To improve outreach, **we recommend that** the group submit an article to the CLIVAR/PAGES newsletter describing the project.

Finally, we have some recommendations about funding issues. We note that no individual task appears to have found obvious funding problems, although the report lists overall funding difficulties. One aspect is instrumentation. Field instrumentation requires a degree of redundancy for security, which could not always be provided in this project due to funding restrictions. **We recommend that** funds are provided to replace the lost mooring and recording instruments. We note that the project has been careful to obtain money from other sources, so that relatively little has been spent on salaries.

Kristineberg Marine Research Station February 1, 2002

Göran Björk	*Matti Leppärant*	*Peter Killworth*
(sign)	*(sign)*	*(sign)*

Based on the comments from the NOClim project group (Appendices A.2.4) we announce the following errata:

It was commented in the evaluation report that the NLOM model do not contain any thermodynamics. We have been informed later on that thermodynamics has been included in a recent development.

Appendix1: Members of the evaluation panels

The evaluation of the co-ordinated projects was conducted by four separate evaluation panels. Each panel consisted of two external experts and one non-Norwegian representative from the programme committee:

RegClim

- *Ulla Hammarstrand,* Department of Meteorology, Stockholm University, Sweden, (Representative from *KlimaProg's* programme committee)
- *Erland Källén,* Department of Meteorology, Stockholm University, Sweden,
- *Aad van Ulden,* Koninklijk Nederlands Meteorologisch Instituut (KNMI), Atmospheric Research Division, AE De Bilt, The Netherlands.

NORPAST

- *Barbara Wohlfarth*, Department of Geology, Lund University, Sweden (Representative from *KlimaProg's* programme committee)
- *Kjell Nordberg*, Earth Sciences, Göteborg University, Sweden
- *Hans Renssen*, Institut d'Astronomie et Geophysique G. Lemaitre, Université Catholique de Louvain, Belgium

COZUV

- *Bo Christiansen ,* Danish Meteorological Institute (DMI), Copenhagen, Denmark, (Representative from *KlimaProg's* programme committee)
- *Paul Eriksen,* Danish Meteorological Institute (DMI), Copenhagen, Denmark
- *Dr. Martin Dameris*, DLR-Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany

NOClim

- *Göran Björk*, Earth Sciences Centre/Oceanography, Göteborg University, Sweden, (Representative from *KlimaProg's* programme committee)
- *Matti Leppäranta*, Department of Physical Sciences, University of Helsinki, Finland
- *Peter Killworth*, Southampton Oceanography Centre ,UK

An overall summary were prepared by the following synthesis group:

- *Ulla Hammarstrand*
- *Barbara Wohlfarth*
- *Bo Christiansen*
- *Göran Björk*

KlimaProg's Programme Co-ordinator Senior Researchers Inga Fløisand/Elin Dahlin, NILU and the Research Council Contact Senior Advisor Terje Mørland has been involved in the preparation of the evaluation and writing of the final report.

Appendix 2: The projects' comments to the evaluation reports

Please note the following: The project leaders of the four coordinated projects only got about one week to give their comments on possible mistakes or misunderstandings in the evaluation reports. Important remarks have been in included the Errata-comments for each project. In addition the projects leaders have made more general remarks to the evaluation reports. These general comments have not been included in the evaluation reports but are presented below. The comments from RegClim are only available in Norwegian.

A2.1 RegClim

Første respons på evalueringsrapport for RegClim

Bidragsytere:
Trond Iversen, Sigbjørn Grønås, Eivind A. Martinsen, Thor Erik Nordeng, Helge Drange, Eirik Førland, Nils Gunnar Kvamstø, Jon Egill Kristjansson, Ivar Isaksen, Lars Petter Røed, Inger Hanssen-Bauer.
Invitert men har ikke bidratt: Knut A. Iden, Bjørn Ådlandsvik.

Svaret er redigert av Trond Iversen.

Overordnede punkter

Det er bred enighet om at komiteen har evnet å diagnostisere mange av RegClim's styrker og svakheter. På overordnet nivå er synspunktene som kommer fram i rapporten vesentlig i overensstemmelse med egne oppfatninger. Vi mener rapporten kan danne et godt grunnlag for de vurderinger KlimaProg (i samarbeid med RegClims forskere) skal gjøre for framtida.

Med sin kompliserte historie med to korte faser, utvidelsessøknader i mellomår, mange institusjoner og forskere, er det imidlertid ikke til å unngå at komiteen har hatt misoppfatninger og mangelfulle opplysninger. Slike kan ha ført til at enkelte konklusjoner og anbefalinger i beste fall er uforståelige, men i verste fall gale og vil kunne virke mot sin hensikt.

Her ønsker vi å påpeke slike misforståelser og mangler og forsøker å unngå polemikk mot rapportens synspunkter. Men vi er også klar over at det er en gråsone her, særlig fordi vi ønsker å begrunne hvorfor noen av misforståelsene og manglene kan forlede KlimaProg til å trekke gale konsekvenser.

Det ser det ut til å være noe nøkkelinformasjon som komiteen ikke har tatt inn over seg, eller har hatt tilgjengelig. I denne sammenheng er det viktig å huske på at siden prosjektet startet høsten 1997 er det produsert et 3 hovedsøknadsbeskrivelser og 2 tilleggsbeskrivelser, 4 framdriftsrapporter (hvorav en utvidet i forbindelse med evaluering av fase I i 1999), 5 GTR (generelle tekniske rapporter), et stort antall tekniske rapporter, populærvitenskapelige bidrag, konferansebidrag, samt vitenskapelige artikler. Det sier seg selv at det vanskelig lar seg gjøre å komprimere alt dette inn i framdriftsrapporten som lå til grunn for evalueringen nå. Vi sendte også inn 29 vitenskapelige arbeider (i tre eks.) sammen med rapporten, men på bakgrunn av flere spørsmål som ble stilt prosjektlederen ved intervjuet 28. januar ble det klart at Komiteen (iallfall i all hovedsak) kun har lagt framdriftsrapporten til grunn.

1) Prosjektets varighet

RegClim har ikke vart i 5 år. Vi startet opp ca. medio september 1997 etter å måtte omarbeide prosjektbeskrivelsen fundamentalt. Framdriftsrapporten ble sendt in medio desember 2001, altså snakker vi i realiteten om en periode på 4 år og 3 måneder.

2) Å skille mellom de to overordnede mål for RegClim

På side 1 nevnes "original aims" for RegClim.

a) Det første (Overall Aim I) er ikke korrekt gjengitt, idet "adjacent sea areas and major parts of the Arctic" er utelatt. Dette *kan* være alvorlig for anbefalingene fordi disse delene av vårt regionale klimasystem ikke kan dekkes tilfredsstillende med en ren regional atmosfæremodell. Samtidig er det betydelige samfunnsøkonomiske og miljømessige virkninger av evt. klimaendringer knyttet til dem. Dette *kan* ha ført til noen av komiteens manglende forståelse for aktivitetene i PT7.

b) Det andre (Overall Aim II) er forsåvidt en korrekt kortversjon, men når de tre ordene "quantification of uncertainties" er løsrevet fra den oppfølgende spesifiseringen som medfører en videre oppdeling i - *prosesser i det nordlige Atlanterhav* og - *betydning av strålingspådriv med sterke regionale kontraster*. Det er således ikke "trivielle" usikkerhetsoverslag for den dynamiske nedskaleringen vi her snakker om, som er en del av Overall Aim I. I mye av sin videre analyse av RegClim uttrykker komiteen tidvis stor forvirring over rollen til disse forskningsaktivitetene, idet de later til å tolke Overall Aim II ganske langt i den retning av at den delen også å skulle gi scenarier for virkningsstudier.

   F.eks. kan man lese i 3. avsnitt på side 3 *"...but the goal is rather to establish a common model framework for climate scenarios";* det kan jo hende at noen forskningsgrupper har et slikt mål for å utvikle et modellapparat, men dette har aldri vært noe uttalt mål for Overall Aim II i RegClim. Målet har vært å bedre vår kvantitative forståelse av de nevnte prosessene, fordi de er dårlig representert i alle de global modellene som p.t. kan nedskaleres i Overall Aim I, og som derigjennom gjør dem usikre. Dette målet kan ikke nås ved å bruke den regionale modellen i Overall Aim I, fordi en regions klima ikke bare bestemmes av prosessene i den samme regionen.

   Disse misforståelsene kom også fram under intervjuet av prosjektlederen den 28. januar 2002. Dessverre strakk på lang nær den avsatte timen til, og nesten 45 minutter forsinket måtte møtet avbrytes for å rekke fly til Oslo. Dette var midt mens vi forsøkte å avklare disse tingene. Imidlertid forsøkte prosjektlederen å oppklare dette pr. e-post, tydeligvis uten å lykkes helt.

3) Scenarieproduksjon og modeller

Dette punktet gjelder produksjon av scenarier for bruk av forskere utenfor RegClim (trolig tenkes på virkningsstudier), (jfr siste avsnitt side 3, men også anbefalinger (!) i andre avsnitt under "Future plans").

Det skulle framgå klart fra våre prosjektbeskrivelser og fra framdriftsrapporten at det er Overall Aim I som skal gi scenariodata for virkningsforskningen. Dette er nedskalering av de presumptivt "beste" globale scenariene til enhver tid. All denne aktiviteten i RegClim *har helt siden starten av prosjektet ligget ved en og samme fysisk enhet: FoU og Klimadiv. ved DNMI i Oslo.* Anbefalingen om dette oppfatter vi derfor som "å slå inn åpne dører", for å si skarpt.

Vi forstår heller ikke at det skulle være et problem at vi gjør både empirisk og dynamisk nedskalering. Dynamisk nedskalering er "dyrt"; det tar flere måneder å gjøre en beregning, og det er store datamengder som må håndteres. Fordelen er at produktet sier noe om klimaet i alle deler av geografien. Empirisk nedskalering (statistisk) kan på den annen side anvendes på mange globale scenarier som da vil gi oss et bilde av usikkerheten i de mye færre dynamisk nedskalerte scenariene. Dessuten vil avvik fra eller sammenfall mellom de to metodenes resultater gi oss en indikasjon om kredibiliteten. I tillegg til å sammenlikne med andre nordiske lands nedskaleringer er dette en vesentlig komponent av den "trivielle" usikkerhets-kvantifisering som ligger i Overall Aim I.

Den "ikke-trivielle" usikkerhetsanalysen i Overall Aim II har det aldri vært meningen skulle gi scenarie-data for direkte bruk i virkningsforskningen. Formålet er å forstå bedre alvorlige mangler i forståelsen av klimasystemet som har spesiell relevans i vår region. Til dette trengs også "scenarie"-beregninger, ved at lange beregninger i koplet modus må gjøres for å avdekke responsen i klimasystemet på (forhåpentligvis) forbedrede metoder som utvikles i RegClim. Da snakkes det om prosesser som er dårlig representert i alle dagens globale modeller og som det arbeides med på forskningsfronten. Forhåpentlig vil også dette i neste omgang også gi bedre data til virkningsstudier, men det blir først ved neste generasjon globale klimascenarier.

Vi synes ikke Komiteen har oppfattet denne distinksjonen, og dermed blir noen anbefalinger dels er irrelevante (se over) og dels uforståelige for oss.

Blant annet føles det ikke meningsfylt å kreve at global modellering for å beregne aerosolers og skyers betydning bedre skal ha samme fysikkparameterisering som DNMIs modell for nedskalering (HIRHAM).

Men de har et poeng i at det kunne være en effektiviseringsfordel om modellsystemet som brukes for å studere havsirkulasjonens betydning brukte den samme atmosfæremodellen som for studier av aerosoler og skyer. Imidlertid er det ikke sikkert at de to gruppene allikevel måtte arbeide med ulike modellversjoner, fordi formålene er ulike og det vil være behov for ulik optimalisering og paralellisering av kodene før lengre scenariekjøringer (100 år og lengre).

4) Tungregnekraft

Vi kan ikke se at evalueringen nevner de begrensninger som ligger i den tilgjengelige tungregnekapasitet for prosjektet. Dette er et punkt prosjektledelsen har forsøkt å sette på dagsorden fra de første diskusjoner om RegClim. Dette vil mer enn noe annet være dimensjonerende for det norske ambisjonsnivå innen klimamodellering, og må ikke glemmes av de myndigheter som planlegger klimaforskningen. Dette burde vært en viktig del av analysen under "Future Plans". Vi har selv nevnt dette på side 22 i vår framdriftsrapport.

5) RegClims deltakelse i internasjonale prosjekt

Under diverse punkter ser det ikke ut til at Komiteen har tatt inn over seg at RegClim er et *prosjekt* som dermed ikke har mulighet for å (f.eks.) søke om andre prosjekter i samarbeid med andre. Vi kritiseres spesielt for ikke å være med i PRISM eller PRUDENCE. Det måtte jo evt. ha vært en eller flere av instituttene i RegClim som var med, og det er faktisk etablert et samarbeid med EU-prosjektet PRUDENCE ved at Trond Iversen er med i "external advisory board", og ikke minst ved at DNMI har et frivillig samarbeid med å utarbeide alternative dynamisk nedskalerte scenarier som et frivillig bidrag fra RegClim til PRUDENCE. RegClim (og DNMI) får som gjennytelse de seneste og kontrollerte globale dataene fra Hadley-senteret for nedskalering. Det kan også nevnes at RegClim(DNMI) er involvert i et nytt EU-prosjekt (GLIMPSE) som det nylig er kommet uoffisielle signaler vil bli finansiert.

Ellers er flere av RegClim-instituttene involvert med flere EU-prosjekter som også kommer RegClim til nytte, men vi tar inn over oss at dette burde vært bedre beskrevet i framdriftrapporten.

RegClim er også med i et nordisk nettverk (RESMoNA), og i disse dager søkes om et nordisk prosjekt sammen med de andre 4 nordiske nasjoner innen nedskalering og tilrettelegging av virkningsdata for energisektoren i Norden.

6) Prosjektledelsen

I tråd med punkt 5) bør det også understrekes at midler til prosjektledelsen av RegClim ikke har vært avsatt, men er i din helhet dekket av DNMI (og delvis UiO). Formelt er det avsatt ca. 20% av normal arbeidstid for prosjektlederen. Faktisk er det en god del mer i form av "gratis" overtid. RegClim har ikke vært et klimamodell-senter med en daglig ledelse slik f.eks. Det danske klimacenter og Rossbycenteret. Derfor har heller ikke ledelsen noen formell innflytelse på hvem de ulike institutter setter til å arbeide med RegClim, og det er urimelig å kreve at prosjektlederen skulle presse gjennom "upopulære avgjørelser" med en slik struktur.
På den annen side har ikke behovet, etter vår mening, vært spesielt stort for slikt hittil, og noen mindre populære tiltak er nok måttet godtas noen få ganger. Men noe kunne nok ha sett annerledes ut med en fastere ledelse.

7) Rekruttering

Da RegClim ble planlagt for første gang ble det av det avgåtte programstyrets formann (Øystein Hov) og den daværende nye formannen (Anton Eliassen) i mars 1997 understreket at et nytt prosjekt skulle være *koordinert mellom flere fagfelt og institusjoner, skulle så langt som mulig bygge på den kompetanse som da fantes i Norge, samt skulle ikke ha rekruttering (dr.-studenter) som vesentlig ingrediens*.

Det føles derfor galt å nå bli kritisert for ikke å ha bidratt nok til rekrutteringen eller for ikke å ha invitert post.doc.s fra utlandet.

Vi er imidlertid enige i at *kritikken bør tas hensyn til for framtida av f.eks. Forskningsrådet og KlimaProg.* Prosjektledelsen har lenge hevdet at rekruttering fort kan bli en akilleshæl for norsk klimamodellering (f. eks. i paneldiskusjonen på Klimaseminaret 17 nov. 1999 av RegClims prosjektleder.).

8) Kontakt med andre koordinerte prosjekter

Kontakten med NOClim og NorPast er tydelig ikke kommet fram overfor Komiteen. Alle styremøter i NOClim og NorPast har observatør til stede fra det andre prosjektet. Fra RegClim møter Eivind Martinsen og fra NOClim Harald Loeng. Utover dette inviterer RegClim alltid deltakelse fra NorPast og NOClim til sine møter. Presentasjoner fra slike møter er inkludert i våre "General Technical Reports (GTR)". RegClim-ledelsen ble også spurt til råds ved planleggingen av NOClim, f.eks. ved møte i Bergen primo April 2000.

På side 3 avsnitt 4 viser evalueringsrapporten til et utsagn jeg skal ha kommet med under intervjuet 28 januar. Denne setningen er en misforståelse. Prosjektlederen uttrykte det samme som i framdriftsrapporten: den regulære representasjon i hverandres styremøter har ikke gitt avkastning som står i stil med kostnadene (ekstra flyreiser, møtetider må tilpasses ytterligere en person), og at den faglige kontakten (som tross alt er viktigst) uansett må foregå ved at forskere er involvert i begge prosjekter. Videre var det meningen å uttrykke tilfredshet med høstens fellesmøte i Bergen der programstyret (det avgående) hadde hovedansvaret for programmet i

samarbeid med de koordinerte prosjektenes ledere. Vi ønsker mer regulære møter av denne typen, men det betyr ikke at NOClim og NorPast ikke vil bli invitert til RegClims fagmøter.

9) Popularisering

Noen av PTene (særlig 2, 6 og 7) kritiseres for liten populærvitenskapelig aktivitet fordi få artikler til Cicerone er skrevet. Til det må det svares at flere av disse PTene har hatt en utstrakt aktivitet i media (aviser, radio, TV). Cicerone er ikke den eneste kanal for popularisering. Forøvrig er det vanskelig å sammenlikne PT for PT, fordi enkelte aktiviteter ligger nærmere nyhetsbildet enn andre. Vår brosjyre som har et opplag på 10000 er ikke nevnt.

10) Vurdering av vitenskapelig ytelse og bidrag

Vi synes også at Komiteen i noe høyere grad kunne tatt hensyn til at noen deler av RegClim allerede hadde kommet ganske langt internasjonalt (noen til og med i aller fremste linje) ved starten. mens andre har startet fra nærmest et nullpunkt (teknisk sett og som faglig renommé). Sammenlikningen mellom enkelte PTer føles derfor skjev når det i liten grad fremheves hvor langt man faktisk har kommet over bare litt over 4 år i et område som involverer tung innsats av teknisk art (tilpassingen av store modellkoder til nye tungregneanlegg, behandling av store datamengder etc.).

Det er verdt å nevne som et eksempel at modellen som blir brukt til dynamisk nedskalering i Overall Aim I er optimalisert for parallell maskinarkitektur av forskere i RegClim. Dette er et arbeid som ikke gir direkte publikasjoner, men er et avansert arbeid som har satt RegClim i stand til å produsere mye mer data til virkningsforskningen enn antatt da RegClim ble planlagt. At dette arbeidet var godt, bevitnes av at Max-Planck-Institut für Meteorologie i Hamburg ønsket denne modellversjonen som gjenytelse for å gi RegClim tilgang på sine siste globale data for nedskalering.

Videre gjøres betydelig teknisk arbeid under Overall Aim II før man kommer så langt at publiserbare resultater er klare. Ikke desto mindre er flere dr-grader og en rekke publikasjoner skrevet også her, selv om virksomheten var liten i 1997.

Det er stort sett PT 6 (direkte effekter av regionale kontaminanter) som aktivitetene var på et avansert nivå da RegClim startet. I alle andre PTer (dvs. 1, 2, 3, 4, 5 og 7) er svært mye startet fra et nullpunkt i klimaforskningen, selv om man gikk ut fra modellverktøy det var kompetanse på fra andre sammenhenger.

11) Bidrag til virkningsforskningen

Komiteen har gjort et stort poeng av at RegClim ikke har hatt nok kontakt med virkningsforskningen, og at det gjenstår mye arbeid for å tilpasse aktivitetene og våre data til dette. *Dette er en kritikk som vi ikke kjenner oss igjen i.*

Prosjektledelsen og PIene for PT1 og PT3 gikk tidlig ut i nyhetsbildet med RegClims nedskaleringsresultater når vi følte at de var nok kvalitetssikret. Dette ble gjort med en pressekonferanse 11. mai 1999, altså i god tid før prosjektet var 2 år gammelt. Sammen med pressekonferansen ble det laget en brosjyre som i et opplag på 10000 –ti tusen-. Mye av hensikten med denne konferansen var nettopp å få "virkningsmiljøene" til å oppfatte at regionaliserte data da var tilgjengelig for virkningsforskning for første gang i Norge. I framdriftsrapporten har vi sammenfattet spørsmål og svar fra journalister som selvsagt var opptatt av å få svar på hva klimaendringene vil kunne bety for f. eks. norske næringsinteresser.

Da måtte vi svare at dette var (p.t. 11/5/1999) utenfor vår kompetanse og at det måtte videre forskning til for å besvare slikt.

Disse svarene ble prosjektlederen konfrontert med av Komiteen under intervjuet 28 januar, der de ble tolket som om vi ikke var interessert i at dataene våre skulle benyttes. Det ble svart at dette var en misforståelse, og for øvrig ble dette også utdypet i en e-post dagen etter.

Tvert imot mener vi i RegClim at vi skal roses for å ha bidratt til å få startet opp aktiviteter for virkningsforskning i Norge, og RegClim(DNMI) er involvert direkte i de fleste av disse initiativene. Disse står nevnt summarisk på side 36 og 37 i vår framdriftsrapport, se særlig PT1.

Det *kan* se ut som om Komiteen har trodd at RegClim selv skulle drive virkningsforskning, men dette har ikke ligget inne i så langt. På et senere stadium kan man imidlertid tenke seg en utvikling i retning av "jord-system-modeller" der f. eks. hydrologi og vegetasjon er en integrert del av klimamodellene.

Detaljerte punkter

12) første avsnitt side 2.

Det kunne vært nyttig å få vite hvem Komiteen mener har oppført irrelevante publikasjoner.

13) tredje avsnitt side 2.

Det bør bemerkes at MU / Klima- og Ozon ikke støttet utenlandsoppholdene til Kristjansson og Iversen.

14) andre avsnitt side 3.

Vi har vanskelig for å forstå at det vitenskapelig sett er tapt noe i "duplication of effort", men muligens noe på den tekniske siden. Uansett ville den regionale modellen være helt forskjellige fra de globale, og formålet med de to globale modellene er så forskjellige at det uansett hadde vært snakk om to modellversjoner. Men noe kunne nok ha vært spart inn og det interne samarbeidet i RegClim ville vært styrket, ikke minst ved at flere arbeider med felles tekniske problemer.

15) andre avsnitt side 4.

ChemClim og Bjerknessamarbeidet er ikke koordinerte prosjekter men spissforskningsgrupper finansiert av forskningsfondet.

16) PT1

- Denne PT har produsert vesentlig *mer* teknisk sett enn planlagt. Dette skyldes at teknisk meget kyndig personale er avsatt til å optimalisere og parallellisere koden. Det er kjørt 15 år med perfekte render (ERA-data), og 2x20 år med scenario-data fra MPI-modelen fra Hamburg. Til sammenlikning er det kun kjørt kortere perioder i Danmark (8 år) og Sverige (10 år), svenskene har riktignok brukt data fra to globale modeller. 20 år dekker en større intern variabilitet i klimaet.
- Nedskalering av Hadleysenter-data gjøres nå i samarbeid med PRUDENCE.
- Det er tidligere rapportert at sammenlikningen med satellittdata måtte gis opp p.g.a. uforutsette større arbeid enn antatt.
- En publikasjon med analyser fra PT1 er nå sendt inn til Climate Dynamics (Haugen, Bjørge og Nordeng).
- Resultater fra PT1 er referert i IPCC TAR (se framdriftsrapporten)

17) PT2

Det er gjort store bidrag til popularisering utover 2 artikler i Cicerone (se framdriftsrapporten).

Aksepterte nye publikasjoner:

Butt, F. A., H. Drange, A. Elverhøi, O. H. Otterå and A. Solheim (2002): Modelling late Cenozoic isostatic elevation changes in the Barents Sea and their implications for oceanic and climate regimes: preliminary results, Quat. Sci. Rev., accepted

Furevik, T., M. Bentsen, H. Drange, J. Johannessen and A. Korablev (2001), Temporal and spatial variability of the sea surface salinity in the Nordic Seas, J. Geophys. Res., accepted

Ny innsendt:
Otterå, O. H. and H. Drange (2002): A possible coupling between the Arctic fresh water, the Arctic sea ice cover and the North Atlantic Drift. A case study. Clim. Dyn., submitted

18) PT4

Denne PT har hatt en stor innsats for å bygge opp teknisk kompetanse. Det bør også nevnes at det så sent som i januar 1999 ble bestemt å gå inn for en modell med full kopling istedenfor en forenklet teknikk med "kvasikopling". Ved den anledning ble innsatsen økt med ett årsverk.

19) PT5

Det er ikke riktig at denne PT har "endret fokus" fra sky-skjemaer til aerosol-skyer-klima studier. Det siste har hele tiden vært hovedmålet. Tidlig i prosjektet var det med *egeninnsats fra DNMI* lagt inn en mulighet for å forbedre konvektive skyparameteriseringer. Dette falt ut etter et års tid da det viste seg at oppgaven ville bli mer arbeidskrevende enn først antatt.
I RegClim er vi lei oss for at disse tingene p.t. ikke er med for fullt, all den stund skyer er svært usikre komponenter i klimamodellene.

Resultater fre PT5 er referert i IPCC TAR.

20) PT6

Vi må nok melde at mye av den kompetanse som er kommet IPCC TAR til del fra disse aktivitetene i høy grad skyldes andre prosjekter enn RegClim. Men flere publikasjoner fra RegClim er referert.

21) PT7

Komiteen har tydelig følt en forvirring og en manglende rød tråd i denne PTs aktiviteter. Litt historikk trengs for å oppklare litt:

- Da RegClim startet var det ikke klart hvilken av de to modellene som det var god kompetanse på i Norge som fortjente å bli utviklet til klimastudier. Det var enten MICOM eller POM. POM ville trenge en del oppjustering for å kunne kjøres som klimamodell, bl.a. trengtes en ismodell koplet til den. NERSC's MICOM hadde en egenutviklet ismodell, men var ikke RegClims eiendom. Etter et års tid ble det avklart at den sistnevnte modellen var kommet lengst for anvendelse i klimastudier, og det ble vedtatt at den modellen skulle være hoved redskapet for å studere dyphavsprosessene i Atlanterhavet.

- Imidlertid trengtes også en modell for å koples til den regionale atmosfæremodellen for dynamisk nedskalering over av og i Arktis. Til dette ble det fortsatt satset på å tilpasse POM, og bl.a. ble det utviklet en ismodell ved DNMI som det er kjørt flere dekaders scenarier med observerte atmosfæredata. En av grunnen for dette valget er en liknende modelltype brukes ved Havforskningsinstituttet for havbiologi, og med POM ville da virkningsstudiene bli vesentlig teknisk forenklet. Senere er ytterligere svakheter ved POM som klimamodell avdekket, slik at MICOM nå også er valgt for dette formålet.

Konklusjon: Jo det har nok godt med en del ressurser til modelltesting og utvikling i denne PT, men teknisk sett er store framskritt gjort og en kopling atmosfære-hav-is på regionalt nivå for å produsere data for virkningsstudier også i havet og i Arktis er nå nært forestående.

Nye publikasjoner:
Manus av Røed, Debenard og Sætra "Future wind, wave and storm surge climate in the Nordic Seas" er sendt til Climate Research.

Teknisk Rapport om det samme (DNMI Report No, 130) er trykket.

22) PT9

Komiteen ser ikke at aktivitetene her ikke kunne vært en del av de andre PTene. Hensikten med å lage denne PTen var å bevisstgjøre betydningen av tolkningsarbeidet fra klimakjøringene, og å bygge opp en kompetanse og et programbibliotek på avansert statistikk.

Nå (RegClim 2002) er aktivitetene (dog nedkortet pga. nedskjæringene i fjor) distribuert til PTene.
Imidlertid er det ikke selvsagt hvor f. eks. aktivitetene innen Forcing Singular Vectors best hører hjemme, og det kan også tenkes aktiviteter på et avansert tolkningsnivå som omfatter flere PTer.

A2.2 NORPAST

The evaluations committee's (EC) report on NOPRAST was received by E-mail 4.25 p.m. February 14, 2002 and forwarded to all NORPAST Pi's the same day. As requested by NFR we have listed mistakes and misunderstandings regarding the evaluation committee's report. However, due to the very short deadline our comments are not complete or as penetrating as we would have wanted them to be. According our information the evaluation was expected to be due in March, thus many of us are/have been travelling and have other commitments, including project co-ordinator Eiliv Larsen, currently at meetings in the USA. We have organised our comments in the following parts:

General comments on the project as a whole
Funding
Integration
NORPAST publications
Detailed information on task and sub-task level
Detailed comments on the tasks and sub tasks

General comments on the project as a whole

We are pleased with the committee's final conclusion " the evaluation committee is of the opinion that the group, within only 3 years, is well under way". Addressing the committee's Issue no. 1: 'Scientific results obtained through the project and contribution to advancement of the field.' We would have hoped that the Evaluation Committee would have been able to see and comment on the NORPAST results in a wider context and evaluate their importance or otherwise. This would have been of great help and value to the NORPAST researchers and to NFR in their assessment of the success or otherwise of NORPAST.

Regarding the "*Weak involvement of other research groups*" (third paragraph) we have the following comment: At the time of starting up NORPAST the Polar Institute was moving from Oslo to Tromsø, and no paleo-workers intended to move. The person they later hired in Tromsø was a partner in the original NORPAST proposal, but specifically asked to be taken out since she felt it to be a conflict with her current membership of the Climate and Ozone Committee. Other institutions: when starting up NORPAST made a general call for letters of intent. In total these intents amounted to NOK 60 mill. worth of research. Some was totally irrelevant to NORPAST, but many tough decisions had to be made.

International collaboration: International scientists involved in each NORPAST project are listed under each project in Chapter 5 as Collaborators. NORPAST international involvement is given in Chapter 7.

Remarks on budget and structural organisation

- "Money to NGU never specified" Incorrect. It is specified to the same level as for the other institutions, but also includes funding directly from NGU.
- "Olsen's engagement unclear." Olsen is listed as a scientific co-worker, Table 5.3.
- "Lauritzen's engagement unclear." This is acknowledged since 5.1.6 was in the original proposal, but later taken out since the rather ambitious sub-project could not be realised due to budgetary constraints.
- Nordli is mentioned as a supported researcher for 5.6.3. The confusion regarding this is acknowledged since 5.6.3 had to be taken out due to budgetary constraints.

- The salary in Appendix 2 is for Knut Stalsberg who is compiling data for the ice sheet database and participating in the joint NORPAST – NSF modelling. Martha Stalsberg was going to do sedimentological/stratigraphical work in the Ranafjord project (5.4.2) with partly NGU, partly NORPAST funding. She has terminated, and the work is partly taken over by Astrid Lysså (NGU).

Maps of the NORPAST study area are given e.g. in Figures 4.2, 5.7, and 6.1.

Funding

Low funding has been a major limiting factor for NORPAST. It has also been a problem that funding was divided into periods of only two years and it has also been problematic that the actual funding was reduced by some 25 % compared to pre-funding signals. Many of the problems addressed by the evaluation committee's comments e.g. on chronology control, lack of data, etc. are due to low, continually reduced funding, not poor planning or implementation.

Integration

Integration between the various disciplines has been given a high priority throughout the project. We agree that there are other ways to organise the tasks in order to achieve this. However, it should not be forgotten that when NORPAST started 3 years ago this was a completely new project construction both for NFR and for the involved pi's. Thus, we feel that this has been a learning process during which NORPAST scientists have learned a great deal about how to run such a large, integrated programme. We are unaware of any "competition between the projects".

NORPAST publications

Except some papers from 1999, we are listing articles that fully or partly are NORPAST results, that is also articles that are spin-off of NORPAST in collaboration with other groups, and results of other projects integrated with NORPAST (e.g. NORPEC, SPINOF; EU-projects). We do not think that it should be closed seals between NORPAST and other projects/groups neither in working nor in publishing. Some other scientific publications are also included, so that the overall scientific productivity of the researchers is represented.

Detailed evaluation on task and sub-task level

On some of the tasks the EC requests more information, for example background data. We can supply additional data to answer most of these questions if requested. However, the NFR guidelines (received Oct 25, 2001) give limitations with respect to the size of the report, e.g. recommending one page per sub-task per year. With such limited space it is virtually impossible to include all relevant information and we concentrated on presenting the results achieved during the NORPAST period.

Detailed comments on the tasks and sub tasks

TASK 5.1 Lakes and terrestrial archives

5.1.1: In the evaluation report it is stated that the robustness of the winter precipitation reconstructions needs to be tested. Within the project and available funding we have made two reconstructions (from Hardangerjøkulen and Jostedalsbreen) which show a similar development. According to John Birks, it is extremely difficult to make statistically-based error bars when combining two such different data sets (equilibrium-line altitude curves and summer temperature curves from biological proxies). The (only) way to test these curves is to produce winter precipitation curves based on other sites and from other areas.

The lack of radiocarbon dates and chronological problems in 5.1.1 is a major problem that was emphasised in the report. The problem is a result of the limited budget of NORPAST. Obtaining AMS dates in Norway is not easy because it commonly takes 3 months for the application to be considered and 6 - 9 months for the dates to be obtained. There has been/is very little money in NORPAST 5.1.1 to pay for dates, even at the cheap price from Trondheim.

The report recommended that fewer sites should have been studied. Then objectives 1 and 3 could not have been fulfilled. It is not possible to make glacier reconstructions and summer temperature reconstructions from the same lakes. Therefore 5.1.1 and 5.1.4 can not work with the same lakes. There has, however, been a close collaboration during site selection to make optimal use of the limited funds. The results from 5.1.4 have been used to make the winter precipitation curves, and during 2002, when more ELA curves and summer temperature curves become available, more winter precipitation curves from other regions of Norway will be made. It is not feasible to use John Birks' computer program for age/depth models on proglacial lake records due to highly variable sedimentation rates. Linear interpolation between the dated levels has therefore been applied to make age/depth models for proglacial lake sediment records.

It is hard to see how project 5.1.1 can be integrated with project 5.1.2, when the time scales scarcely overlap. 5.1.1 and 5.1.2 have, however, co-operated closely in site selection the lakes in North Norway has been cored with equipment and personnel from both 5.1.1 and 5.1.2. 5.1.1 integrates with 5.5 as it uses the transfer functions to make quantitative reconstructions. 5.1.1 has been integrated with the marine results in the Holocene synthesis.

5.1.2: 'limited public outreach'. Results from this project were presented in NRK 'Schrødingers Katt' seen by over 1 million people in Norway.

From the EC -report: "only one site will have ^{14}C AMS dates and hence have any chronology'. This is not true, and therefore the comments/suggestions are irrelevant.
It was stated that only one site would be DELIVERED with a chronology.

The southern site is not a 'repetition of Krakenes'. Krakenes is unusual in having a glacier develop in the catchment during the Younger Dryas. This obscures the regional temperature conditions and fluctuations. Bjerkreim (S. Norway) does not have a glacier in its catchment in the Younger Dryas and should provide a regional record. Secondly, the sites are 1.5 degrees of latitude apart, with summer temperatures today of 12.6 and ca. 15 deg C, a considerable gradient. Thirdly, the presence or absence of Interstadial tree- birch is critical in reconstructing the interstadial climate. If tree-birch was anywhere in the Norwegian interstadial, it would have been in southernmost Norway.

Temporal resolution is controlled by the sedimentation rate at a site, and higher temporal resolution cannot be "achieved" as suggested by the evaluators. Spatial resolution requires more sites, and that is not provided for in NORPAST. The evaluators assume that short climatic oscillations are detectable and should be focused upon. This is a wrong scientific approach; one cannot focus on such events if they are not detectable. There is also a misunderstanding that one must have a high-resolution chronology in order to analyse a sequence at 50- 100 year intervals. The sampling interval can be determined without a chronology. The chronology is needed to date the interpreted events.

It is hard to see how the late-glacial project 5.1.2 can be integrated with Holocene projects 5.1.1 and 5.1.4, when the time scales scarcely overlap. 5.1.2 integrates with 5.5 as it uses the transfer functions to make quantitative reconstructions. It has been integrated with the marine results in the late-glacial synthesis.

5.1.4: The cores from this project are being used for multi-proxy studies in other projects (e.g. NFR Strategic University Programme NORPEC) such as plant macrofossils, diatoms, chironomids, and orabitid mites.

Sylvia Peglar retires at the end of 2002 and returns to the UK. She has spent all her NORPAST 75 % time doing NORPAST research and also teaching and passing on her unique pollen analytical expertise to young Norwegian doctoral students employed on other NFR supported projects, e.g. NORPEC, so that the Norwegian - north Sweden modern pollen - climate calibration set and transfer functions can continue to be used in Norwegian paleoclimatic research after her retirement. This requires very careful pollen taxonomic quality control and harmonisation. This use of her time is considered more important than publishing independently when her involvement in NORPAST is as a joint Principal Investigator with H.J.B. Birks. Mary Edwards withdrew from her role in this project for personal family reasons. She is active in project 5.6.1.

The lack of radiocarbon dates in 5.1.4 is a major problem that the Principal Investigators had themselves emphasised in their report.

Integration and interaction between 5.1.1, 5.1.2, and 5.1.4. All three projects involve different sites (mountain lakes in 5.1.1, coastal sites in 5.1.2 where late-glacial sequences can be found in Norway, inland lakes along critical climatic gradients at or near major vegetational boundaries where climatic changes are most likely to be expressed). We have tried to achieve 'optimal' site selection for 5.1.1, 5.1.2, and 5.1.4 as we believe scientifically this is the best thing to do, rather than finding a sub-optimal site that could be worked on by 5.1.1, 5.1.2, and 5.1.4. Inevitably the 'optimal' sites selected are not the same in each project. Results from 5.1.4 are shared with 5.1.1 by providing biologically-based reconstructions of summer temperature that are then used to reconstruct changes in winter precipitation from glacial ELA changes. Figures 5.2C and 5.9 of Holocene winter precipitation are a direct result of integrating biologically-based reconstructions of summer temperature from projects like 5.1.4 with results shown in Figures 5.2A and 5.8. There is almost no temporal overlap between 5.1.1 and 5.1.2.

5.1.5: Budget discrepancies: The December accounts (2000 and 2001) also include funding from NGU. The project is to be regarded as an internationally pioneer work on this topic, and time is needed for fully to explore the potential. It is worth mentioning that the paleoclimatic potential related to other types of paleoclimatic data, e.g. glacier fluctuations and pollen, have been explored for decades. The group has itself acknowledged that this is a difficult task and that many of the factors are local. Nevertheless, they have pointed out (and demonstrated) ways to overcome the difficulties.

The suggestion of a monitoring program: This might be a good suggestion, but it is way beyond the time and budget frames of a NFR program. In addition, the uniqueness of this group is the ability to obtain long-term (paleo) trends in extreme weather situations.

TASK 5.2 Historical archives

Comments on the evaluation report for sub project 5.2.1. Funding: In the NORPAST project period there has been no funding from other sources than the Meteorological Institute own contribution in addition to the NORPAST funding. This is not enough to be a full time NORPAST researcher.

Documentary sources: When we stated that "detection of additional diaries in near future is very unlikely" we had in mind this project period ending this year. Seen in a longer time perspective these sources are certainly not fully explored.

TASK 5.3 Ice sheet dimensions

5.3 General comments: It is acknowledged that it might be difficult to see the links between the ice sheet part and the other terrestrial/marine parts. A first and admittedly crude effort to link marine and terrestrial with the ice sheets are made in the synthesis section of the report (Chapter 6). This is a stepwise process from primary data within the different sub-systems, via syntheses to linkages.

Integration 5.4, 5.5.1 and 5.3.1: Coring lakes on Svalbard for 'quantitative paleoclimatic reconstructions'. Developing quantitative reconstruction methods to work in the High Arctic, Svalbard is a very difficult task. Further, the link between marine cores and ice sheets has been addressed in some of the modelling experiments (e.g. Fig. 6.24). We admit that further marine, terrestrial and ice sheet correlation is interesting and important, but far out of reach in terms of budget and scientific aims of 5.3.1.

5.3.2: It is agreed that it would be more straightforward to include ice sheet modelling in this task as was the original intention. This was not possible due to budgetary reasons, and modelling is now performed in a NSF (USA) project to which NORPAST contributes. Therefore only a synthesis for ice sheet modelling is a NORPAST contribution to this effort.

TASK 5.4 Marine archives

5.4.1: The goals do not fit to the title of the project: This is correct, the project was reduced due to reduced funding and the goals were adjusted according to this. However, title and ID-number has been kept for practical reasons. We agree that this field needs more explorations and it should be considered that this subtask has been operating less than one year at the time of reporting. The extra information asked was omitted due to the limitations given by the NFR-guide-lines for this evaluation report, however we shall be happy to submit this if requested by NFR. Whether the reconstructed temperatures were annual, monthly, seasonal values are still under investigation, however the latest data on this (February 2002) indicate that November BWTs are reconstructed.

5.4.3: There is a caption to Figure 5.45 in the report.

Collaboration between sub-projects 5.4.1, 5.4.2 and 5.4.3. With only one year in operation of 5.1.4 and even less for 5.4.3 (due to budget) time is limited and most of the data within the projects are fairly fresh. The recent data on annual-to decadal time resolution of marine records achieved during 2001 is considered a scientific break-through and a joint TASK 5.4 paper is planned.

TASK 5.5 Transfer functions

5.5.1: The relevant statistics for the benthic foraminifera transfer functions are given in Table 5.5 and examples of their application are given in Figure 5.44 and associated text. It can be seen from Table 5.5 that the benthic foraminifera transfer functions have an RMSEP of about 1 degree C, about the same as other temperature transfer functions. The work on a diatom - ice-cover transfer function is underway in another NFR supported project (NORPEC) in conjunction with European colleagues. It had to be removed from NORPAST 5.5.1 because of lack of funding.

TASK 5.6. Modelling

5.6.2: The committee correctly understands that at the time of writing the report the ice sheet model was initialised with these data.

A2.3 COZUV

Review of the Coordinated Ozone and UV project

The comments are written in italic with blue colour.

Here follow comments from some of the project participants. In some cases these comments try to clarify misunderstandings and in other cases they reflect the opinion of the partners with respect to the review.

Introduction

The review of the Coordinated Ozone and UV project (COZUV) was carried out in January-February 2002. The review group consisted of Bo Christiansen (DMI), Paul Eriksen (DMI), and Martin Dameris (DLR). The group met in Copenhagen 28-29 January, 2002.

The basis for the review was the report produced in December 2001 by COZUV and the revised project proposals (or work programmes) for the first (1999-2000) and second (2001-2002) phase of the project.

It would have been useful for the review group to also have the template provided by the Programme Committee since some of the criticism below is related to the organisation of the report. If this template had been available to the reviewers they would also have known about the very strict space limitations in section 2 of the report, namely one page per year per task. We feel that some of the criticism is based on lack of information about the work carried out, a lack of information caused by the limited space available.

Norway hosts strong research groups in both the ozone and UV fields. In particular the efforts done on ozone modeling is well known internationally. A main purpose of the project is to combine the ozone and the UV research.

Not combine, but coordinate. There are several combined tasks dealing with ozone alone which are of great importance in the project. This should not be the main reason why the reviewers claim that the project has failed.

The report has a nice graphical appearance and includes important results. However, it seems to be compiled from the contributions from the different groups without much coherence. The different tasks are not presented the same way, e.g., only for some tasks the report includes an introduction. The way section 1 (progress) and section 2 (scientific achievements) are separated makes it difficult to read, in particular as the division of "progress" and "achievements" is not clear.

We feel that this criticism is unfair because we have tried our best to follow the template provided by the Programme Committee and this template states clearly that there should be one section on project progress and one section on scientific achievements.

It is the opinion of the review group that the lack of coherence in the report reflects a basic problem of the project. Although progress has been made in all tasks and important results have been obtained in several of the subtasks the collaborative effort seems weak.

Task 1: 3-d modeling of atmospheric chemistry

Both modeling groups, based on the CTM2 and the SCTM respectively, are well established in the international community. There has been considerable work done on development and testing the CTM2 - in particular in phase 1. However, the progress seems to have been limited to model development while progress in the use of the model, inter-model comparison, and comparison to observation is limited.

There is only one CTM modelling group participating in the COZUV project – even if we are using two different CTMs (one tropospheric and one stratospheric model). The purpose of using two models in the COZUV project is that the two models complement each other and we have not intended to make any intercomparisons between the models. The close collaboration that is referred to in the proposal is the development and use of the same physical packages in the two models (which is also done successfully in the project).

There is an effort to compare CTM2 with observations from other tasks. Figures 2.1.1.1 to 2.1.1.4 compare CTM2 to observations by satellites, sondes and lidars. But the comparison is very superfluously and critical discussions are lacking. In Fig. 2.1.1.1 observations and models are presented with different color scales. Why not present the difference between observations and modeling? The panels in Fig. 2.1.1.2 look similar but there is no discussion to which extent this is due to dynamics or chemistry. The difference between the lidar and the model in early December (fig. 2.1.1.4) is not mentioned.

We have been unable to get the numbers (data file) that the figure 2.1.1.1 is based on. We therefore had to use the postscript file provided by JPL, NASA. Thus, a difference or other than the current comparison was difficult.
It is not stated in the progress report, but we have spent a substantial amount of time to try to understand the differences between the model and measurements. But for the figures 2.1.1.2-2.1.1.4 we have found no bias in the results. The deviations seems to be randomly distributed both spatially and temporarily.

How far is the SCTM in the 1980-2000 experiments? Different information is given on pp. 16, 63, and 90. The delay in this experiment could be important as task 9 depends on these results. Actually, this is the only link between task 9 and modeling.

Model experiment for 1980-2000 had to be restarted because we identified some problems with the chemistry code. These are fixed and the model run is resubmitted.
At page 16 both future and current scenarios are described, but so far only the present day scenarios are done. According to the work plan, the future scenarios will be integrated later this year (referring to page 63). Time slice integrations for 1970 and 1980 are completed, but the difference between 1970 and 1980 in chlorine loading is, according to the SCTM, small. Thus, the time dependent integration is from 1980 to 2000 only.
The improvements in the SCTM have elucidated some shortcomings in some of the SCTM packages, which we have had to mend. We have started to run the experiments and these will be finished in due time before the end of the project as the model is quick to run (24 hours/year).

Is Fig. 2.1.1.2 a result of this project? We could not find any reference to such experiments with the 2-d model in the work programme.

The review group is probably talking about Fig. 2.1.2.2 here. Since 2-d model output is used as an initial state for the SCTM, it was important to show that we manage to simulate a reasonable initial state for the SCTM for current chemical state, and credibility to future chemical states.

Figure 2.1.2.1 shows the changes in ozone between 1980 and 1970 as simulated by the SCTM. This result should have been compared to respective analyses of observations. Data are available to check if trends are realistic. At least a reference to Fig. 2.6.3.5 could have been included. Why is only April 1 shown and not a monthly or seasonal mean?

This will be done in activity 6.3 as soon as the results from the model runs are available.

Activity 1.4 and 1.5 seem to disagree on whether or not meteorological data have been provided for 2000 and 2001 (pp 16-17).

The story of meteorological data is a long one, and more complicated than explained in the report. In Act. 1.5 6-hourly global analyses at T106 resolution are acquired from the ECMWF via DNMI on a daily basis. These data are used in some of the analyses in the project, such as in Act. 6.2, and they are also used by a number of users of NILU's NADIR data base. These data do not contain all the parameters needed for input to the CTM-2 model, so the modelling group at UiO acquire the needed data directly from ECMWF. Because of work involved in the calculation of some of the parameters needed for the model, not all the meteorological data are yet available for all the years that have been selected for study. This does not represent a problem so far, because the CMT-2 model undergoes improvements and the study years will have to be re-run in any case. The CTM-2 was recently "frozen" and will not undergo further changes during the rest of the COZUV-2 project period.

A couple of developments promised in the work programme seem not to have happened but this is not commented on in the report. Reading only the report it looks like all milestones have been reached.

- SCTM runs are not based on CTM2 as promised in the work programme for phase 2 (p. 6). SCTM now use initial fields provided by the Oslo-2d model for the long term calculations.

- The year 1997 should have been modeled by now by both the CTM2 and the SCTM. Why are these simulation not compared in the report?

We were too unclear in the COZUV-2 application, as it appears that we intended to use the CTM2 output as initial state for the SCTM runs. This is not the case. Our intension was to improve the stratospheric chemistry modules in CTM2 and then implement these changes into SCTM. Otherwise, we cannot find other deviations from the work plan. The milestones that are not reached are commented (PHASE2), and for PAHSE 1 all the milestones have been reached as reported.

Some important work has been done in this task regarding both models but there seem to have been only little interaction between the two modeling groups. Also, the number of publications from this task is relatively low.

It has not been our intention to make intercomparisons between SCTM and CTM-2 since these are very different models with different emphasis both in terms of region studied and type of problem. The SCTM is a pure stratospheric model, whereas the CTM-2 goes from the surface to 10 hPa. The SCTM is used for long term trend studies and the CTM-2 is used for process studies during shorter periods of time (such as individual winters). The close collaboration that is described in the proposal points to that we have intended to use more or less the same physical packages in the two models, thus to reduce time in developing new packages. Since it is the same group that develop and use the two models is it not really meaningful to talk about a lack of collaboration.

Task 2: Dynamical studies

Yvan Orsolini, scientist in charge of this task, has not been available for comments on such short notice. But since this task probably gets the most favourable review, this is maybe not a problem. See however a comment lower down.

The outcome of this task in both project phases seems to have been an undisputed success, both from a scientific point of view and from the point of view of integrating modeling and observations from different parts of the project. In phase 1 a Lagrangian model has been used to reconstruct ozone profiles from ALOMAR and the model was coupled to chemistry from Oslo. In phase 2 this model was used for calculating global maps of several species, which has been delivered as input to Task 6. The progress and the results are clearly presented in the report and the milestones have been reached. The interesting results have been published in peer-reviewed journals.

The work on ozone mine-hole events has attracted much attention. However, the statistical significance of the results in Fig.~2.2.3.1 is not discussed. It seems to be a general rule in COZUV that statistical considerations and indications of error-bars are left out.

This comment cannot be regarded as a serious criticism. The reviewers give no further examples to underpin this statement. On the contrary, there are examples of error analysis, e.g. in act. 6.2 (see table 2.6.2.1 on page 88 in the report).

Also, the influence of the strong filtering leaving only time scales between 2-10 days needs more attention.

Task 3: Ozonesonde observations

This task was planned as support for other tasks. Problems in Ørland have been overcome by a replacement of equipment. Some details about the number of launches are given in section 1 of the report. However, we miss a description of the accuracy of data and of possible changes in method and instruments. Some overview plots could have been shown of ozone and temperature as was done for the lidar measurements in task 5. This could also be helpful for other groups to identify interesting situations. Information about the availability of the data and on how these can be obtained is missing.

The scientific community, the users of these data, know very well where to find these data as they are made available on NILU's data base NADIR. This is explained in the report, but it would have been a good idea to show some figures with examples of data. In order for scientists to assess the data for analysis of interesting situations we would have to plot all the more than 100 profiles and that would have filled several pages in the report, something we are not supposed to do. The procedures followed in conjunction with the launch of ozonesondes are the ones recommended by the WMO and the accuracy of these measurements is well known in the scientific community.

Task 4: DOAS measurements

The milestones have been reached, except for an apparent delay in the AMF calculations. A total of six reviewed papers are listed but at least the first and last paper have been submitted before the start of this project. Also, it is hard to see how many of the other papers that are directly linked to this project.

It is true that two of the publications were submitted before the start of the project. Their inclusion was meant more as a basis for background information for the tasks planned in COZUV. The other listed publications have strong connections to Task 4 activities, although none of them were fully financed via COZUV funding. A fully financed COZUV publication would most likely need to be based on thorough comparisons between measurements and the Oslo CTM, and would include detailed interpretation of trends and all major compounds and possible deviations. At this stage of the project such a study is not possible due to lack of data from the Oslo CMT-2

Considerable work on ozone AMF is claimed in task 2.4.4, but only very few results are presented. Some details about NO2 AMF are given but a detailed discussion of its effect and implications are missing.

For ozone, there is a possible misunderstanding by the reviewers. Prior to COZUV NILU has done much work on the development of the climatology of AMFs for ozone based on ozonesonde data from Ny-Ålesund and Sodankylä. This fact was stated in the proposal. In regard to the development of the climatology of AMFs for NO_2, this work will continue during the present year. In the case of NO_2 the major difficulty has been the attainability of suitable measured or modelled NO_2 profiles. It was originally planned to use profile data from CTM2. This is still planned, but other models may need to be used as backup (i.e., SLIMCAT).

Characteristically, most of the comparisons with models have been done with SLIMCAT and not with CTM2, although now some results seem on way. A critical discussion is missing regarding Fig. 2.4.2.1. It is not enough to mention a general "good agreement" between model and observations.

This was the first comparison that had been made thus far in the project, and thus did represent a major milestone in the co-operation with the CTM group. The comparison shown in Fig. 2.4.2.1 is cursory, pending further development in the model's treatment of layers. It was still too premature at that stage to offer detailed explanations for the shown deviations.

Figure 2.4.2.2 could be compared to GOME data.

The SAOZ total column NO_2 data shown in Figure 2.4.2.2 is presently under reanalysis using a validated state-of-the-art analysis routine. When this is completed during 2002, thorough comparisons with satellite instrumentation can be undertaken.

A few comments about Fig. 2.4.3.1. BrO is very badly measured and error-bars of 25% are to be expected. This should have been mentioned. Why is mid-February 1999 mentioned as an exception? Model and observations compare much worse in the second half of 1998. Some discussion should have been included here. Is it the model or the data that we should trust? Is these months dominated by special meteorological conditions? Could the CTM2 simulate that episode?

As the reviewer mentioned, BrO is a difficult compound to measure accurately. NILU's measurement methods and analysis procedures have been standardised with other groups and it is agreed that this should have been mentioned.
NILU's measurement methods and analysis procedures have been standardised with other groups, and the model shows very similar results and deviations compared to the other stations. The data for second half of 1998 has hence been reanalysed, and the disagreement is greatly reduced. At this point, the CTM2 is not at a stage where such a comparison of BrO-DSCDs could be done. Mid-February 1999 was mentioned in detail in the report due to the fact that this

period is most interesting from the standpoint of heterogeneous reactions during active vortex conditions. This was pointed out in detail in the report.

Task 5: Ozone lidar measurements

For this task all milestones have been reached. The report contains a couple of very nice presentations of results (Fig. 2.5.1.2, 2.5.1.2, 2.5.4.1). Such profiles could help modelers to identify interesting episodes.

This task has delivered data to the comparison with models in task 1 and the analysis in task 2.

The lack of ozone trends in the high stratosphere is interesting if it holds with further analysis. It would be interesting to compare these observations with the SCTM simulations when available.

Task 6: Analysis of ozone change

This is the key task of the project as it involves modeling and observations in a joint effort to analyze ozone change. The description of the results is well organized, although it is puzzling that results from activity 6.1 are given in section 1 and not section 2. It is a little disappointing that no papers have been submitted to reviewed journals at this stage.
On page 83 we explain why the results from activity 6.1 are described in section 1. This is just a consequence of the split into one section on progress and one on scientific achievements. Since 6.1 is a support activity with no scientific output it was felt that it was more appropriate to describe the work in section 1.

Regarding the milestones it would seem that this task will be very busy in the final year. It is not clear how much activity 6.2 is behind the work-plan and if the delay will be possible to catch up. The work plan is not specific on the time-plan for calculation of ozone loss for the winters 88-89 to 99-00. A few of the panels of Fig. 2.6.2.5 were already presented in the work programme, so it would seem that this task will have to produce 4-5 times as much work in 2002 than it did in 2001. We worry if the promised analysis on the rest of the levels can be completed in time.

On page 39 in the report it is stated that the other levels will be analysed in 2002. The sonde data are in place and the same methodology as used for the 475 K level will be used for the other levels. The amount of work is therefore not so large. One to two weeks of full time work should suffice for this analysis.

The fact that Figs. 2.6.3.1 and 2.6.3.2 are plotted with different color scale gives the impression that the different groups only communicate when compiling the reports.

This is of course not true. One of the reviewers was present at the COZUV meeting in November 2001 so he should know that there is collaboration between the groups other than just when compiling reports. The reason for the different colour scales has been explained above, but can be repeated here: A postscript file with the MLS data (fig 2.6.3.2) was obtained from JPL, NASA. We did not get hold of any data to make our own plot. Different research groups have their own plotting routines so this is why the two plots are different. It would have cost many days of work to write plotting routines that would present the data in the same way (assuming we would get hold of the MLS data). The idea that we wanted to convey here was that the fine structure in the ClO field is revealed by the domain-filling trajectory model (Fig. 2.6.3.1) and that these features are not apparent in the MLS data. This fact is clearly seen even with the different colour scales on the two plots.

The analysis presented in Fig. 2.6.2.5 is very interesting and the graphical presentation useful. The discussion is good, although a comparison with the results of MATCH or Müller is missing.

We agree on this and such a comparison must of course be done in a published paper. However, the description of act. 6.2 alone covers more than twice as many pages are we were allowed to use for whole Task 6. With such limitations on space it is simply impossible to carry out a discussion in the same way as one would do in a scientific paper.

The trends in Fig. 2.6.3.5 should be compared to observations. Only if indications are found that the trends are real, sensitivity experiments should be performed. It seems that the SCTM is already behind schedule and additional experiments will only cause further delays.

Activity 6.3 is very important and should be given high priority in 2002. This task could be the center of a real joint effort. Regarding the plan described on p. 40 we think that CTM2 and SCTM should be compared for the same period and with the same observations.

We welcome this idea for a joint effort that involved several tasks. Further comparisons between observations and CTM-2 are planned for the remaining year of COZUV-2.

Task 7: Ground-based UV measurements

This task is important in its own right, but it seems isolated from the rest of the project. Interesting results have been obtained and the task has a nice publication rate with two published reviewed papers and three in preparation.

We have serious concerns about the interactions between this task and the rest of the project. The interaction was weak from beginning according to the workplan with only two links to task 8 and 9, respectively. In reality, the interaction seems to have been even weaker as neither of these tasks seem to have made use of data from task 7.
As mentioned in section 1.0.3 some of the milestones in this task have not been reached.

The development of the tracking system has apparently been more ambitious than expected. Several delays seem to have appeared in this task.

In task 7.4 a model activity was promised in the work programme (p. 57) to be completed in 2001. However, we could not find this effort mentioned in the report.

The description on p. 47 of the problems regarding man-power and budget cuts are not clear. Is the cancelled campaign at Andøya due to a budget reduction within this project?

Yes this can be pointed out. In the reduction of the budget, no money were left for the campaign to be carried out.

It is said that the campaign will be merged with the EU project INSPECTRO. Will the same project be "sold" twice?

No, there is no money for this in COZUV, for a comparison of direct measurements to be carried out the experiments will be performed in a new project.

How will the cancellation and the merging influence the rest of the project?

Links to task 5 will be less, ozone observations with lidar. But this was not promised from the beginning either.

Task 8: Airborne UV measurements

Arve Kylling has not been available for comments on this short notice.

This task has been attacked by a series of delays of technical nature and further delays are foreseen (p. 50). The delays are due to filter problems and a malfunctioning balloon. This is all well described in the report and such delays are hard to forecast and impossible to avoid. We do however miss a description of how the delays will interfere with other parts of the project. As for the previous task the links to other tasks are few and weak. In the work programme indirect links to task 1, 3, 5 and 7 are mentioned. We have not been able to read from the report to what extend these links have been realized or to what extend they are expected to be realized in 2002.

The comparison between model and measurements in Fig. 2.8.1 seems very impressive. The authors use the word "excellent" but give no indications if this is better than other in situ measurements. The advances of this system compared to other strategies should have been described.

Regarding the link to task 1 it would have been interesting to know how the UVSPEC model is related to the radiative codes used in the CTMs. Are the calculated photo-dissociation rates different from standard rates and will the new values impact the chemistry modeling in Task 1? Such questions would have been natural to address in a project like COZUV.

Task 9: UV modelling

Due to lack of data the original goals for phase 1 were changed and the task totally redefined for phase 2. Phase 1 was finished satisfactorily with the publication of a reviewed paper. Phase 2 now deals with the generation of UV-maps for Norway and is supposed to link the UV and ozone parts of COZUV.

It seems from the work programme that the generation of UV-maps for the future should have been completed by now (although there is some confusion about the numbering of subtasks). According to the report the use of the SCTM for this purpose is only on a planning state. The comparison of UV-maps with measurements has been speeded up, but where is the promised input from task 7?

UV-maps like that presented in Fig. 2.9.2.1 are useful and represent a product that can be delivered to the community. However, we do not believe that such maps for the future has much reliability, as the cloud-cover in the future climate is unknown. The problem with clouds are not discussed in the work programme or in the report (it is briefly mentioned in the section "The way ahead"). Even for clear-sky situations one should remember that future ozone is badly predicted on the northern hemisphere. Furthermore, also surface albedo could possibly change in the future. Sensitivity experiments, where the UV-maps dependence on such parameters is investigated, are required.

Task 1 will be linked to task 9 in 2002. Oslo CTM model will be used to generate future ozone scenarios which is an input to the generation of future UV maps in task 9. Task 9 has compared its simulated UV map data to GUV data from the UV network of Norway. The task 7 group contributes to this network. Task 9 is thus well linked to task 1 and 7.

Task 9 forms an important tie point to the user community, by collaboration with medical and biological researchers.

Task 9 could have included modelling of future clouds, aerosols, trace gases, etc. for the generation of future UV maps. However, there are uncertainties in modelling of such ancillary parameters, and also this may not have been feasible with the limited funds of the COZUV project. We believe that fixing other radiative parameters than ozone to current levels, and only studying the impact of possible scenarios of chemical constituents on future ozone and UV radiation levels is of interest to the scientific community, and is publishable in the literature.

Forecasts of UV-maps a few days ahead are also possible. But for this purpose ozone can be treated just a passive tracer and CTM simulations are not necessary.

General

The project has recruited 1.5 Phd, 0.5 postdoc and 3 master students. This is relatively little compared to the budget and in particular considering the number of groups involved and the number of different tasks. The number of reviewed publication is moderate. We recognize interesting and original papers in particular from task 2 and 7.

The project has recruited 1 postdoc (Thorseth). There are more than 3 master students, but since these have no funding from NFR all have not been mentioned in the report. There has at least been 3 masterstudents involved only in task 7. The names are not given in the report.

The international collaboration within the project is very good. The different groups participating in COZUV collaborate with a large number of foreign institutions and contribute to many EU funded projects. A good effort has been done on public outreach.

It is difficult to judge from the report the work that is a direct consequence of the COZUV project and the work that would have been done anyway, financed by other sources such as EU programs. It is natural that a project like COZUV will interfere, and perhaps overlap, with other projects. This makes it so much more important that the results and consequences of COZUV are clearly identified.

In every research group one gets funding from different sources. It is therefore very difficult to state that a certain piece of work purely belongs to this or that project. During COZUV-1 in 1999 and 2000 some of the COZUV money that went to NILU was used as national money to support EU projects where we worked on the same problems. In COZUV-2 there has been no such link, which means that labour and other expenses charged to the COZUV project represent pure COZUV work. This means that the large majority of the results presented in the report are pure COZUV results and that some results come from combined COZUV and EU funding.

The main purpose of a broad project like this is to initiate co-operation between the different groups. In COZUV the main borders are between the CTM groups, the analysis groups, and the UV groups. We find that COZUV is weak on the collaboration side, although some first steps are taken in this direction.

We agree that collaboration between the groups could have been tighter. But we do not agree that COZUV is weak on the collaboration side. Several steps have been taken to create collaboration, exchange data and to compare results. It is quite natural that it will take time to create close links between groups that previously have not collaborated closely and one should also keep in mind that various groups are at different levels of development. So far the various

groups have had focus on the development of their own methodologies. It is probably not until the end of the project or in a renewed project that one can see the synergies of a coordinated project.

A systematic inter-comparison between models and observations is missing, although individual models are compared to some observations. Models are run for different periods and with different input-parameters, which makes comparison difficult. Too often in the report comparisons are not discussed in detail.

There are two reasons for this: 1) The limited space that was allowed to use has limited the description of comparisons. 2) Delays in the model development has resulted in a smaller amount of data than wanted. It should be kept in mind that the development of a 3-D CTM is a major undertaking. The limited funds available through COZUV means that it will take time to reach a level where the model is really useful for comparison with observations. The SLIMCAT model, for example, was developed in a research group with 70 researchers, postdocs and students. We therefore hope that the committee will understand that the progress so far has been good and that it will take some time to develop the close collaboration that is asked for.

The UV tasks seem rather isolated from the rest of the project. Where links between the UV and ozone research have been defined in the work programme it is difficult to find them realized in the report. The lack of a clearly demonstrated co-operative effort is our main objection of the project.

A comment would be that in the case of UV so many other climatological factors than ozone are involved which would be natural to include that this should not be the main objective of the project.

The success of a project like COZUV depends on the definition of a few joint actions where everybody participate.

It might not be possible to define an action where everybody participates. The review groups does not give any hint as to what such a joint action should look like. It would probably be more fruitful to try to fulfil the links and cooperative efforts that are outlined in the workplan.

Such actions are not identified in the program. The links between tasks should have been made more clear from the start and the coordination should have been stronger.

If this would have been the final report, the project would have failed.

As it happens, this is not the final report. It seems that the reviewers have looked upon the report as a final report and not a progress report with severe constraints on organisation and number of pages.

The promise in the original proposal of ".. a close collaboration between the involved groups in order to ensure a coherent effort" has not been fulfilled. On that basis we would not suggest a third phase. A stronger coordination is needed in the last year. We also suggest a concentrated effort in form of a joint activity where many tasks are involved. Such a joint effort could be based on activity 6.3. A single interesting year or season could be selected. For this period simulations from the two CTMs and the trajectory model could be compared in detail with observations from the observational tasks. Preferably, UV measurements and modeling should be included too.

Much of this is planned for 2002 as explained on page 40 of the report.

We acknowledge the need for long-term, stable financing of research groups. The funding through EU programs might be an important supplement and encourage international co-operation, but it is too insecure and sporadic to form the basis for the research. Here national funding is needed to provide the stability for research groups to thrive and develop. On the question of the advantages and disadvantages of coordinated and "free" projects, we have the opinion that coordinated projects are important when joint action or close co-operation is needed. But the co-operation should be real. It is often claimed that new results are obtained when different disciplines meet. While this may be true in some cases it does not in general weaken the necessity and importance of research concentrated within one well-defined field. In COZUV, model development and the work on the NILU-Cube are examples of well defined tasks that could have been done outside a coordinated project. If close collaboration is not needed well defined smaller project should be preferred.

The report discusses several possibilities for future activities. Here we offer a few comments.

Chemistry-climate interactions: The two-way coupling of chemistry and climate are important for several reasons. But, the coupling of GCMs and chemistry schemes is a time consuming and troublesome undertaking. As this path has been taken by other research groups and in particular as the Norwegian groups are among the leading experts in CTM modeling worldwide, we suggest that future efforts be concentrated here. There is still a strong need for CTM improvements and the impending information form ENVISAT on concentration of different species will provide a new challenge for model-observation comparison.

3-d UV modeling including clouds: There is no doubt that this is an important issue as clouds have a very large impact on the UV reaching the surface. As we mentioned in the discussion on task 9, UV-maps for the future may be useless unless the possible cloud-change is included.

Monitoring: Regular monitoring on Norwegian sites is very important both regarding to ozone and UV. It should be remembered that many years of data is needed to define a trend and that the funding therefore should be stable and continuous.

Stratospheric water vapour: As mentioned in the report the recent reported trend in stratospheric water vapour might have large consequences for both the radiative forcing on the troposphere-surface system and for the understanding of the cooling in the stratosphere. Furthermore, water vapour can change the chemistry in the stratosphere. Up to now measurements are very few and any additional effort in this direction would be very important. We support the idea of water vapour measurements at Ny-Ålesund. As mentioned above, this calls for continuous funding.
This is a very welcome remark. It is interesting to note, though, that such measurements were proposed for COZUV-2 but turned down.

Some general remarks:
We agree that the collaboration has been somewhat weaker than desirable. However the tasks carried out by each group have laid the foundation for a more extensive collaboration in the future. It would therefore be better to identify how the collaboration could be improved and thereby harvest the results of the efforts put in so far, rather than to declare that COZUV is a failure and stop the collaboration. We don't believe that such a move would benefit Norwegian ozone and UV research.

The reviewers seem to focus very much on the co-operating part of the projects, criticism to which we agree upon to some extent. However, the reviewers' very strong focus on how the combination of ozone and UV research within the projects has performed seems to be too dominating and unfair for the individual ozone parts within the project where there has been a good co-operation which will be strengthened in the last part of the project.

UV is a scientific field which was originally mostly dominated from the focus on ozone but has more and more become a scientific field where all climatological factors are involved. We agree that it might not be natural to continue a co-ordinated project only on ozone and UV, but include, as the reviewers point out, clouds, ground albedo and other factors. But collaboration between different ozone groups should not suffer from this scientific development within the field.

We feel that some of the criticism could have been avoided if the reviewers had had access to the template for the reports. The constraints caused by this template have led to a report that maybe doesn't reflect all the work done and that at least has hindered scientific discussion of results, as asked for by the reviewers. We therefore feel that the project has not been judged in a fair way.

A2.4 NOClim

In the comments to Task 5, the review panel writes that "The US Navy NLOM-model does not seem to us to be an ideal choice, since its representation of topography is poor and it contains essentially no thermodynamics." In relation to this, we would like to point out that the present version of the NLOM has an embedded mixed layer submodel, and thermodynamics are indeed included (Wallcraft et al., 2001). This is a recent development that we suspect the panel to be unaware of. Results from a "thermodynamic NLOM simulation" will be used in Task 5 for studies of mixed layer processes only.

The review panel writes: "Task 5.3, concerning sea ice, does not seem to have progressed far." With respect to this comment, we would like to point out that a number of publications has emerged from work related to Task 5.3, including 4 manuscripts listed under the section "Peer-review journals". (One of the manuscripts was accepted for publication prior to the submission of the NOClim Progress Report.) These manuscripts are Alekseev et al., Johannessen et al., and 2 x Nagurni et al.; see the Progress Report for the full citations.

The review panel writes (p.9): "We recommend that technical reports, talk abstracts, etc. which do relate to ongoing work be supplied to future committees, as these will give a more accurate impression of the work status." Our Technical Report No.1 which does contain exactly this kind of information has been available on the web site, which the review panel has checked. We also suggested to the programme secretary, Inga Fløisand, to send hardcopies of the report to the committee, but were discouraged to do so. In retrospect, we see that it might have been appropriate to include it in the original package of selected publications, but we (probably wrongly) emphasized review publications at the time. [P.S. Our Technical Report No. 2 has recently been made available on the web!].

Reference:

Wallcraft, A. J., A. B. Kara, H. E. Hurlburt and P. A. Rochford, 2001:
The NRL Layered Ocean Model (NLOM) with an embedded mixed layer sub-model:
Formulation and tuning. J. Atmos. Oceanic Technol., submitted.

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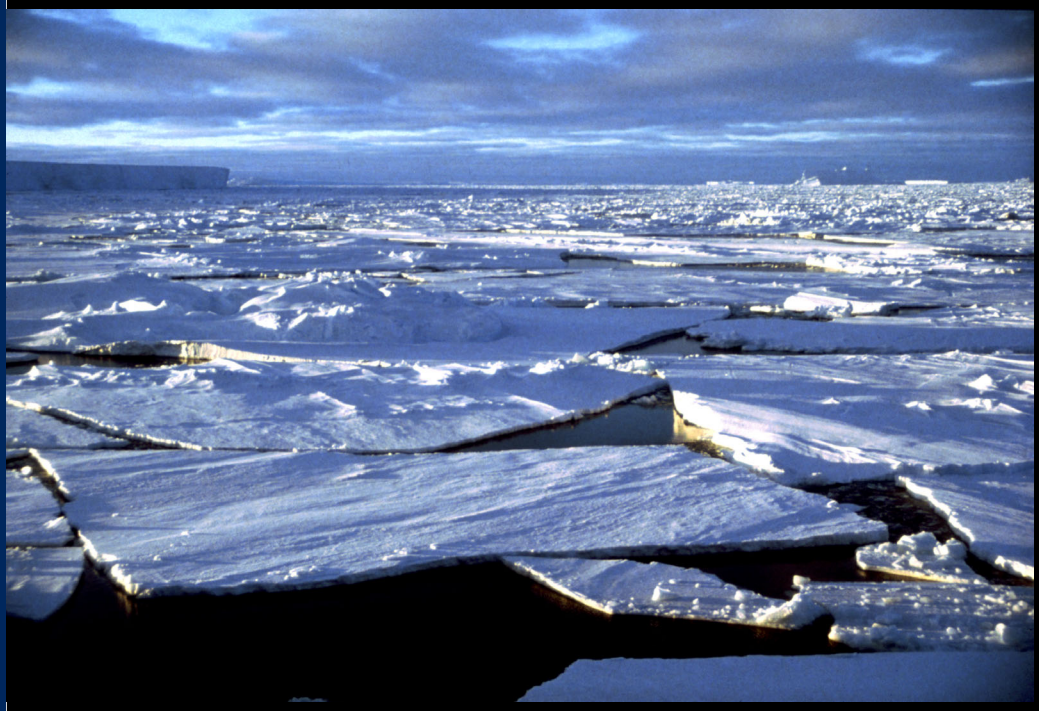

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