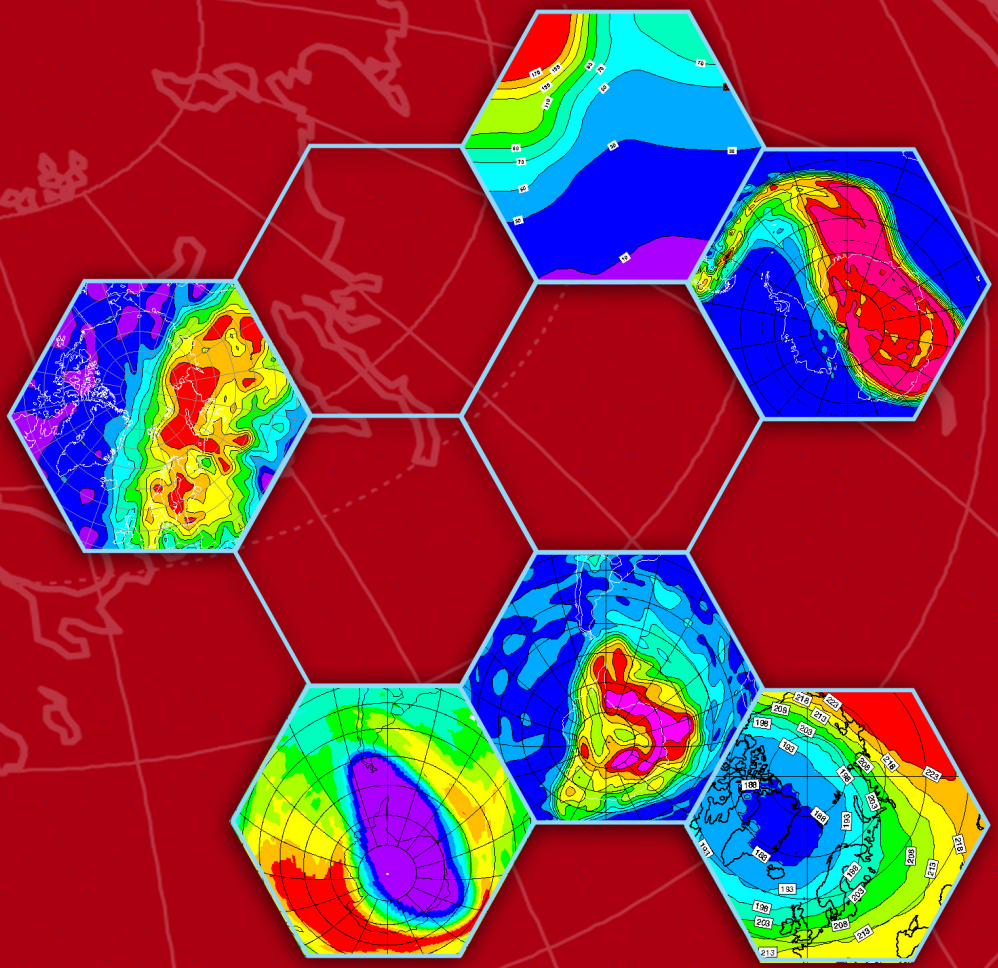
NADIR NEWS

No. 1 / 2006



NADIR

Contents

Editorial:

This issue of NADIR NEWS is meant to give information on new developments and products at NADIR since the previous issue (November 2003) and in conjunction with the SCOUT-O3 campaign. Most of the information given in the previous issue has been kept in this issue so that it constitutes an independent source of information. For those who are not familiar with the NADIR data centre it can be mentioned that NADIR was put into operation in conjunction with the European Arctic Stratospheric Ozone Experiment in 1991-92. NADIR is an abbreviation for NILUs Atmospheric Database for Interactive Retrieval. NADIR now has nearly 1000 users from all over the world, and there are more than several hundreds of login sessions per day during the most intensive winter periods.

Nomenclature

We use fonts of different colours and styles in order to improve the readability of the text. In the body text we use `this font` when we refer to directory names, file names and text lines in text files, which are to be taken literally. *`This font`* is used for placeholders of text or file names. Such text should not be typed literally but replaced with text that applies to your case. Programs and scripts are referred to by ***`this font`***. Commands that you type are shown in **`this font`**. If a command contains placeholders, they are given in ***`this font`***.

Links to web pages and ftp sites are given in red colour, like this:

http://www.nilu.no

The PDF version of this document have hyperlinks to all referred web pages, so you can access them just by clicking on the link.

New developments

Since the previous issue of NADIR NEWS (November 2003) a number of new developments have taken place at NADIR. The following sections describe these new items in more detail. The information given in previous issues is also included, so this issue gives a complete description of the NADIR services.

Zardoz Hardware

A new version of zardoz.nilu.no was installed in March 2005. The server is now a Sun-Fire-V210 with 2 UltraSPARC III processors running at 1 GHz. It runs the Solaris 10 operating system and is equipped with 2 GB of RAM and about 2 TB RAID5 disk space. Incremental backup is performed every night.

Directory structure

The directory structure implemented at NADIR has been designed in order to make navigation easy for our customers and also to make the maintenance and backup of the file systems easy. Most project related directories are located under `/nadir/projects`. Projects that are not directly linked to the coordinated European campaigns are found under `/nadir/projects/other`. Here one finds projects such as APE, GODIVA, Leewave, OSDOC, SAONAS, GOA and TOPOZ as well as several others. For the ENVISAT Cal-Val and the ASSET databases, data files are located under `/nadir/esa/data` and `/nadir/eu/asset/data` respectively.

SCOUT-O3 directory tree

A directory tree has been set up for the SCOUT-O3 project. The SCOUT-O3 data will be stored under `/nadir/projects/scout-o3`. Under the main directory, data from the related activities will be stored in subdirectories such as `/nadir/projects/scout-o3/tropical/` and `/nadir/projects/scout-o3/ozone_uv/`.

Coordinators for those projects that have not yet arranged with directories should contact the NADIR team as soon as possible.

Daily updated plots

On zardoz you can find ready-made plots of a number of parameters that are updated on a daily basis. The plots are stored as GIF files. These products are found in various subdirectories under the directory `/nadir/plots`.

Maps of isobaric ECMWF fields

Analysis and forecast maps of temperature and geopotential height at the 14 standard isobaric levels from 1000 to 5hPa are made every day. The maps are stored as colour GIF files in `/nadir/plots/isobaric_gif/`*yymmdd*. Figure 1 shows an example of such a map.

Maps of isentropic ECMWF fields

Analysis and forecast maps of temperature and potential vorticity at isentropic levels are stored as colour GIF files in `/nadir/plots/isentrop_gif/`*yymmdd*.

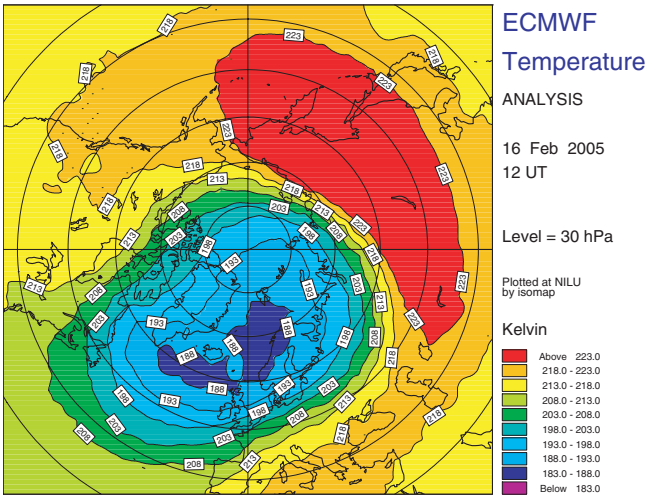


Figure 1. Analysis of temperature at 30 hPa for 12 UT on 16.February 2005.

Maps of T_{106} data

Analysis maps of various parameters at T_{106} resolution (1.125° × 1.125° degrees are produced on a daily basis. These plots are available under `/nadir/plots/t106`. There are maps of T and GPH at isobaric levels and of PV and T at isentropic levels. The maps are stored in the GIF format. Figure 2 shows an example of such a map.

ECMWF products on the web

The maps of isobaric, isentropic and T_{106} data described above, are also available through the web site http://nadir.nilu.no/ecmwf. In addition to these, it is also possible to create trajectory plots similar to those made by the **trajplo** program described on page 18.

Through the web site, it is possible to download pre extracted T_{106} data in NASA-Ames format. As a part of the ENVISAT CalVal database project, a routine for extraction of met-data into HDF format was developed. This program is called **`hdf-mars`** and is described in detail on page 14. It is possible to access this program through the web site and thereby extract met-data on demand – solely by the use of a web browser.

The web site is only available for those who have signed the ecmwf4 protocol. Use the same username and password as you do on zardoz.nilu.no to enter the site.

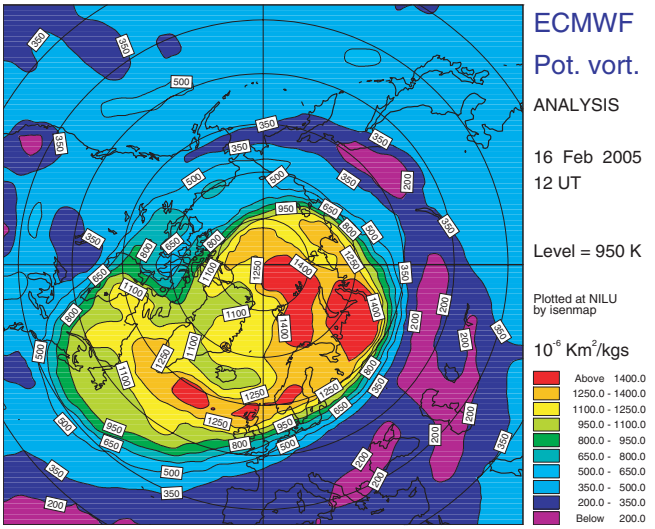


Figure 2. Analysis of potential vorticity valid for 12 UT 16 February 2005 at the 950 K isentropic level (approx 4-8 hPa)

Maps of filaments

In conjunction with the former RETRO project, the group at CNRS put in to operation a service for daily maps with analyses and forecasts of potential vorticity. Plots of filaments in GIF format are produced using a high resolution MIMOSA advection model (18 x 18 km) of PV developed at Service d' Aéronomie du CRNS. The model starts from ECMWF PV analysis on 1st November and computes the advection of PV using daily ECMWF analyses and forecasts available on NADIR. In order to follow the diabatic evolution of PV during the winter, a relaxation toward the large-scale ECMWF PV field is applied with a 10 days relaxation time. Daily plots of filaments are produced for 7 isentropic levels, 350, 380, 400, 435, 475, 550 and 675 K and for 00, 24, 48, 72, 96 and 120 hours forecast. Temperature maps at 475 K are also produced on the same format for interpretation. Figure 4 shows one example of such a map. These maps are found as GIF files in http://www.aerov.jussieu.fr/~fgoutail/MIMOSA.html

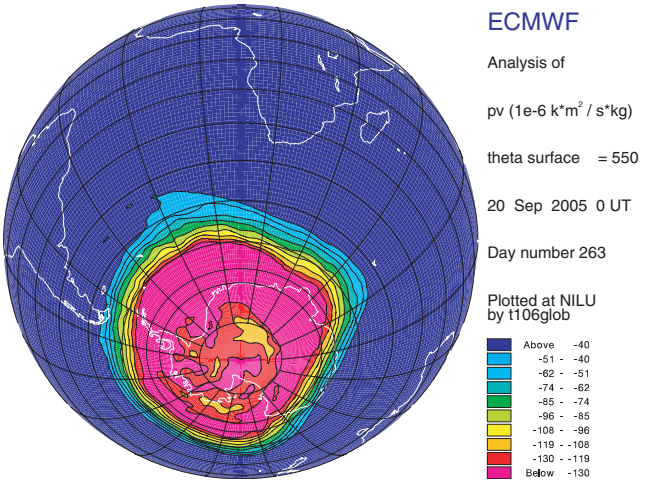


Figure 3. Map of south polar potential vorticity for 20 September 2005.

Total ozone maps

The WMO real time ozone mapping unit at the University of Thessaloniki produces daily maps of total ozone based on the GO3OS, i.e. the Dobson and Brewer network of spectrophotometers. These maps are found as gif/png files at http://lap.physics.auth.gr/ozonemaps/

Figure 5 shows such a map.

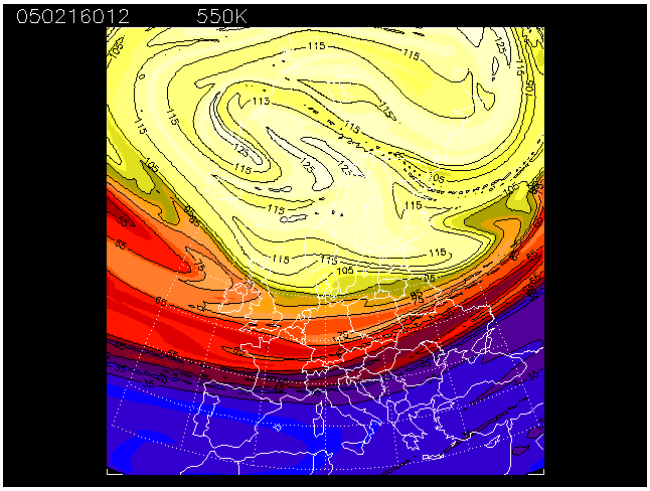


Figure 4. 24 hours forecast map of PV at 550 K valid for 16 February 2005. This map has been made with a domain filling trajectory model running at CNRS.

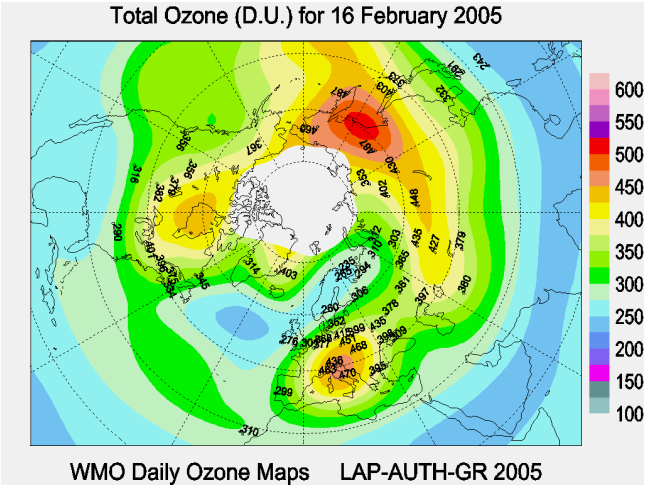


Figure 5. Total ozone for 16 February 2005 based on the GO_3OS and GOME.

Current and recent projects

In this section we present the projects that are part of 'Stratospheric-Climate Links with Emphasis to the Upper Troposphere and Lower Stratosphere' (SCOUT-O3) project and other projects that are currently using the NADIR database. Some recent, but completed projects are also presented. A complete list of all NILU database-related projects is available at http://www.nilu.no/datacentre

The SCOUT-O3 project

SCOUT-O3 is funded by the European Commission in cooperation with national funding agencies. There are 59 partner institutions from 19 countries. The project started in May 2004 and will last for five years. The central aims of the project are to provide scientific knowledge for global assessments on ozone depletion and climate change for the Montreal and the Kyoto protocols. That includes predictions about the evolution of the coupled chemistry/climate system, with emphasis on ozone change in the lower stratosphere and the associated UV and climate impact by a large range of state of the art chemistry climate models.

Overall there are six main scientific activities in SCOUT-O3 in which detailed studies of atmospheric processes will be made:

- Ozone, climate and UV predictions
- Field campaigns in the tropics
- Extra-tropical ozone and water vapour
- UV radiation
- Chemistry and particles: studies of kinetics, photochemistry, heterogeneous processes and nucleation
- Global diagnostic chemical transport modelling

The achieved improvements in knowledge as well as in the models will then be used to predict the evolution of the coupled chemistry climate system. This scientific research is underpinned by database, public outreach and project management activities. NILU will provide the required database services for all the scientific work based on its experience in previous European projects.

A major aim of SCOUT-O3 is an improved understanding of the mechanisms by which air passes from the upper troposphere to the lower stratosphere. To investigate these processes two tropical field campaigns will be performed. An airbourne campaign took place in Darwin in November and December 2005 as the first phase of the TWP-ICE project (an Australian and American project) and the UK NERC ACTIVE campaign. All the data from the campaign are stored at NILU. A balloon campaign will take place in Africa in cooperation with the AMMA project in August 2006. In order to interpret and understand the small scale feature in a global context satellite measurements (e.g. from ENVISAT and CALIPSO), meteorological analysis and other global fields will be used in conjunction with models from regional to global scales.

More information on SCOUT-O3 and related projects can be found on the web site of the European Ozone Research Coordinating Unit.

The VINTERSOL campaign

VINTERSOL (Validation of INTERnational SATellites and study of Ozone Loss) is a major European field campaign studying ozone loss. VINTERSOL ("Winter sun" in the Scandinavian languages) took place from late 2002 until mid 2004. It was the latest major field campaign to study ozone loss. There has been tree previous European campaigns before VINTERSOL; the European Arctic

Stratospheric Ozone Experiment (EASOE); the Second European Stratospheric Arctic and Midlatitude Experiment (ESEAME); and the third European Stratospheric Experiment on Ozone (THESEO). Like them VINTERSOL relied jointly on support from national funding agencies and from the Environment and Sustainable Development programme of EC DG Research. An important dimension for the campaign was the involvement of several new European satellite instruments. VINTERSOL was mounted in conjunction with the validation campaign for the ENVISAT satellite. More information on the VINTERSOL campaign can be found on the web site of the European Ozone Research Coordination Unit, http://www-ozone-sec.ch.cam.ac.uk/.

The GMES-GATO project

Global Monitoring for Environment and Security - Global Atmospheric Observations (GMES-GATO) was an EU funded concerted action, which took place from January 2003 to January 2005. Its aim was to develope a strategy for global observations of atmospheric composition within GMES. Project issues included greenhouse gases, stratospheric ozone and urban pollution on global, regional and local scale. Database was one out of five topics in GMES-GATO, and issues like user needs and harmonisation between different databases was addressed during the project. A user-survey was undertaken to assess the needs of the various scientist and the outcome of this is feeding directly into the plans for further developments through the SCOUT-O3 project. More information can be found at the official web site:

http://www.nilu.no/gmes-gato

Information of the cooperation between the European Union and the European Space Agency through GMES can be found at the official web site:

http://www.gmes.info

The ASSET project

ASSET (Assimilation of ENVISAT Data) is a European (EU) initiative to exploit and develop earth observation data from Envisat using data assimilation. The project has two major activities and is aiming to exploit the satellite data in Numerical Weather Prediction (NWP) and investigate the distribution of chemical species. A third supporting activity covers data management, and the NADIR data centre is used to make these value-added data available to the scientific community. The project runs from January 2003 until mid 2006 and aims to (a) develop a European capability for chemical and UV forecasting and (b) provide analyses for coupled climate/chemistry studies. More information on the ASSET project can be found at the official web site:

http://darc.nerc.ac.uk/asset/

The ASSET database builds on the system developed for the ENVISAT CalVal database, and the assimilated products are therefore accessible through a searchable web interface. The ASSET dataset is currently only available to the project partners, but the idea is to make it public after completion. The ASSET database is found at:

http://nadir.nilu.no/asset

The QUILT project

QUILT (*Quantification and Interpretation of Long-Term UV-Visible Observations of the Stratosphere*) started in January 2001 and ended in mid 2004. The EU funded project addressed stratospheric ozone depletion in particular, but did also focus on better exploitation of existing data, and on development of new long-term observing capacity. QUILT used the existing ground-based, satellite and balloon borne UV-visible data as well as 3D atmospheric modelling tools for quantifying ozone loss and ozone development, and to investigate its relation to active halogen and nitrogen species.

The official QUILT web page is found at: http://nadir.nilu.no/quilt and gives a general introduction to concepts, aims and achieved goals. Password protected pages are also available to project partners, and allows the consortium members to upload and download data files through the web interface.

The UFTIR project

The consortium of the EU-project UFTIR is built around the European part of the NDSC FTIR community, complemented with some atmospheric modeling and related laboratory teams. “Time series of Upper Free Troposphere observations from a European ground-based FTIR network” (UFTIR) started in February 2003 and will last for 36 months. The main objective of the project is to provide trends and time-series of distinct tropospheric and stratospheric target gases such as N_2O, CH_4, HCFC-22, CO, C_2H_6 and O_3. All time-series will be archived at NADIR. More information on the project is found at: http://www.nilu.no/uftir

The COZUV and AerOzClim projects

COZUV (Coordinated Ozone and UV project) was a joint Norwegian project within stratospheric ozone and UV research. It started in January 1999 and ran through 2002. The main objectives were to gain increased understanding of the processes that lead to ozone loss in the Arctic and at middle latitudes and to understand how changes in the ozone layer affects the amount of UV radiation that hits the ground. More details can be found at: http://www.nilu.no/projects/cozuv/

AerOzClim (Aerosols, Ozone and Climate) is a natural continuation of the work laid down in COZUV. It started up in 2003 and will last for four years. The main objective of AerOzClim is to improve our understanding of aerosol-climate and ozone-climate interactions, by developing and

applying global models in combination with analysis of data, to study processes involved, and to provide improved parameterisations for climate models. More information at: http://www.geo.uio.no/forskning/atmosfare/prosjekter/AEROZCLIM

The ESA Campaign Data Service

The ESA (*European Space Agency*) Campaign Database (CDB) was developed and implemented at the Norwegian Institute for Air Research to provide the EOP-S campaign section of ESRIN-ESA with sufficient support for storage of campaign data. The CDB builds on the experience of the ENVISAT Cal/Val database, but has been further developed to handle data from all ESA campaigns and from a multitude of earth observation sciences. The database, and its underlying structure, is suitable for archiving and indexing all forms of geophysical/geo-located data in a common context. CDB is available through http://nadir.nilu.no/cdb**.**

The Envisat Cal/Val database and its underlying technical system was presented in detail in the previous edition of Nadir News and only new developments are covered in detail here. Furthermore, a separate campaign database handbook is available to the users of the system.

Introduction

The ESA (European Space Agency) Cal/Val database was developed and implemented at the Norwegian Institute for Air Research to provide ENVISAT scientist with a common framework and repository for exchange of correlative data, mainly from ground based measurements. The experience from this activity led to a new ESA initiative to develop a more generic database, the ESA Campaign Database (CDB). This system is a generalisation and further development of the Cal/Val system used for some ENVISAT calibration and validation campaigns. Differences are kept to a minimum, to make the transition easy for the user community of the original system. The CDB includes all data and metadata definitions from the previous Cal/Val data centre, but is able to handle data from all ESA campaigns. It is a system for storing and indexing complex data sets from a multitude of earth observation sciences, and is no longer a database for correlative data only. The database, and its underlying structure, is suitable for archiving and indexing all forms of geophysical/geo-located data in a common context.

The objective of the campaign database is to provide an online information system that supports users in managing and exploiting campaign datasets for Earth Observation missions and applications. In a more future perspective the overall aim is to provide a data centre that handles Cal/Val data, satellite data and campaign data in an integrated way. The centre will in this way increase the dissemination potential for all classes of data. The database is built with a strict quality control of incoming data and options for individual file-formatting is very limited. Using the same principles also for non Cal/Val data, will simplify the use of multi disciplinary data since all files are part of the same uniform data set.

Description of the Data Service

Description of metadata

Metadata are in fact data about data. They provide the information that the data-user needs in order to understand the actual data. For an atmospheric observation, the data can be a series of numbers that does not make sense unless you provide the metadata on what the numbers represent. Typical metadata in this case would be time and location of the measurement, what parameter is measured, what is the uncertainty in the measurement, who did the measurement, what unit is used, etc.

In the ESA project on calibration and validation of ENVISAT (Cal/Val), a comprehensive effort was put down into developing a structure for defining such metadata. The structure was based on previous developments at NILU, mainly through the experiences gained from the EMEP database that has been operative since 1979. The archiving guidelines of the Cal/Val database specifies all the metadata parameters that are needed for each data file and it is designed to store most types of measurements. Most metadata parameters are furthermore associated with a list of legal values that must be used to describe the observation. This makes it easier to store similar or related types of observations in a comparable manner. As an example, a variable containing ozone measurements should be named O3.CONCENTRATION, and not ozone, ozone_concentration, etc. Only the legal values of metadata will be accepted by the database.

CDB builds on the efforts laid down in the ENVISAT Cal/Val project and reuse the same lists of legal parameters. However, new entries to these lists have been provided in order to cope with the different requirements and scope of CDB. This work is furthermore a continuous effort since new campaigns are regularly starting to use the data centre. Because of this, lists of continuously updated legal values of the various metadata parameters are provided on the database web-interface. In addition, a complete description of the rules behind all metadata definitions and lists of all legal values are available to the users in a campaign database handbook.

Description of the database architecture and functionality

The technical system of the Envisat Cal/Val database was described in detail in the previous edition of Nadir News. The ESA Campaign Data Service utilises the same technical framework so the details are not given this time. The new and distinct feature of the upgraded system is the possibility of handling more than one project or campaign within the same file system and web portal. A new web interface was developed for this purpose and it allows users to access data from one or more campaigns depending on what he/she has been given access to. The access control is seamlessly coupled to the traditional access system on zardoz.nilu.no and regulated through data protocols. The previous web interface is still available at http://nadir.nilu.no/calval, and NILU will continue to support this portal for existing users. For new users we recommend to use the new interface as it provides better functionalities for downloading and uploading data.

The main differences between the new CDB and the previous Envisat Cal/Val solutions are the possibility of uploading non-HDF files and a graphical search interface. In addition, there are a lot of new metadata entries to allow uploading of data from campaigns on land surface biology and geophysics. In the previous system, only HDF files formatted according to the metadata guidelines were accepted for upload. This was seen as a limitation for some data types, especially for images which were unpractical to convert into another binary format. A method for uploading such files into the same database was implemented through the web portal which makes sure all necessary metadata are collected with the binary file. In addition to the main image (which often are stored on a non standard format), the data submitter may associate a thumbnail image (often named quick-look) to the file to help data users when searching for through images.

In addition to the search interface described in the previous edition of Nadir News, a graphic interface showing the geo-graphical location of the data may be used for searching. This is a webpage with a Macromedia Flash MX application showing a world map with information on geo-location. The map works in two modes, the Station and the Trajectory mode, and the user may zoom into the map to study details. The station mode displays data where geo-location is constant within a data file and the trajectory mode displays data where geo-location varies over time, but is constant for each time step in the file (i.e. it is not a moving field). The trajectory mode furthermore displays the altitude of the location by a colour scheme. A user may retrieve data by clicking on a dot (in the station mode) or on a trajectory. Within the flash-application a filter-tool with drop-down menus similar to those of the text-based search interface is available, and the user may chose one or several parameters. The map in the background will automatically be updated when the user chooses a value for one of the parameters and dots or trajectories not matching the chosen values will vanish. This allows the user to differentiate between all available data files and the user will see the location of all data files before he/she press the "Get file(s)" button at the bottom of the filter. It is also possible to click on any of the remaining dots/ trajectories to retrieve data from only that parcel or location. A screen shot of the mapping tool is shown in Fig. 6.

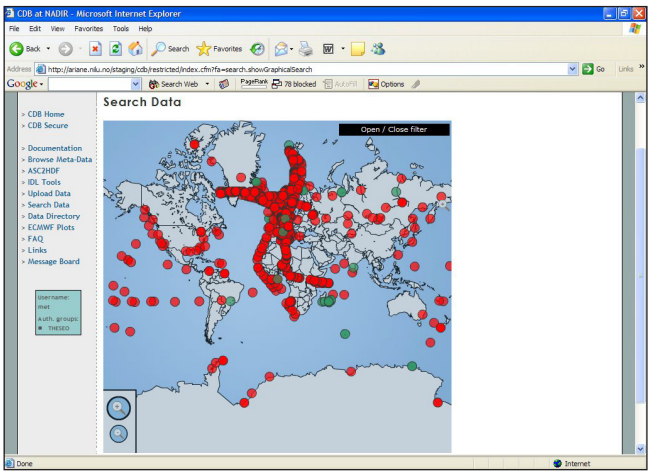


Figure 6: Screenshot of the mapping tool in the station mode. The user sees the location of all files in the database, but will only have access to those marked with green.

To cope with all the changes at the data centre, the index MySQL database and the file processing tools had to be updated. ASC2HDF is now available in release version 3. Furthermore, a user-friendly front-end to the ASC2HDF program has been developed, and this allows the users to fill in data in an excel sheet and to save the content directly as a HDF file. The tool assists the users to format the data correctly.

User support

CDB aims to increase the use of geophysical data after a campaign is completed. Measurements are made available for other scientists (only after permission is given from original PI) and data are no longer sent to rest in the drawer of a scientist desk. CDB provides the final archive for the data. Another advantage with using the CDB is the possibility of sharing data within the campaign consortium – both during the campaign and in the analysing phase. An important part of the CDB operations is therefore provision of user support and advisory to data managers on how to archive data and what types of data they should store.

All registered users have access to on-line information through the web portal and also to a CDB handbook that explains how to use data and how to format, upload and manage files. A help-desk is available to all users of the data service and technical personnel are available to solve file formatting and system related issues to data submitters and data users. Furthermore, there are scientific personnel available to solve less technical issues and to assist data users with interpretation of data and to provide campaign data managers with assistance on archiving strategies.

Existing data and software

The rest of the document describes data and software that were described in previous issues of NADIR NEWS, but there have been some updates and changes. Minor changes and bugfixes are commented where appropriate.

VINTERSOL Data

The VINTERSOL campaign data are stored under `/nadir/projects/vintersol`. Ozone sonde data, which were collected mainly as a part of the Match campaign organised through the QUOBI project, are stored in `/nadir/projects/vintersol/data/o3sondes`.

Under the main VINTERSOL directory, data from the related projects are stored in subdirectories such as `/nadir/projects/vintersol/euplex` and `/nadir/projects/vintersol/quilt`.

THESEO and THESEO 2000 Experimental data

The directory tree for the THESEO data are found under `/nadir/projects/theseo/`. Under this directory there are subdirectories for each of the THESEO related projects, such as Halomax, Metro, PSC-analysis and PVC. Real time PTU soundings from various stations in the European Arctic and Greenland are to be found in `/nadir/projects/theseo/misc/psc_alert`.

SESAME Experimental data

Experimental data from the SESAME campaign can be found in `/nadir/projects/sesame/data`. on zardoz. A detailed description of these data was given in the June 1996 issue of NADIR NEWS.

EASOE Experimental data

The experimental data from the EASOE campaign was issued on CD-ROM in 1995. The data are public domain, so the disk can be obtained by contacting the NADIR team at NILU. The data can also be found under `/nadir/projects/easoe/data`.

Satellite data

TOMS

Data from TOMS (Nimbus-7, Meteor-3, ADEOS and Earth Probe) can be found in subdirectories under `/nadir/satellit/toms`. The data from the OMI instrument on board the AURA satellite are recently added to the directory `/nadir/satellit/omi` (from September 2004) and will be downloaded in parallel to the TOMS data. TOMS and OMI files have common data formats. Software for plotting TOMS and OMI data is described in the chapter of plotting software.

TOVS

TOVS data were provided for the SESAME campaign by CNRM in Toulouse, and the data can be found in `/nadir/projects/sesame/data/satellit/tovs`. More than 5600 files were submitted through September 1997, when the service was discontinued. Software for plotting is described on page 21.

The data files are compressed, but you can copy the files you need to `/nadir/tmp` and uncompress them if you want to plot them with the plotting program on zardoz.

ECMWF data on 2.5° x 2.5° grid

These are the data that have been available since the start of the NADIR datacenter.

Isentropic data

Analyses for 12 UT on the levels 350, 380, 400, 435, 475, 550, 675 and 950 K are made available by the Danish Meteorological Institute for the geographical area from the North Pole to 30N. Pressure and PV are given, and it is possible to calculate temperature. This is done by several of the programs developed at NILU, such as the Uniras plotting programs. During the campaign phases up to ten days forecasts are available. These data normally cover the time interval from 1 November to 30 April, but due to the activities around the ENVISAT Cal/val database the isentropic data were available throughout 2002. Analyses and forecasts are found in the directory `/nadir/isentrop/yyyy/mm` where `/yyyy/mm` designate year and month. In this way we limit the number of files in each directory. Forecasts will be deleted when they are a few days old to limit the number of files.

During the Antarctic test campaign of the QUOBI project in 2002, isentropic data were also made available for the southern hemisphere. These data were also produced for the real match campaign in 2003. These files are stored in the same directory as for the northern hemisphere. Arctic files are named `atyymmdd.hhh` and Antarctic files are named `asyymmdd.hhh` where hhh is forecast time.

Isobaric data

Analyses for 12 UT on the 14 standard levels 1000, 850, 700, 500, 400, 300, 200, 150, 100, 70, 50, 30, 10 and 5 hPa are made by the Norwegian Meteorological Institute. Available

parameters are temperature, geopotential height, zonal wind and meridional wind. The geographical area is from the North Pole to 30N. These data are collected daily around the year. There are also 1,2,3,4 and 5 days forecasts. The analyses and forecasts are found in `/nadir/isobaric/yyyy/mm`.

Trajectories

10 days back trajectories arriving at a large number of end points are provided by the Danish Meteorological Institute. All measurement sites participating in VINTERSOL are included as well as a grid net of 118 end points covering the area from the North Pole to 30N. There are data for the same eight levels as for the isentropic fields. The trajectory data are stored as large collective files. If you want to extract data for a single station, you can use a program called ***traj2000***, which is described on page 25.

The trajectory data are found in `/nadir/trajecto/yyyy/mm`.

PV at stations

Potential vorticity at the seven standard levels is calculated for a number of stations by the Danish Meteorological Institute by bilinear interpolation in a 1.125x1.125 grid. This gives more exact data than one obtains by extraction from the 2.5x2.5 grid data. Software for extraction of data for stations of interest is described on page 23.

These data are found in `/nadir/isentrop/pvstat/yyyy/mm`.

As a novelty PV, temperature and geopotential height on the different isentropic levels are stored for each station for both 00 and 12 UT. This makes it easy to extract PV, temperature or geopotential height for a given level above a station for the whole winter. The data are stored in files named pvyymmdd.tt where tt is the analysis time (00 or 12). The files are not in the NASA Ames format, but they are simple and self-explanatory.

ECMWF data on 1.125° × 1.125° grid

The demand for meteorological data increased during the EASOE and SESAME campaigns, and NILU therefore implemented a routine for daily transfer of global fields at so-called T_{106} resolution. This corresponds to a maximum latitude/longitude resolution of 1.125° × 1.125°. This routine became operational in early January 1995. We have also acquired data from previous winters (the EASOE winter, the 1992-93 winter and the first SESAME winter) on tape, and these data are also available. The latter data are referred to as archive data in the following. We have developed and implemented programs for extraction of the data and for interpolation of data from model levels to either isobaric or isentropic levels. It is also possible to obtain potential vorticity at isentropic levels.

Daily data

These data originate from ECMWF and are stored in spectral form, so-called T106. These are model analyses that currently contain 91 model levels, with model level 91 beeing the ground or surface level. Model top is raised to 0.01 hPa. The upper levels are pure pressure levels, and the lower are pure sigma levels, whereas the other levels are a mixture of these two. Before 1. February 2006 the model analyses contained 60 model levels, older data contain even fewer levels. At each level several parameters are stored. At present the available parameters are: temperature (T), zonal wind (U), meridional wind (V), vertical wind (W) and the natural logarithm of the surface pressure (LNSP) (LNSP is only present at level 60). Programs to extract these model level data are available on zardoz, and routines for interpolation of data to isobaric and isentropic levels are also offered. Software routines are described later.

Data are available from 00 UT on 8 January 1995 onwards, with 6 hours intervals, giving data at 00, 06, 12 and 18 hours. Usually the data are received at NILU one or two days after calculation at ECMWF. Some longer delays have been encountered.

A set of interpolating routines has been written to convert data from model levels to more natural units like pressure or theta surfaces. These programs will interpolate to a wide range of surfaces. Available pressure surfaces are: 0.1, 0.14, 0.2, 0.3, 0.5, 0.7, 1, 1.4, 2, 3, 5, 7, 10, 14, 20, 30, 50, 70, 90, 100, 140, 200, 300, 500, 700, 850, 1000, 1013.25 hPa; available theta surfaces are all levels from 200 to 700K in 5K steps, from 700 to 1000 K in 25 K steps and from 1000 to 3000 in 250 K steps.

All the parameters contained in the model file can be extracted and interpolated, except for LNSP, which is the logarithm of the surface pressure.

Archive data

These data also originate from ECMWF and are also stored in spectral from, so-called T_{106}. These are model analyses that contain 31 model levels (19 levels before 1992), with model level 31 (19) being the ground or sea surface. The upper four levels are pure pressure levels and the lower three levels are pure sigma levels. At each level several parameters are stored. At the present time the available parameters are: temperature (T), specific humidity (Q), zonal wind (U), meridional wind (V), vertical wind (W) and the natural logarithm of the surface pressure (LNSP). Specific humidity is available until 4 April 1995, after when this parameter is only stored on a Gaussian grid.

Programs to extract these model level data exist on zardoz, and extraction of data to isobaric and isentropic levels is also offered (see following chapter).

Data are available from 1 October 1988 to 7 January 1995,

after when the daily data take over. Please note that access to ECMWF data from the various years, are restricted by several protocols.

For converting data from model levels to more natural units like pressure or theta surfaces, a set of interpolating programs have been written. These routines will interpolate to a wide range of surfaces. Available pressure surfaces are the same as for the daily data (see above).

All the parameters contained in the model level data can be extracted and interpolated, except for LNSP, which is the logarithm of the surface pressure.

The maximum resolution is 1.125° × 1.125° for the T_{106} data. A lower resolution can be specified to the ***sp2ll*** program described below. This will produce an output file with fewer grid points.

Extraction of data on 1.125° × 1.125° grid

At NILU we have developed programs to extract portions of the T_{106} data. These programs are based on software provided by ECMWF, but considerable effort has been put into the implementation of these programs and in the development of programs for interpolation of model level data onto isobaric and isentropic levels. We have also developed a code to calculate potential vorticity on isentropic levels. The data are in so-called grib format and in spectral form. In order to get useful data from these files one has to convert to ascii numbers on a latitude longitude grid. We have chosen the NASA Ames format for the ascii files. Thus, a file that you extract from the T_{106} data will be very similar to the other meteorological data on 2.5° x 2.5° grid. You can extract either the whole globe or a portion of it.

Daily data at model levels

sp2ll

For extraction of data at model levels, only one program has to be used: ***sp2ll*** (spectral to lat./lon.). The program that uses the ***gribex*** routines provided by ECMWF to "degrib" and extract the T_{106} spectral coefficients and produce data on a regular latitude and longitude grid. The output from this program is an ascii file in NASA Ames format 3010, a plain 7-bit ASCII file. The ***sp2ll*** program takes the arguments from the command line.

- **Syntax**

```
sp2ll yy mm dd hh Var Level Resolution
West East North South Outfile
```

yy mm dd and ***hh*** are year, month, day and hour, respectively. ***Var*** is the meteorological parameter you want. ***Level*** is the model level number, and it has to be in the range 1 to 31. ***Resolution*** is the geographical resolution in degrees. The best resolution you can obtain from T_{106} is 1.125° × 1.125°, so normally you would give 1.125 here, but you can also specify poorer resolutions, such as 2.5. ***West*** is the western limit. It has to be in the range -180 to 180. ***East*** is the eastern limit. It has to be in range -180 to 180, and it has to be larger than ***West***. ***North*** is the northern limit. It has to be in the range 90 to -90. ***South*** is the southern limit. It has to be in the range 90 to -90, and it has to be smaller than ***North***. ***Outfile*** is the name of the file to contain the resulting data.

Invoked without command line parameters, ***sp2ll*** prints out a usage list. This is helpful when trying to remember the syntax.

The ***sp2ll*** program reads the contents of the environment variable ***MARSPATH***. This variable must be set by user before ***sp2ll*** is used. ***MARSPATH*** must be set to:

```
/nadir/t106/yyyy/mm
```

This done with the command:

```
setenv MARSPATH /nadir/t106/yyyy/mm
```

This command can be put in your .login file if you plan to extract much model level data.

- **Example 1**

```
setenv MARSPATH /nadir/t106/2005/08
sp2ll 05 08 05 18 T 18 1.125 -180 180 90 -90
global.T.dat
```

This command extracts temperature from 18 UTC on 5 August 2005 for the whole globe at model level 18. The output is stored in the file `global.T.dat`.

- **Example 2**

```
setenv MARSPATH /nadir/t106/2005/01
sp2ll 05 01 30 06 U 31 1.125 -50 50 90 30
europe.U.dat
```

This command produces zonal wind from 06 UTC on 30 January 2005 for a region stretching from 50°W to 50°E and 90°N to 30°N, and the result is stored in the file `europe.U.dat`.

Archive data at model levels

For archive data (i.e. data which has been acquired on tape from ECMWF) the process of extracting data on model levels is identical to the one for daily data.

Daily & Archive data at pressure and theta levels

met-mars

In order to obtain T_{106} data at pressure and theta levels an

additional set of programs have to be used. These are the interpolating programs **hy2p**, **hy2th** etc. A normal user will not need to be concerned about the usage of these programs, since a script called **met-mars** in most cases performs the task of extracting and interpolating by calling the necessary programs. The script **met-mars** is invoked by the user and will extract and interpolate. It will automatically set MARSPATH, so the user does not need to set this environment variable.

- **Syntax**

met-mars *yy mm dd hh West East North South Resolution Surface Level Variable Outfile*

where ***yy***, ***mm***, ***dd***, ***hh***, ***West***, ***East***, ***North***, ***South*** and ***Resolution*** have the same meaning as above. The latter should be 1.125 (only this resolution works). ***Surface*** is the type of surface and can be either **th** or **p**. ***Level*** is the numerical value of the level (see the chapter describing the data on page 14 for allowed levels). ***Variable*** is the name of the meteorological parameter and can be one of the following: **T**, **U**, **V**, **W**, **Z**, **PV** and, in addition for archive data, **Q**. All of these variables can be interpolated to any of the available surfaces. The outfile from this script is in NASA Ames format number 3010. This is a plain 7 bit-ASCII file that can be transferred by ftp or e-mail.

- **Example 1**

```
met-mars 05 08 10 12 -180 180 90 30 1.125
th 475 T t050810.12.475
```

This will extract temperature on a theta surface at 475 Kelvin for the 10 August 2005 12 UTC producing a NASA Ames output file named t050810.12.475. The geographical area is from the North Pole to 30°N

- **Example 2**

```
met-mars 05 08 10 12 -180 180 90 30 1.125
th 435 PV pv050810.12.435
```

This will give potential vorticity at 435 Kelvin over the Northern Hemisphere down to 30°N.

- **Example 3**

Potential Vorticity over the south polar area at a theta surface:

```
met-mars 05 09 20 18 -180 180 -50 -90
1.125 th 650 PV pv050920.18.650
```

This gives PV between 50°S and 90°S at 650K.

- **Example 4**

```
met-mars 05 01 23 06 -180 180 -60 -90
1.125 p 100 T t050123.06.100
```

This gives temperature over the south polar area (60°S to 90°S) at the 100hPa pressure surface.

- **Example 5**

```
met-mars 05 09 26 12 -180 180 90 -90
1.125 th 500 PV pv050926.12.500
```

This gives a global field of PV at 500K for 26 August 2005.

At present *only* the 1.125 degree resolution can be used in the **met-mars** script, although the **sp21l** program can accept any resolution.

The script **met-mars** is resident in /nadir/bin and can be copied and changed by the experienced user. The script is written in the Bourne shell. This script utilizes the programs **sp21l**, **hy2pv**, **hy2th**, **hy2p**, **hy2z_th** and **hy2z_p**. 5 versions are available for each of the **hy2xx** programs since input data contain 19, 31, 50, 60 or 91 model levels. Not all kind of variations are covered by this script, and some users may have to change the script to fit the individual needs. Any problems that you might have using these programs should be reported to Ann Mari Fjaeraa at NILU.

hdf-mars

hdf-mars is very similar to met-mars, but the output is returned as an HDF file insted of ASCII. The HDF format is similar to that used in the ENVISAT Cal/Val database system. When using **hdf-mars**, you are not supposed to indicate any outfile, since the file-name is automatically generated according to the CalVal metadata definitions. The output from the program is written to the users home directory.

- **Syntax**

hdf-mars *yy mm dd hh West East North South Resolution Surface Level Variable*

The arguments are similar to those in **met-mars**.

Making extractions more time-efficient

Both **met-mars** and **hdf-mars** are able to extract all available isentropic or isobaric levels into one file. This is done by giving -1 (minus one) instead of a level. For **met-mars**, the time consumption is almost the same when extracting all levels compared to extraction of a single level. For **hdf-mars**, the time consumption is somewhat larger when all levels are extracted at once, but significantly less than the time needed to extract all levels separatly.

If you are planning to download data on several levels, it is strongly advised to use the multi-level option. This will surely save you a lot of time.

Pre-extracted T_{106} data

In connection with the daily updated production of T_{106} maps described on page 6, a selection of data on 8 isentropic and 20 isobaric levels are pre made and stored on zardoz on a daily basis. Data are always available for the last 30 days. The files are located at /nadir/met/extractions/isobaric/*yymmdd*/ and /nadir/met/extractions/isentropic/*yymmdd*/. The same files are furthermore available for download through the web page http://nadir.nilu.no/ecmwf

Graphical presentation of data

Uniras programs have been developed to plot data at T_{106} resolution. All programs described in the following can either be run on zardoz, where they have been installed, or you can transfer the source code to your local computer and install it there. In order to plot data at T_{106} resolution, you first have to extract the data you want to plot, and then start the plotting program.

Introduction

There are three main Uniras plotting programs; ***isenplo***, ***isenmap*** and ***isomap***.

There are also plotting programs for plotting of T_{106} data, which are described below. If you experience any problems using these plotting programs, or if you have any ideas for improvements, please contact Ann Mari Fjaeraa at NILU.

Structure of programs and input files

In order to run all programs presented below, a number of input files are supposed to reside in `~/.uniras`, where "~" symbolizes your home directory.

Most plotting parameters can be varied by editing the file `~/.uniras/Uniras.inp`. The programs can run without this file, because default values for all variables are defined within the programs. The only two input files mandatory are `mclass.inp` and `colour.inp`. If you, through editing of `Uniras.inp`, choose to plot just isolines and no colour shaded map, you also need a file with data on the thickness of isolines (e.g. `mdash.inp`). All these input files are available in `/nadir/src/uniras/metplot_input`. If you run the command **`metplot_install`** on zardoz, the directory `~/.uniras` will be created, and the necessary input files will be copied to this directory. This command will also add the following line to your `.cshrc` file:

```
setenv ECMWFPATH /nadir
```

The plotting programs read this environment variable in order to find the ECMWF data.

Installing the plotting programs at your own site

If Uniras is available at your site, you can copy the source codes, header files and sample input files from zardoz. If you transfer the source files from zardoz you have to fetch the files in these four directories:

`/nadir/src/uniras/metplot` for the ***Makefile*** and the main programs (***isenmap.f***, ***isomap.f*** etc.), `/nadir/src/uniras/lib` for the include files (****.h***) and the subroutines (such as ***mclass2.f***, ***mapsiz2.f*** etc), from `/nadir/src/uniras/geomaps` for the country maps, and from `/nadir/src/uniras/metplot_inp` for sample input files. The files from the latter directory have to be put in `~/.uniras`. In order to simplify the installation, we have also put these files together with the script ***metplot_install*** in a tar file named `/nadir/src/uniras/`***metplot.tar***. Copy this file to your local computer. Make sure that the tar file resides in the directory under which you want the programs to be installed.

In the following we will call this directory `$sourcetop`. Then carry out the following steps:

1. **`tar xvf metplot.tar`**

   The files will now be found in `$sourcetop/metplot`, `$sourcetop/lib`, `$sourcetop/geomaps` and `$sourcetop/metplot_inp`.

2. cd `$sourcetop/metplot`

3. Open ***Makefile*** in a text editor and edit the line that say **`INSTALLTOP=/nadir/bin`** to something suitable for your site.

4. Open the ***metplot_install*** script file in a text editor and edit the line that says **`INPUTDIR=/nadir/src/uniras/metplot_input`** to `$sourcetop/metplot_inp`. Then edit the line that says **`setenv ECMWFPATH /nadir/data/ecmwf`** to the corresponding path for your site. If you read the data directly from one of the CD-ROMs provided by NILU you should set this path to /cdrom/data/. We refer to this as `$datapath` in the following.

5. Make sure that you are still in the $sourcetop/metplot directory, and issue the command: make install. This will compile and link all the programs and move the Uniras executables and ***metplot_install*** to `$INSTALLTOP`.

6. Make sure that the access rights of the Uniras executables and metplot_install are so that you and your colleagues can access them.

7. Make sure that your PATH variable points to `$INSTALLTOP`. If it does not, edit your ***.cshrc*** file accordingly. Type **`source ~/.cshrc`** or open a new window. Also type **`rehash`**.

8. Go to your home directory. Issue the command: **`metplot_install`**. The necessary input files are now in `~/.uniras`, and the line **`setenv ECMWFPATH $datapath`** has been appended to your ***.cshrc*** file.

9. Issue the command: **`source ~/.cshrc`**

10. Run any of the plotting programs following the instructions in the sections below.

11. If the look and size of the plot do not correspond to what you want, go to `~/.uniras` and edit the file ***Uniras.inp***

A note on device drivers

In the Uniras plotting examples used throughout this document we use either `mx11` or `htp3a4` as the device driver. The `mx11` driver is the general driver for plotting on

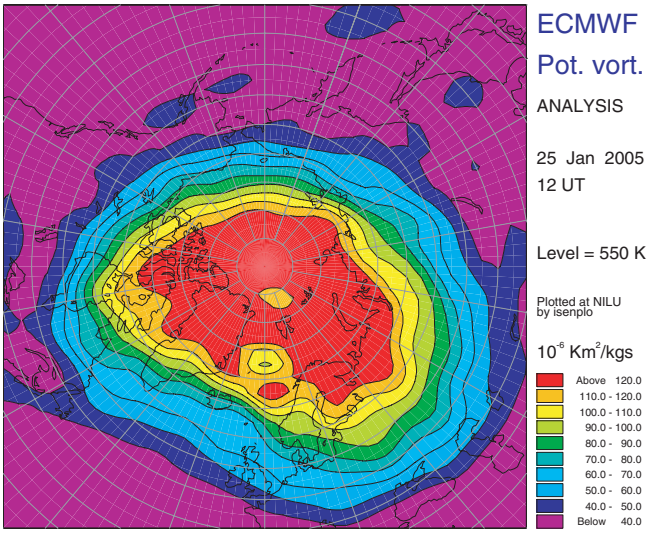


Figure 7. Potential vorticity at 550 K on 25 January 2005.

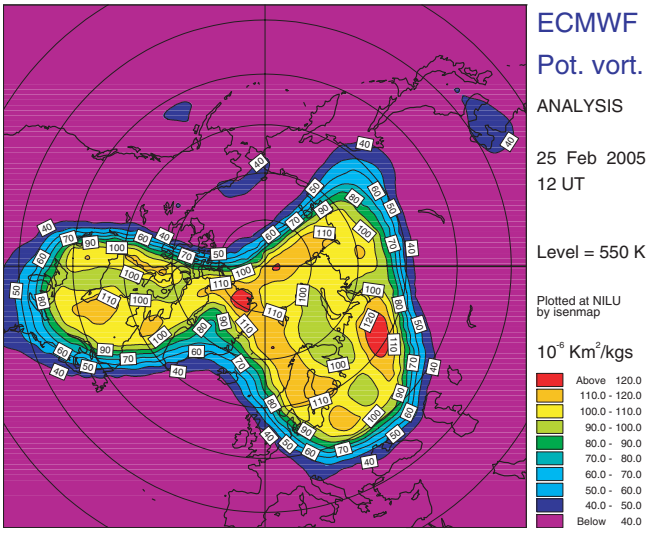


Figure 8. Potential vorticity at 550 K on 25 February 2005.

the screen if your computer runs an X-11 windows system. Please note that the use of X-graphics (mx11 driver) is disabled for external uses on zardoz. The `htp3a4` device driver has been chosen as an example of a driver that produces colour postscript output. Most of the Uniras plots shown in this newsletter have been made with the `htp3a4` driver. The postscript file has then been converted to ***epsi*** (*Encapsulated Postscript Interchange*) format with a shareware program called ***ps2epsi*** before importing it into the word processor. Some of the plots have been made with the driver `hcposteps`. This driver produces an `eps` file (Encapsulated Postscript), which can be imported directly into many word processors. In version 7 of Uniras we have had problems with the `htp3a4` driver since it only produced black and white output. We have therefore switched to the driver called `hcposta4`, which works fine.

Plotting of isentropic data on 2.5° × 2.5° resolution

There are two programs available for plotting of isentropic data on the 2.5° × 2.5° grid: ***isenplo*** and ***isenmap***. There is also a program for plotting of vertical sections of isentropic data, ***isenvert***.

isenplo

This program uses the Uniras routines ***gcnw2s*** and ***gcnw2v*** for the plotting of the colour shaded map and isolines, respectively. These routines do not support annotated isolines, which make them useless for b/w isoline plots. However, these routines can plot the grided data directly without calling any interpolation routines, which means that ***isenplo*** runs faster than the other programs. This program is ideal for colour plots. Alternatively, one can plot a grey tone map.

- **Syntax**

```
isenplo type date fc_hours level device
```

where ***type*** is either **te**, **pv**, **pr** or **ps** depending on whether you want temperature, PV, pressure or PSCs, respectively. ***date*** is the date on the form yymmdd, ***fc_hours*** is the number of forecast hours relative to 0 or 12 UT on ***date***, ***level*** is the isentropic level you want the plot for, and ***device*** is the name of the Uniras device you want the output on. Typical devices are: **mx11** for X windows (screen) and **hcposta4** for colour postscript. You should set ***fc_hour*** to 0 if you want the analysis.

The permitted values for ***fc_hour*** are 24, 48, 72, 96, 120 and 192 if you want forecasts based on the 12UT analysis and 12, 36 and 60 if you want forecasts based on the 0UT analysis (see the chapter on isentropic data on page 11).

- **Example 1**

```
isenplo pv 050125 0 475 hcposta4
```

This will give a plot of potential vorticity for 25 January 2005 at 475K as a postscript file.

Figure 7 shows the resulting plot.

- **Example 2**

```
isenplo te 050114 0 550 mx11
```

This will give a plot of temperature at 550K for 12 UTC on 14 January 2005. The picture will be sent to your X11 screen.

- **Example 3**

```
isenplo pv 050205 0 475 mx11
```

This will give a plot of potential vorticity for 5 February 2005. The level is 475K.

isenplo_min

This program is identical to isenplo, but it marks the minimum and maximum values of the temperature and pressure fields and the maximum for the PV field.

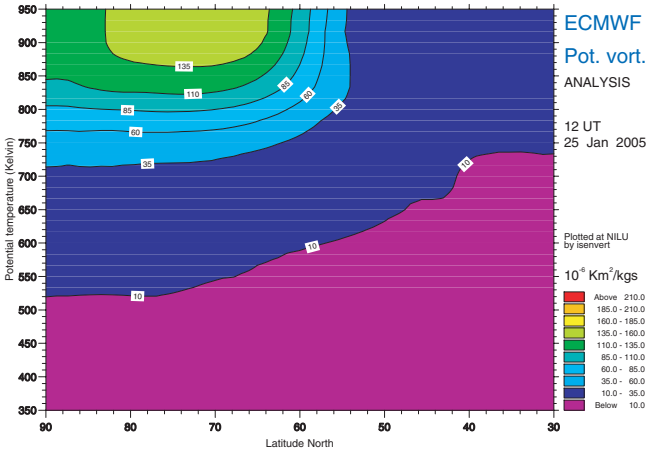


Figure 9. Potential vorticity along 180E om 25 January 2005.

isenmap

This program uses the Uniras routines ***gcnr2s*** and ***gcnr2v*** for the plotting of the colour shaded map and isolines, respectively. These routines do support annotated isolines, which make them useful for b/w isoline plots. However, these routines need the data on a rectangular grid, which means that the data have to go through an interpolation routine. Thus, this program takes some more time to execute than ***isenplo***.

- **Syntax**

`isenmap type date fc_hours level device`

where ***type*** is either **te**, **pv**, **pr** or **ps** depending on whether you want temperature, PV, pressure or PSCs, respectively. ***date*** is the date on the form yymmdd, ***fc_hours*** is the

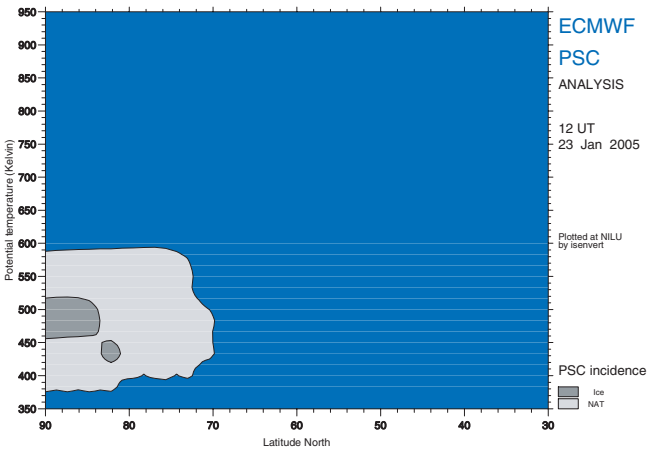


Figure 10. Vertical PSC distribution along 20E on 23 January 2005.

number of forecast hours relative to 0 or 12UT on ***date*** (see explanation above in section on ***isenplo***), ***level*** is the isentropic level you want the plot for, and ***device*** is the name of the Uniras device you want the output on. Typical devices are: **mx11** for X windows (screen) and **hcposta4** for colour postscript.

- **Example**

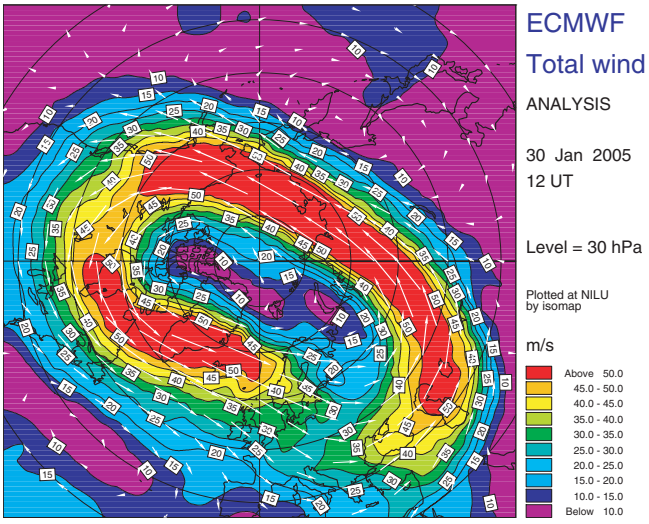


Figure 11. Total wind for 12 UT on 30 January 2005.

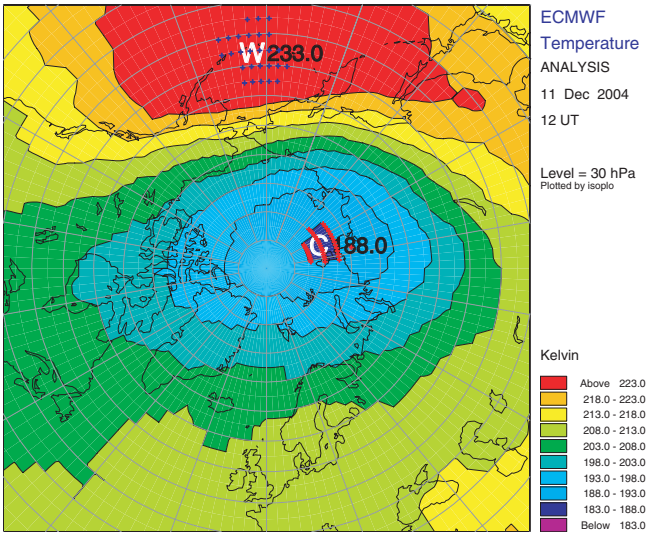


Figure 12. Temperature at 30 hPa on 11 December 2004. A minimum temperature of 188 K was found.

`isenmap pv 050225 0 550 hcposta4`

This will give a plot of potential vorticity for 25 February 2005 at 550K to a postscript file.

Figure 8 shows the resulting plot.

isenvert

This program plots a vertical section of potential vorticity, pressure, temperature or PSC incidence along a meridian. This program is useful for investigating the vertical distribution of these parameters.

- **Syntax**

`isenvert type date longitude device`

where ***type*** is either **te**, **pv**, **pr** or **ps** depending on whether you want temperature, PV, pressure or PSCs, respectively, where ***date*** is the date on the form yymmdd, where ***longitude*** should be in the range 0 to 357.5, and where ***device*** is the name of the Uniras device you want

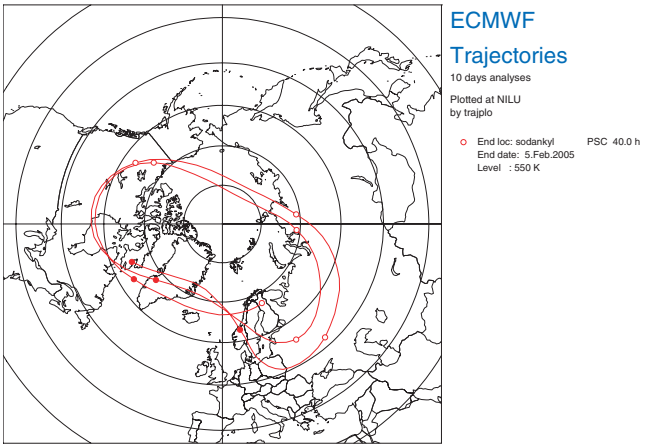


Figure 13. Trajectory ending at 550 K above Sodankylä on 5 February 2005.

the output on.

The following two examples show how this program can be used to localize the vortex edge as a function of altitude and the vertical extent of a PSC cloud, respectively.

- **Example 1**

```
isenvert pv 050125 180 mx11
```

This will produce a plot of PV along the International Date Line for 31 January 2005.

The resulting plot is shown in figure 9.

- **Example 2**

```
isenvert ps 050123 20 mx11
```

This command will give a plot of the vertical extent of PSCs along 20°E on 23 January 2005.

The resulting plot is shown in figure 10.

Plotting of isobaric data at 2.5 ° × 2.5 ° resolution

isomap

There is only one program for plotting of low resolution isobaric data; ***isomap***.

- **Syntax**

```
isomap type date fc_hour level device
```

The input parameters are as described above for isenmap, except that ***type*** can be one of **gp** (geopotential height), **te** (temperature), **mw** (meridional wind), **zw** (zonal wind), **tw** (total wind) or **ps** (PSC). ***level*** now has to be one of the 14 standard isobaric levels.

- **Example 1**

```
isomap tw 050130 0 30 hcposta4
```

This will produce a map of total wind (the vector sum of u and v) for 12 UTC on 30 January 2005 at 30hPa. Figure 11 shows the plot.

isoplo

This program plots isobaric data using the same plotting technique as the program isenplo (see above). The advantage of this program over isomap is that the plotting is quicker since there is no need for interpolation to a rectangular grid. This program also marks on the map the position of the maximum and the minimum temperatures in the field.

- **Syntax**

```
isoplo type date fc_hour level device
```

The input parameters are as described above for isomap.

- **Example 1**

```
isoplo te 041211 0 30 mx11
```

This will produce a map of temperature for 11 December (12 UTC) at 30 hPa. The resulting plot is shown in figure 12. Here the geographical limits in `Uniras.inp` have been set so that the whole field from 30°N is included.

Plotting of trajectories

trajplo

The ***trajplo*** program runs without the aid of a script. It plots isentropic trajectories at seven levels.

- **Syntax**

```
trajplo date_1 station_1 level_1 date_2
station_2 level_2 ... date_n station_n
level_n device
```

where **n** can be in the range 1-6. The station name can be either one of the measurement sites or one of the grid points. The measurement sites have eight character codes, which normally are the first eight characters of the stations name. The grid points should be referred to as:

```
gridpoin, lat, lon
```

Available stations have varied during the EASOE, SESAME, THESEO, VINTERSOL and SCOUT-O3 campaigns. In order to obtain a list of stations in a file you can run the program ***statlist***.

- **Syntax**

```
statlist date outfile
```

This produces a text file with all the stations names in it.

- **Example 1**

```
trajplo 050205 sodankyl 550 mx11
```

This will give a plot of a trajectory ending at the 550 level above Sodankylä. The plot in figure 13 shows the result.

- **Example 2**

```
trajplo 050101 sodankyl 475 050101 thule
```

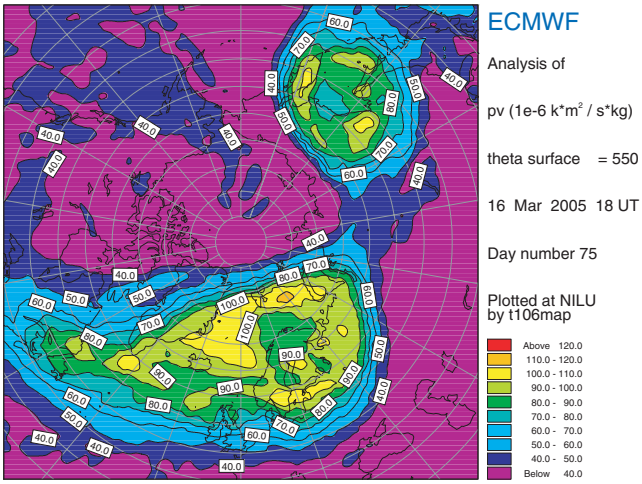


Figure 14. Potential vorticity at 550 K on 16 March 2005 18 UT over the Northern Hemisphere.

```
475 050101 uccle 475 050101 aberystw 475 050101 nyalesun 475 050101 kiruna 475 mx11
```

This will produce a plot on the screen of six trajectories at 475K ending at the given stations.

As described on page 6, it is possible to access ***trajplo*** through the web site http://nadir.nilu.no/ecmwf.

Plotting of T_{106} data

Introduction

Three programs are available for plotting of T_{106} data. One program, ***t106map***, gives the same type of maps as ***isenmap***, whereas the second program, ***t106glob*** plots data in an orthographic projection. The former is well suited for plots over the Northern Hemisphere, whereas the latter can be used to plot either hemisphere. Both these programs plot arbitrary files resulting from the extraction of T_{106} data described above. Since the programs don't know which parameter to plot, the lower and upper class limits have to be given on the command line. These programs hence don't use the ***mclass*** subroutine.

The third program, ***t106plot***, follows the same syntax as ***isenmap*** and ***isomap***. This program produces the same type of plot as ***t106map***, but it is restricted to plotting PV, temperature and PSC incidence (calculated from the temperature). The instructions and examples below will make the use of these programs a bit clearer.

Common to all three programs is that the data have to be on $1.125° \times 1.125°$ grid, but the programs handle any geographical coverage. The data array is dimensioned to contain a global field at this resolution, but before data is read it is filled with missing values. The area covered by the data file is specified in the data file header, so that the data are put into the appropriate array elements.

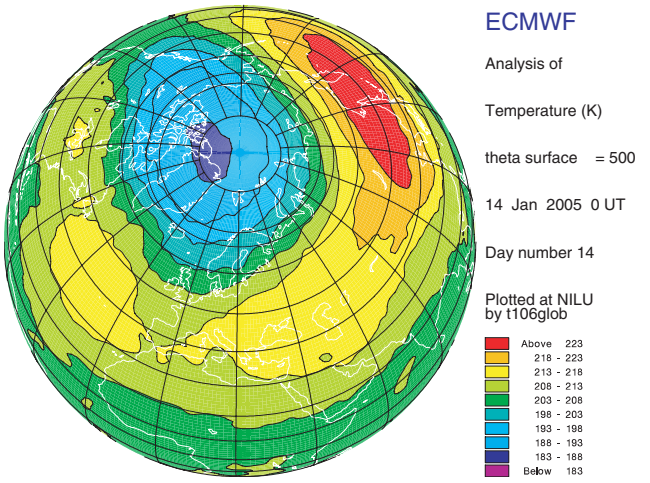


Figure 15. Orthographic plot of temperature at 500 K on 14 january 2005 at 0 UTY. The map is centered over Kiruna.

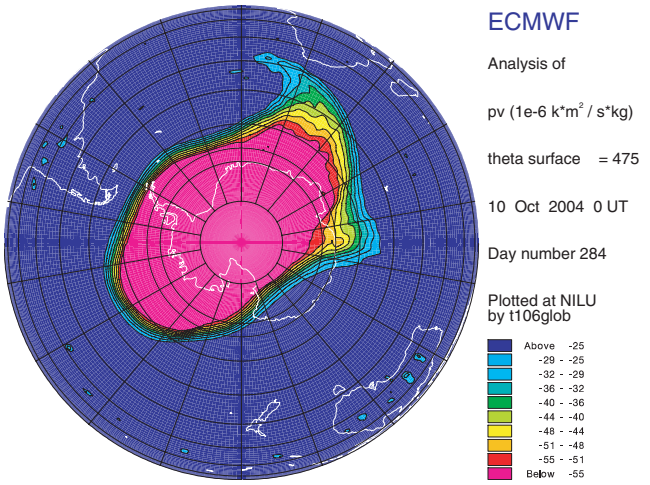


Figure 16. Orthographic plot of potential vorticity at 475 K on 10 October 2004 at 12 UT. The map is centred over the Antarctic Peninsula. Note that the PV is negative in the Southern Hemisphere.

t106map

Use this program if you want to plot a map over the Northern Hemisphere of any arbitrary parameter that you have extracted from the spectral T_{106} data.

- **Syntax**

```
t106map data_file min max device
```

where ***data_file*** is the name of a NASA Ames file that you have extracted using ***met-mars*** as described previously, where ***min*** and ***max*** are the lower and upper class limits, respectively, and where ***device*** is the name of a Uniras device.

- **Example 1**

Assume that you want to plot a PV map of the Northern Hemisphere from 30°N to the Pole for 18 UTC on 16 March 2005 at 550K. First you have to extract the data with ***met-mars***:

```
met-mars 05 03 16 18 -180 180 90 30 1.125
```

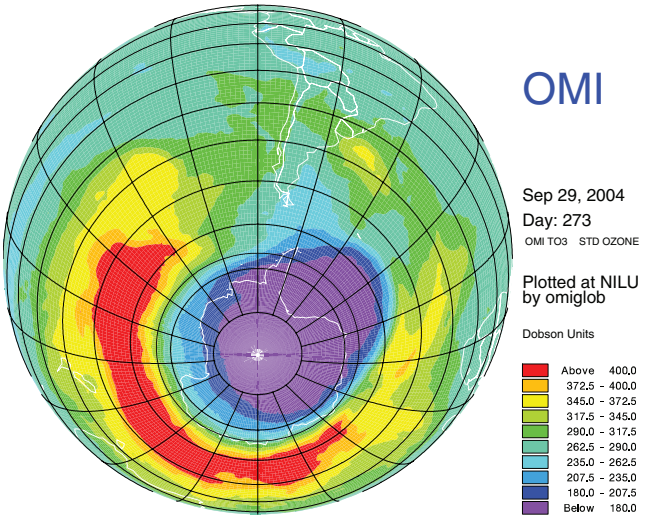


Figure 17. Orographic plot of total ozone from the OMI instrument for 29. September 2004. The ozone hole can be seen as the region with total ozone < 180 DU.

```
th 550 PV pv05031618.550
```

Then you specify the output file from this command as the data input to the plotting program:

```
t106map pv05031618.550 40 120 mx11
```

The resulting plot is given in figure 14

t106glob

Use this program if you want to plot a map of any arbitrary portion of the globe. This program uses the orthographic projection (i.e. the globe looks like it does from space). You specify on the command line the latitude and longitude of the centre of the map. This way you can see the globe from any vantage point you want. This program is ideal if you want to plot a map over the Southern Hemisphere, such as Antarctica.

- **Syntax**

t106glob *data_file min max centre_lat centre_lon device*

where ***data_file*** is the name of a NASA Ames file that you have extracted using ***met-mars*** as described previously, ***min*** and ***max*** are the lower and upper class limits, respectively, ***centre_lat*** is the latitude of the map centre, ***centre_lon*** is the longitude of the world centre, and ***device*** is the name of a Uniras device. The lower and upper class values are determined by ***min*** and ***max***, and the number of classes will be determined by the number of colours in the colour file (e.g. `colour.inp`) pointed to in `Uniras.inp`.

- **Example 1**

Assume that you want to plot a temperature map at 500K over the Northern Hemisphere for 0 UTC on 14 January 2005, centred over Kiruna.

First, you extract the data with ***met-mars***:

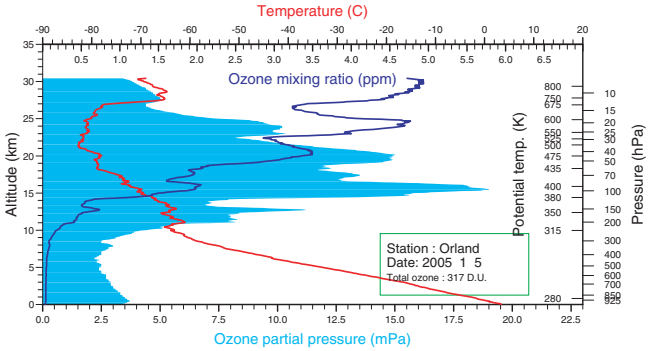


Figure 18. Plot on ozonesonde profile from Orland (Norway) on 5. January 2005.

```
met-mars 05 01 14 0 -180 180 90 -90 1.125
th 500 T t05011400.500
```

The output from this program is used as input for the plotting program:

```
t106glob t05011400.500 183 223 68 21
mx11
```

The plot will look like figure 15.

- **Example 2**

Let us assume that you want to make a plot of PV at 475K over the south polar region for 10 October 2004, 12UTC, centred over the Antarctic Peninsula. First, you extract the PV field:

```
met-mars 04 10 10 12 -180 180 90 -90
1.125 th 475 PV pv041010.12.475
```

Then make the plot:

```
t106glob pv041010.12.475 -75 -30 -68 -60
mx11
```

The plot is shown in figure 16.

t106plot

This program can plot temperature, PV and PSC incidence (based on temperature data) from NASA Ames files with 1.125° × 1.125° resolution. This program reads the class values from `~/.uniras/mclass.inp` or any other file that you specify. In this sense it works in the same way as ***isenmap***.

- **Syntax**

t106plot *data_file parameter device*

where ***data_file*** is the full path to the file containing the data, where ***parameter*** is one of **te**, **pv** or **ps**, and where ***device*** is the Uniras device name.

- **Example 1**

Let us assume that you want a PSC map at 475K for 12UT on 14 January 2005. First, you extract temperature data for

this date and time:

```
met-mars 05 01 14 12 -180 180 90 30 1.125
th 475 T t05011412.475
```

The you plot the PSC map using the temperature data:

```
t106plot t05011412.475 ps mx11
```

Plotting of TOMS data

There are two programs to plot TOMS data, one that plots a stereographic map of the Northern Hemisphere and one that plots an orthographic map of any part of the globe.

tomsplot

This program plots an azimuthal stereographic plot of TOMS data over the Northern Hemisphere.

- **Syntax**

```
tomsplot data_file min max device
```

where ***data_file*** is the full path to the TOMS data file (which should be in the normal NASA TOMS format (not NASA Ames format)), where ***min*** and ***max*** are the lower and upper class limits, respectively, and where ***device*** is the Uniras device.

- **Example 1**

```
tomsplot /nadir/satellit/toms/nimbus7/
d930315.dat 250 450 mx11
```

We have used 16 colours, rather than the 10 normally used. This is done by editing the file `~/.uniras/Uniras.inp`. Go to the line which says: `tomsplot.colour.input_file_name`, and edit this line so it looks like this:

```
tomsplot.colour.input_file_name=
~/.uniras/colour16.inp
```

The file `colour16.inp` can be found in

```
/nadir/src/uniras/metplot_inp
```

tomsglob

- **Syntax**

This program is quite similar to ***t106glob*** since it can plot the globe from any vantage point.

```
tomsglob data_file min max centre_lat
centre_lon device
```

where ***data_file*** is the full path to the TOMS data file (which should be in the normal NASA TOMS format (not NASA Ames format), where ***min*** and ***max*** are the minimum and maximum class values in Dobson units, where ***centre_lat*** and ***centre_lon*** are the latitude and longitude of the centre of the map, respectively, and where ***device*** is the Uniras device.

- **Example 1**

```
tomsglob /nadir/satellit/toms/
eptoms/0409/L3_ozone_ept_20040929.txt
```

This command will produce a total ozone plot on the screen with the Antarctic Penninsula in the centre of the map. Production of Earth Probe TOMS real time data and products has been suspended from January 1, 2006. The same commands, as used above, can be run to plot the ozone data from OMI onboard the AURA satellite. The path will be

```
tomsglob /nadir/satellit/omi/0409/L3_
ozone_ept_20040929.txt
```

The map is shown in figure 17.

Plotting of TOVS data

tovsplot

This program plots a stereographic map of total ozone from TOVS as provided by CNRM in Toulouse. Data from 1993 – 1997 are available.

- **Syntax**

```
tovsplot file_name min max device
```

where ***file_name*** includes the full path of the file to plot and ***device*** is the Uniras device.

min is the lowest class value, max is the upper class limit.

- **Example 1**

Let us assume that you want to plot a TOVS map for 27 February 1996. First you copy the compressed TOVS file to `/nadir/tmp`, so that you can uncompress it:

```
cp /nadir/projects/sesame/data/satellit/
tovs/
m9709/tv970926.oz2.Z /nadir/tmp
```

Then you uncompress it:

```
cd /nadir/tmp
uncompress tv970926.oz2.Z
```

Now the file can be plotted:

```
tovsplot tv970926.oz2 0 350 hcposta4
```

This gives a file called `POST` that you can ftp to your local computer and print on your local printer.

Plotting of ozonesonde data

This program is ideal for plotting individual ozone profiles from specific stations.

- **Syntax**

```
sondeplo station date_hour ordinate
orientation device
```

where ***station*** is the name of the launch site, ***date_***

hour is the date and hour of launch on the form yymmddhh, ordinate is type of ordinate (a, t or p),

for altitude, theta and pressure, respectively,

orientation is the orientation of the plot (1-4)and ***device*** is the Uniras device for the output.

- **Example 1**

```
sondeplo orland 05010512 a 1 hcposta4
```

The result is shown in figure 18.

meanprof

This program calculates and plots an average profile from any number of individual profiles. The program takes as input the name of a file that contains a list of ozonesonde data file names

- **Syntax**

```
meanprof file_list device
```

where ***file_list*** is the name of the file that contains a list of sonde data files and ***device*** is as before.

- **Example 1**

```
meanprof iv9203.dir hcposta4
```

profile

This program can be used to inspect a large number of profiles on the computer screen. The program takes a file list as input, and one profile is displayed after the other by pressing the space bar or a mouse button.

- **Syntax**

```
profile file_list
```

where ***file_list*** is a file with a list of file names of ozonesonde data

Time series of data on 2.5 ° × 2.5 ° grid

Isentropic data

isen_ts

The program ***isen_ts*** will make a time series of any of the parameters temperature, pressure, potential vorticity and PSC incidence for a given grid point. The output is to an ascii file. The program reads the necessary input parameters from the command line.

- **Syntax**

```
isen_ts start_date  end_date  data_type
level lat lon outfile
```

where ***start_date*** and ***end_date*** are the start and end dates of the time series on the form yymmdd, where ***data_type*** can be **te**, **pv**, **pr** or **ps** for temperature, potential vorticity, pressure and psc incidence, respectively, where ***level*** is the isentropic level in the range 350 to 950K, where ***lat*** and ***lon*** are the latitude (multiple of 2.5 in the range 30 to 90) and longitude (multiple of 2.5 in the range -177.5 to 180) of the site you want data for, and where ***outfile*** is the name of the file to contain the output.

- **Example 1**

```
isen_ts 041201 050330 te 475 52.5 -5.0
te475.dat
```

The source code can be found on zardoz in

`/nadir/src/nongraph/meteorol/isentrop/isen_ts.f`

isen_minmax

The program ***isen_minmax*** will make a time series of the maximum and minimum temperature anywhere north of 40°N. The input parameters are taken from the command line.

- **Syntax**

```
isen_minmax start_date  end_date  level
outfile
```

where the parameters have the same meaning as for the previous program.

- **Example 1**

```
isen_minmax 050101 050430 475 tmin.dat
```

isen_mincoor

This program will make a time series of the minimum and maximum temperature in the same way as isen_minmax. In addition, isen_mincoor also gives the latitude and longitude of the minimum temperature points. The input parameters are taken from the command line.

- **Syntax**

```
isen_mincoor start_date  end_date  level
outfile
```

where the parameters have the same meaning as for the previous program.

- **Example 1**

```
isen_mincoor 041201 041210 475 tmin.dat
```

Isobaric data

iso_ts

The program ***iso_ts*** is analogous to ***isen_ts***, and the syntax is the same. Running ***iso_ts*** without parameters gives a list of allowed parameters.

iso_minmax

This program is analogous to ***isen_minmax*** and the syntax is the same. Running ***iso_minmax*** without parameters

gives a list of all the input parameters.

iso_mincoor

This program is analogous to isen_mincoor and the syntax is the same. Running ***iso_mincoor*** without parameters gives a list of all the input parameters.

Time series of T_{106} data

We will here show how you can use the ***met-mars*** script to extract time series from the T_{106} data. This will be shown through a couple of examples.

- **Example 1**

Let's assume that you want to make a time series of the possible PSC area at 475K during the last four winters. By possible PSC area we mean the geographical area covered by PSCs. This means that we have to find the number of grid cells with temperatures lower than a certain threshold, determined by the partial pressures of water vapour and nitric acid, and then add the area of all these grid cells. In order to find this we have to extract a temperature field for each day of these four winters. In this chapter we will show how you can extract a time series of temperatures from the T_{106} data available at NADIR.

In order to extract the temperature fields we will use ***met-mars***. Because of the large number of extractions (one per day) it will be best to do this with a script. Since the extraction and interpolation of T_{106} data is quite time consuming, we recommend that you do one month at a time. You can make one script for each month and then run these scripts individually. Here follows a script that will extract data for December 2005. We extract data for 12UT only.

```
#!/bin/csh
foreach date ( 01 02 03 04 05 06 07 08
09 10 11 12 13 14 15 16 17 18 19 20 21
22 23 24 25 26 27 28 29 30 31 )
met-mars 05 12 $date 12 -180 180 90 30
1.125 th 475 T  t.05.12.$date.12.475
end
```

- **Example 2**

Let's assume that you want to see how the vortex has moved over a period of one month. The T_{106} data will give you a much better time resolution than the 2.5°×2.5° data, since we have analyses for every 6 hours. The time period of interest is Februar 2005. The following script will extract the data:

```
#!/bin/csh
foreach date ( 01 02 03 04 05 06 07 08
09 10 11 12 13 14 15 16 17 18 19 20 21
22 23 24 25 26 27 28 )
foreach hour ( 00 06 12 18 )
met-mars 05 02 $date $hour -180 180 90
30 1.125 th 475 PV
pv.05.02.$date.$hour.475
end
end
```

These data can then be plotted with ***t106map*** to give postscript files. These postscript files can then be converted to GIF files, so that they can be animated with ***xanim***. On zardoz you find a routine called convert that converts postscript files to GIF files. The following script will plot the extracted data and convert the plot files to GIF format:

```
#!/bin/csh
foreach date ( 01 02 03 04 05 06 07 08
09 10 11 12 13 14 15    16 17 18 19 20
21 22 23 24 25 26 27 28 )
  foreach hour ( 00 06 12 18 )
  t106plot pv.95.02.$date.$hour.475 pv
hcposta4
  mv POST pv.95.02.$date.$hour.ps
  convert pv.95.02.$date.$hour.ps
pv.95.02.$date.$hour.gif
  end
end
```

Time series of PV at individual stations

The Danish Meteorological Institute provides more exact PV data for a number of stations. These files are not in the NASA Ames format, and we have written a special program, ***pvatstat***, to read these files and make a time series of PV for an individual station. The program works on data files from before 1 November 1995. Files from after this date can be read with ***pvatstat2***.

- **Syntax**

```
pvatstat f_date l_date level outfile m|n

pvatstat2 f_date l_date level param time
outfile m|n
```

where ***f_date*** and ***l_date*** are the first and last date, respectively, ***level*** is the isentropic level and ***outfile*** is the name of the file to contain the result. The last parameter should either be the letter **m** (literally) for manual interaction or a number (***n***) indicating which station number you want. If you are not sure what the number of your station is, you should type **m** in order to get a list of the stations' coordinates. From this list you can choose a station number. Beware that the station numbers can change between different time periods, since the number of stations included has changed during the years. Hence, the first time you run ***pvatstat*** for a given time period you should choose ***m*** as the last parameter.

- **Example 1**

```
pvatstat 941201 950331 475 pv475.dat m
```

This will give you a time series of PV at 475K between the given dates. The output will be written to the file pv475.

dat, and since we have typed **m** at the end, the program will list the station coordinates and ask you to choose one of them.

- **Example 2**

```
pvatstat2 041201 050331 pv 0 475 pv475.dat 12
```

This will give you a time series of PV at 475K between the given dates. The output will be written to the file pv475.dat This will give you PV time series for station number 12 in the pvatstat2 data.

Listing of data for single days

Introduction

The NASA Ames files with ECMWF data are not easy to read manually. Because of this, we have made some programs that can read these files (or portions of them) and make a more readable output.

Isentropic data

isen_extr

The program **isen_extr** takes out a portion of the data for a given meteorological variable, date, level and within certain geographical limits. The output is directed to the screen.

- **Syntax**

```
isen_extr date forecast_hours type level lat lon
```

where **lat** and **lon** give the latitude and longitude of the upper right corner of the geographical area to extract.

- **Example 1**

```
isen_extr 041225 0 pv 550 80 20
```

Isobaric data

isolist

The program **isolist** makes a listing of the contents of an isobaric file where the four parameters temperature, GPH, u and v are listed on one line for each grid point.

All results are written to file in your home directory.

- **Syntax**

```
isolist date forecast_hours level outfile
```

The meaning of the input parameters is as before.

- **Example 1**

```
isolist 050101 0 100 isodat.100
```

isoprof

The program **isoprof** takes out data for all the 13 isobaric levels for a given date and a given location.

- **Syntax**

```
isoprof date forecast_hours lat lon outfile
```

where the input parameters are as before.

- **Example 1**

```
isoprof 950101 120 67.5 20.0 profile.dat
```

iso_extr

The program **iso_extr** takes out a portion of the data for a given meteorological variable, date, level and within certain geographical limits. The output is directed to the screen.

- **Syntax**

```
iso_extr date forecast_hours type level lat lon
```

where **lat** and **lon** give the latitude and longitude of the upper right corner of the geographical area to extract.

- **Example 1**

```
iso_extr 051225 0 T 50 80 20
```

How to make XY diagrams

xyplot

This is a Uniras program for making XY plots, for example of time series. The program takes two parameters on the command line; the device name and the orientation of the plot. The rest of the input comes from an input file, **xyplot.inp**, which has to reside in ~/.uniras. The source code and a sample input file can be found on zardoz in /nadir/src/uniras/xyplot. With this program several curves can be plotted in different colours and/or line styles. It is also possible to specify text strings and their location on the plot in the input file. Let us assume that you want to plot a time series of minimum temperatures in the Northern Hemisphere for some of the first winters in the nienties. First, you run the program **isen_minmax**, which is described on page 22. From the output one can extract columns 2 and 3 with the **awk** command:

```
awk '{print $2, $3}' tmin.dat > tmin.jul
```

The file tmin.jul can then be used as input data for **xyplot**. Make one such data file per winter, e.g. tmin02.jul, tmin03.jul, tmin04.jul and tmin05.jul. Specify these files in the xyplot.inp input file. In this input file one can also decide on the width, line style and colour of each curve.

- **Syntax**

```
xyplot device orien [julopt]
```

where **device** is the Uniras device, **orien** is the orientation

of the plot (1-4) and ***julopt*** is an optional parameter which should either be omitted or set equal to **jul**. If ***julopt*** is set to **jul**, day numbers larger than 250 will have 365 subtracted from them, so that one can make plots of time series covering the whole winter, and where dates before 1 January will get negative day numbers.

- **Example 1**

```
xyplot hcposteps 1 jul
```

The path to the data files must be given in the input file `~/.uniras/xyplot.inp`.

Other programs

Picking out data inside the vortex

pvpick

If you have a large set of data files for a given station, such as spectrometer data, lidar data or ozonesonde data, it can be useful to pick out only those data files that represent measurements carried out inside the polar vortex. It might be tedious to make this selection manually. This can be done quite easily with the program ***pvpick***. As input it needs a file with the file names of the data files and a file with PV data. This latter file will typically be the output file from the ***pvatstat*** program. The program picks out the date part of a file name by searching for a "/" followed by "8" or "9" three characters later. If your files names follow the convention adopted by NADIR, this should be a good criterion for picking out the date part of the file names. From the PV data file those dates that have PV above a certain threshold are picked. These dates are compared with the dates found from the file with data file names, and a list of file names, which satisfy the PV criteria is written to an output file. The PV limits for the most common levels are given in the source code, but these can be changed by copying the source code to your home directory or to your local computer. The program can be found in `/nadir/src/nongraph/meteorol/misc`.

- **Syntax**

```
pvpick dirfile pvfile level outfile
```

where ***dirfile*** is the file containing the file names, ***pvfile*** is a file with a time series of PV data for the station, ***level*** is the isentropic level, and ***outfile*** will contain a list of files that satisfy the PV criterion defined in the program.

Extractions of trajectories for individual stations

Trajectory data used to be stored both as large collective files containing data for all stations, and as smaller files for each station. In order to save disk space these data are now only stored as large collective files. If you are interested in transferring trajectory data for only one or a small number of stations, you can extract data for single stations. The extraction program is called ***traj2000***. This program will extract trajectories for all the isentropic levels ending at one station for a specific date. When logged on to zardoz, run

```
traj2000 -help
```

to get instructions on how to use this program. To extract trajectories for dates before Desember 31 1999, use the program ***traj***. Usage is similar to ***traj2000***.

A summary of all programs

Here follows an alphabetical list of all the programs described in this newsletter together with a short description of their purpose

Table 1 Program summary

Program name	Purpose	Page
asc2hdf	Converts an ASCII file into HDF	**10**
hdf_mars	Extracts and interpolates gribbed spectral ECMWF data. The output is in HDF format.	**14**
isen_extr	Lists a lat/lon portion of isentropic ECMWF data to the screen.	**24**
isenmap	Plots a map of isentropic ECMWF data at 2.5x2.5 deg. resolution. Isolines can be annotated, so the program is useful for b/w plots.	**17**
isen_mincoor	Makes a time series of the maximum and minimum temperature anywhere north of 40N form the isentropic ECMWF data. Also gives the coordinates of the max and min points.	**22**
isen_minmax	Makes a time series of the maximum and minimum temperature anywhere north of 40N form the isentropic ECMWF data.	**22**
isenplo	Plots a map if isentropic ECMWF data at 2.5x2.5 deg resolution.	**16**
isenplo_min	Plots a map if isentropic ECMWF data at 2.5x2.5 deg resolution. Marks on the map the position and value of maximum and minimum values.	**16**
isen_ts	Extract a time series of isentropic ECMWF data for a given grid point and level.	**22**

Program name	Purpose	Page
isenvert	Plots a vertical section of isentropic ECMWF data along a meridian.	**17**
iso_extr	Extract a portion of the isobaric ECMWF data. Output is written to the screen.	**24**
isolist	Writes the contents of an isobaric ECMWF file with one line per grid point. The output is written to a file.	**24**
isomap	Plots a map if isobaric ECMWF data at 2.5x2.5 deg resolution.	**18**
iso_mincoor	Makes a time series of the maximum and minimum temperature anywhere north of 40N from the isobaric ECMWF data. Also gives the coordinates of the max and min points.	**23**
iso_minmax	Makes a time series of the maximum and minimum temperature anywhere north of 40N from the isobaric ECMWF data.	**22**
isoplo	Plots a map of isobaric ECMWF data at 2.5x2.5 deg resolution.	**18**
isoprof	Extracts the four parameters of an isobaric ECMWF file for all 13 levels at a specified grid point.	**24**
iso_ts	Extract a time series of isobaric ECMWF data for a given point and level.	**22**
meanprof	Calculates and plots a mean ozone profile from a list of ozonesonde files.	**22**
met-mars	Extracts and interpolates gribbed spectral ECMWF data. This program must be run before you can use the plotting programs t106glob, t106map and t106plot.	**13**
profile	Interactive Uniras program that display a list of ozone sonde profiles in succession.	**22**
pvatstat	Extract time series of PV data for individual stations. Works on data throughout October 1995.	**23**
pvatstat2	Same as pvstat, but works on data files starting November 1995.	**23**
pvpick	Picks out data files for a station according to a certain PV criteria.	**25**
sondeplo	Plots individual ozone sonde profiles.	**21**
sp2ll	Extract spectral ECMWF data onto a latitide/longitude grid. Data will be on model levels. We recommend the use of met-mars for extraction of spectral data.	**13**
statlist	Produces a list of end points in a trajectory data file.	**18**
t106glob	Plots t106 data in orthographic projection. met-mars must be run first to extract the data.	**20**

Program name	Purpose	Page
t106map	Plots t106 data (any parameter) in stereographic projection. Met-mars must be run first to extract the data.	**19**
t106plot	Plots t106 data (T, PV or PSC) in stereographic projection. Met-mars must be run first to extract the data	**20**
tomsglob	Plots TOMS data in orthographic projection.	**21**
tomsplot	Plots TOMS data over the Northern Hemisphere in stereographic projection.	**21**
Tovsplot	Plots TOVS data over the Northern Hemisphere in stereographic projection.	**21**
traj	Extracts trajectory data for a single station from the large collective trajectory files.	**25**
traj2000	Same as traj, but works for data after 1999.	**25**
trajplo	Plots up to six trajectories.	**18**
Xyplot	Plots one or more curves in an XY diagram.	**24**

Description of service	URL
Preliminary model results from the SLIMCAT 3D model	Http://www.env.leeds.ac.uk/~fengwh/winter0405.html
Near-Real-Time plots from REPROBUS and forecast + analyses from MIMOSA	Http://www.aerov.jussieu.fr/~fgoutail/
Large archive and NRT products from the GOME and SCIAMACHY instruments	Http://www.iup.physik.uni-bremen.de/eng/datenprodukte/index.html
Tropospheric Emission Monitoring Internet Service. Near-real time service and archives of various GOME and SCIAMACHY products	http://www.temis.nl
Annual NCEP data for the northern and the southern hemisphere	Http://hyperion.gsfc.nasa.gov/Data_services/met/ann_data.html
Near-Real-Time plots of Ozone, NO_2, BrO, HCHO, OClO and SO_2 products from GOME	Http://www.iup.physik.uni-bremen.de/gomenrt/
Links to various MAPSCORE related Near-Real-Time services	Http://www.leos.le.ac.uk/mapscore/data/linkspage.html

Online services

A number of institutions and investigators have put in place web sites with near real-time data. Some of the services that we are aware of are listed in the table above.

Who to contact at NILU?

If you have any questions regarding the NADIR services, please contact one of the following persons:

Rita Larsen Våler (user accounts, data protocols).
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If you are in doubt about who to contact you can send an E-mail to nadirteam@nilu.no. The request will then be handled within a few days.

Access to ECMWF data

ECMWF data can be accessed by those who are affiliated with certain EU projects within atmospheric chemistry research, and who have signed the ECMWF data protocol. An agreement has been made with ECMWF for the ENVISAT Cal/Val, the VINTERSOL and SCOUT-O3 time periods, and a new protocol (ecmwf4) has been made. This protocol can be obtained by contacting Rita Larsen Våler (rlv@nilu.no).

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