LRTAP 15/75

DERIVATION OF EMISSION FIELDS AND THEIR APPLICATION

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Most of the sulphur is emitted as SO_2, and the emission survey performed by the Central Coordinating Unit is a mapping of SO_2-emissions in Western Europe (see ref. 1). This emission survey gives the SO_2-emissions in a grid system; $\frac{1}{2}^\circ$ latitude times 1° longitude (see fig. 1), covering the countries marked with A on fig. 1. The countries are: Austria, Belgium, Denmark, England, Scotland, North Ireland, France, Luxembourg, the Netherlands, Norway, Sweden, and Switzerland.
The emissions are given as a constant component and a temperature dependent component for the year 1973.

In order to make reliable estimates of SO_2- and SO_4-concentrations, we must know the emissions everywhere in the region of calculation. For the countries markes with B on fig. 1, we have used information from (ref. 2) to estimate emissions in grid squares, each 127 x 127 km^2, see fig. 1. As for the rest of the area, see ref. 3 and ref. 4..

Before we can apply the emission surveys in transport calculations, we must transform all the emissions in the region of calculation to the same reference system. We have chosen a grid consisting of square elements, 127 x 127 km^2 at 60° N.(Squares on a sterographic conform mapping).

The transformation is performed by deviding the $1^\circ \times \frac{1}{2}^\circ$ elements into 64 subelements, regarding these to be "points", each "point" representing 1/64- part of the emission in the $1^\circ \times \frac{1}{2}^\circ$ element. We have computed the position of each "point" in the new reference system, and in this way transformed all emissions to the square grid system. The same technique has been used to construct emission fields where the grid elements are 63.5 x 63.5 km^2.

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APPLICATIONS

a) When using the one-layer Lagrangian model (see ref. 5), we have applied an emission field of SO_2, constructed by the method described above: 32 x 32 grid elements, each 127 x 127 km^2 at 60^oN (At the south-western part of fig. 1, five rows of grid squares have been omitted from the region of calculations)*. Adding the constant and the temperature dependent components, we have applied yearly mean SO_2-emissions in the calculations. The emissions applied are independent of time, and this must be considered in the interpretation of the results.

b) For the two-layer Lagrangian model, we need emissions in two layers (see ref. 6). The way in which these emissions are derived is described in ref. 6. The region of calculation is the same as described above (a). The emissions applied are independent of time (as above). Time dependent emissions in the models may give more reliable results, and in the near future, we have planed to include such effects in the models.

c) For statistical treatment of concentration estimates from trajectories and data from sampling sites, we need emission fields (see ref. 7).
In these concentration estimates, we have applied emission fields derived in the way described above.

I: 37 x 32 grid elements, each 127 x 127 km^2
II: 74 x 64 " " , each 63.5 x 63.5 km^2.

(Both grid systems cover the same area, see fig. 1)
On the basis of trajectories and both these grid resolutions, we have estimated concentrations from:

i) emission fields independent of time
j) emissions changing over the year as a sinus plus a constant,

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* see doted line on fig. 1

k) emissions changing over the year as (j) and daily changing as the diurnal gas demand in U.K.

From correlation analysis, we found no effect of diurnal change of the emissions (k). (The data were daily mean concentrations at the ground sampling stations).
For stations near large sources, yearly change of the emissions (j) gave slightly better correlation coefficients than with constant emissions. (For stations far from large sources, no effect). The measurements used in this analysis covered two winter periods. When analysing data covering several seasons, it should be more important to include this effect. Changing the resolution of the emissions from 127 km to 63.5 km, improved somewhat the estimates for stations near the large sources.

REFERENCES

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(6) A two-layer Dispersion Model, Description and a few Results (LRTAP 5/75), by A. Eliassen and J. Saltbones, Norwegian Institute for Air Research, April 1975.

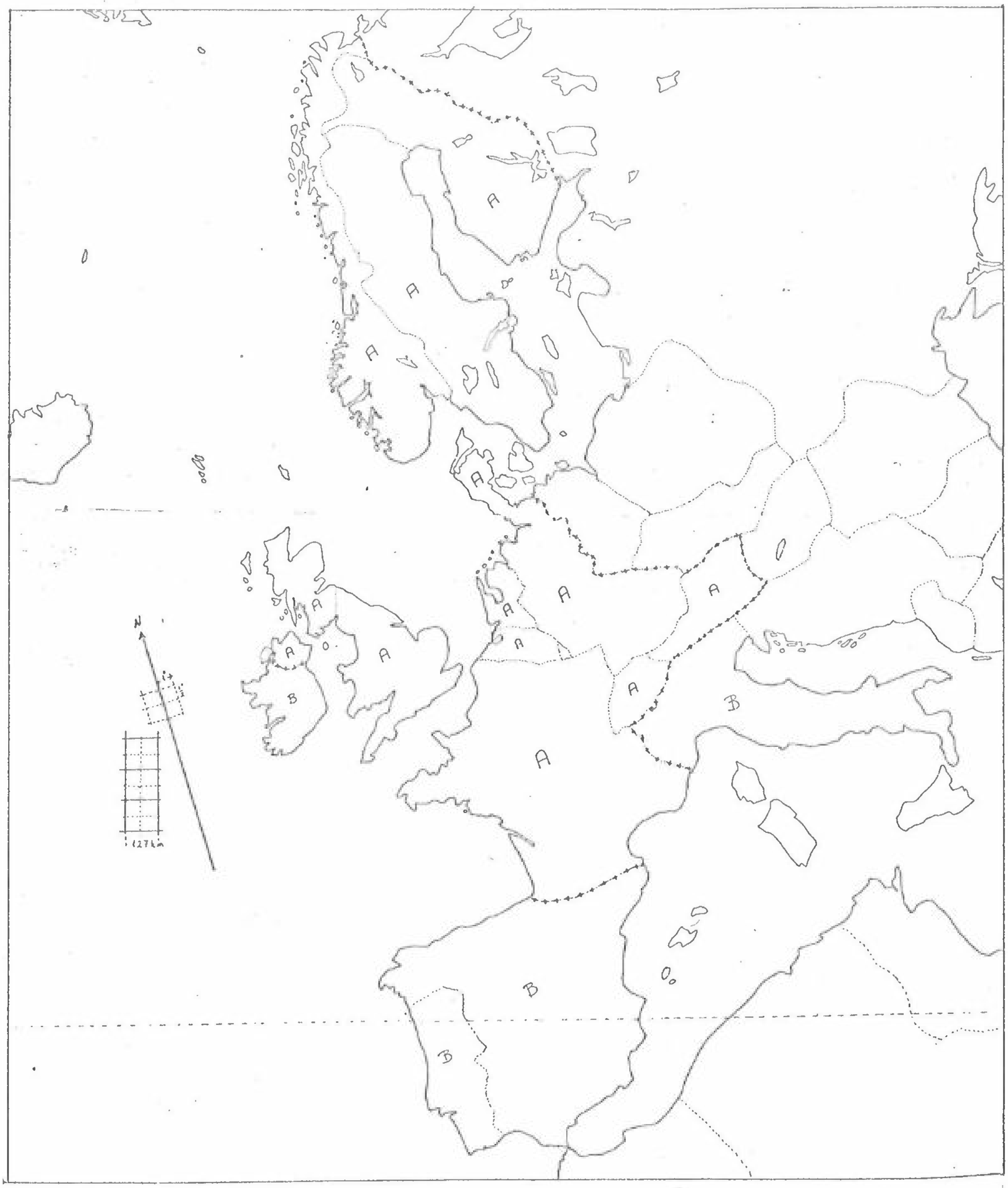

Figure 1 : Showing the region of calculation, where we have derived the emissions of SO_2 in square grid systems,

I: 37 x 32 grid elements, each 127 x 127 km^2,

II: 74 x 64 " " , each 63,5 x 63,5 km^2 at $60^{o}N$

(Squares on a sterographic conform mapping).
West of Ireland we have indicated the size of the square grid elements, and the $1^{o} \times \frac{1}{2}^{o}$ elements (see ref. 1).
For the countries marked with A, we know the emissions from ref. 1.
For the countries marked with B, we know the emissions from ref. 2.
For the Eastern European countries, emissions are derived from ref. 3.