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# Gas deposition of sulphur dioxide on the territory of the Czech Republic in 1991

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**Abstract**

In this communication detailed map of deposition of sulphur dioxide gas is presented on the territory of the Czech Republic in the year 1991. The concentration and deposition values have been calculated for a rectangular grid-size of 10x10 km. In the areas where concentration data were not available, the values have been computed by spatial interpolation based on linear statistical techniques of Kriging. The deposition velocities were estimated in accordance with the dominant land-use types assigned to 10x10 km grid squares, using a geographical information system for the grid analysis.

## 1. INTRODUCTION

The significant acidifying pollutants in the Czech Republic are sulphur dioxide, nitrogen oxides and ammonia, and their reaction products. There is no doubt about the negative influence of these acidifying components on soils, water and vegetation [1].

The Czech Republic decided in the year 1992 to participate in UN ECE program of mapping critical loads and critical levels. One of aims of the National program of critical loads is the calculation of deposition and its geographic variation by means of thematic maps. There can then be compared with critical load maps to deduce exceedance. The Ministry of Environment of the Czech Republic has delegated activity in this domain to the Environmental Monitoring Centre situated in Opava.

For estimation of gas deposition $SO_2$ on the territory of the Czech Republic distinguishing by the proportions of agricultural and forestry ecosystems, a deposition model has

been used deriving deposition fluxes from annual mean concentrations of $SO_2$ in air above the dominant land-use types (ecosystems) and from appropriate deposition velocities.

## 2. CALCULATION OF GAS DEPOSITION OF SULPHUR DIOXIDE

To define air concentrations over the grid spatial interpolation of air $SO_2$ concentration values was used with a set of 333 points irregularly dislocated on territory of the Czech Republic. Monitoring stations had been placed at these points. On the basis of daily measurements at these stations in the year 1991 the annual concentration values were calculated [2]. For the transformation from the irregular grid to the regular (square) one the spatial interpolation method used techniques of Kriging [3].

The following deposition model for the calculation of gas deposition of $SO_2$ was applied [4]:

$$DEP(SO_2)_{GAS} = C(SO_2).V_d(SO_2).F_u \qquad (1)$$

where $C(SO_2)$ represents the average annual concentration of $SO_2$ in the ground air layer ($ug.m^{-3}$), $V_d$ deposition velocity of $SO_2$ ($mm.s^{-1}$) related to mean height value $z = 1$ m above ground and $F_u = 9,855$ corresponds to transformation factor from $ug.mm.m^{-3}.s^{-1}$ to $mol_c.ha^{-1}.yr^{-1}$.

The values of deposition velocity, $V_d$, have been defined to depend on the dominant land-use types:

$V_d$ = 8 $mm.s^{-1}$ for forests
= 5 $mm.s^{-1}$ for forest-arable land
= 4 $mm.s^{-1}$ for crops and meadows
= 2 $mm.s^{-1}$ for water areas, residential and productional built-up areas, mining and devastated areas.

These deposition velocity values $V_d$ are average data selected from estimates published in the literature [5,6].

The cartographic model of land-use types was derived from the map "Land use" published in "Atlas of the environment and health of the population of the ČSFR" in scale 1:1000000 [7].

A single land use type was defined for each 10x10 km grid square according to the dominant (i.e. most prevalent) land use in that square.

## 3. RESULTS AND CONCLUSIONS

The distribution of gaseous $SO_2$ deposition values is mapped on the 10x10 km grid for all the territory of the Czech Republic (Figure 1.). The top 5% of values of gas $SO_2$ deposition (>3335 $mol_c.ha^{-1}.yr^{-1}$) is again in north-west part

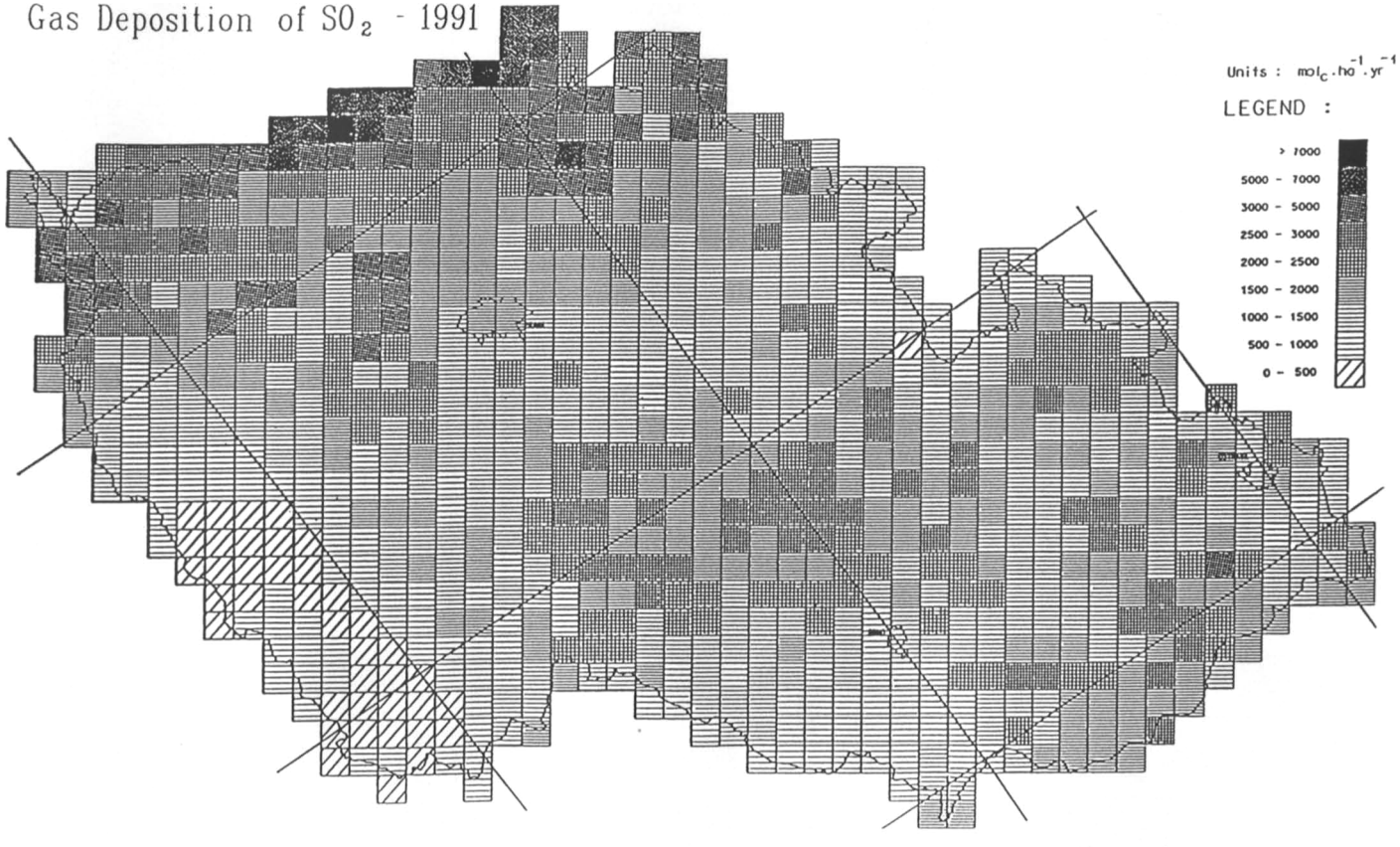


Fig. 1. Gas deposition of $SO_2$ in the Czech Republic in 1991 ($mol_c.ha^{-1}.yr^{-1}$).

of Bohemia and in certain localities of middle and east Bohemia. The 5% share of lowest values (<540 $mol_c.ha^{-1}.yr^{-1}$) are located in the region of south Bohemia and in a small area of north-east Bohemia. The annual mean value of gaseous $SO_2$ deposition in the year 1991 was 1741 $mol_c.ha^{-1}.yr^{-1}$. The range of gas $SO_2$ deposition values is 7446 $mol_c.ha^{-1}.yr^{-1}$ (min=138 $mol_c.ha^{-1}.yr^{-1}$, median=1532 $mol_c.ha^{-1}.yr^{-1}$, max=7584 $mol_c^{-1}.ha^{-1}.yr^{-1}$).

An areal distribution of gas $SO_2$ deposition on the territory of the Czech Republic is characterized by an uneven transition from the highest values in north-west region of Bohemia to the lowest values in south Bohemia and in south Moravia. Considerable variability of high deposition values is shown over all the territory.

The numeric results of the calculations have been classified into 9 categories for the purpose of the cartographic displaying. For better orientation the map is supplemented with the frontier of the Czech Republic and the EMEP grid (size 150x150 km), which is the spatial reference for the European maps used within UN ECE [8].

## 4. REFERENCES


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