EFFECT OF THE LONG-RANGE TRANSPORT ON THE AIR QUALITY OF BUDAPEST

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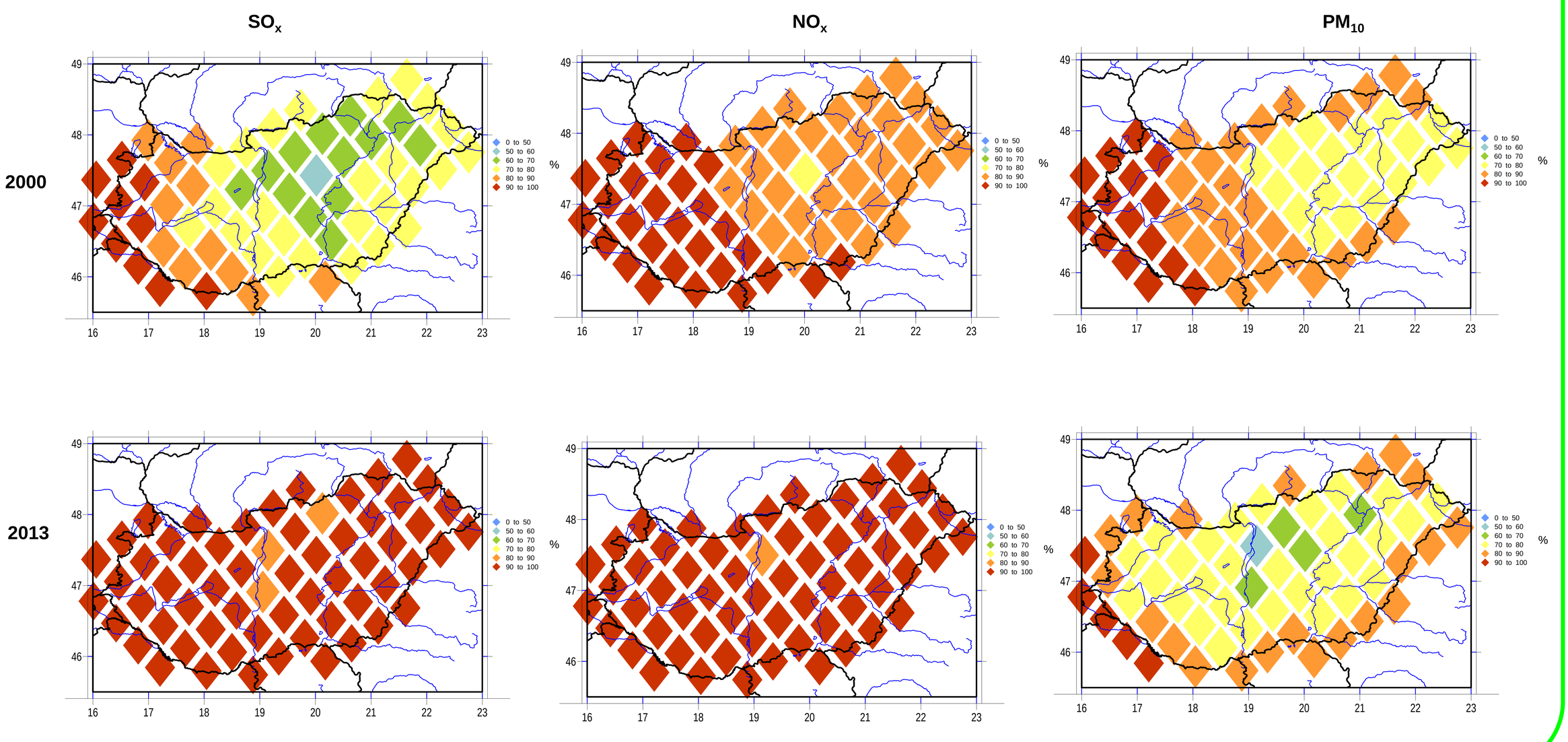
Introduction

The amount of pollutants emitted in one location and the fraction that finally reaches a certain downwind location dependents on three factors: (i) the quantity of the pollutant emitted or produced at the source, (ii) the meteorological conditions that transport the pollution from one continent to another, and (iii) the physical and chemical transformation processes that modify the quantity and composition of the pollution during transport that lasts from days to weeks. The aim of our work was determining the effect of the long range transport on the air quality of Budapest. This information could be very important when an air quality forecast system is being developed. Without these information the forecasted values of different pollutants could be underestimated. The special output of the EMEP chemical transport model was used: the yearly grid-to-grid source-receptor calculations by country for deposition of sulphur and nitrogen, and concentrations of particulate matter (PM). To evaluate the year to year temporal variability of the long range transport the model results between 2000 and 2013 were analyzed.

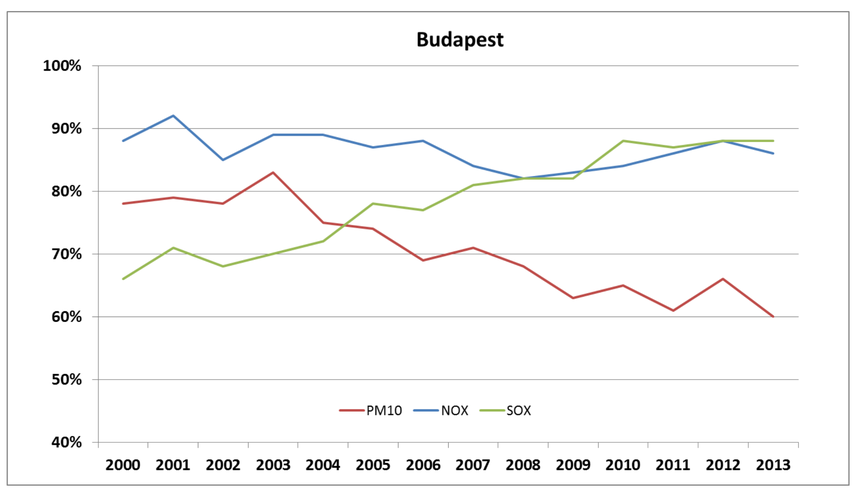
Method

Many types of air pollutants have been observed to travel far from their sources causing air quality problems. Therefore, it is very important to begin the development of chemical transport models with investigating the long-range transport of the air pollutants. A representative of these types of models is the EMEP Eulerian long-range transport model (Simpson, et al. 2012). The model is an important tool to analyze both acidification and photo-oxidant activities in the air. Determining the effect of the long range transport of different hazardous materials on the air quality of Budapest the EMEP chemical transport model was used. Applying the results of this chemical transport model only the yearly average of this effect could be analyzed. The results will show how this effect is important and how we will able to put this information into an air quality forecasting system.

Fraction of transboundary contribution to SO_x and NO_x deposition, and PM_{10} concentration in Hungary (unit %)



Fraction of transboundary contribution to SO_x and NO_x deposition and PM_{10} concentration in Budapest (unit %)



Conclusion

Considering the deposition of SO_x and NO_x the picture was changed remarkably in the last 14 years. After 2007, the deposition of oxidised sulphur and nitrogen in Hungary are determined mainly by the transboundary sources. The quantity of this effect is larger than 90%, and it is smaller only in the surrounding area of Budapest.

In case of PM_{10} the situation is somewhat different, as the effect of the long range transport shows a continuously decreasing tendency. The multiyear variation is mainly explained by changes in the PM_{10} emission of Hungary. In the years when the emission of Hungary was decreased significantly the proportion of the long-range transport increased slightly. Unfortunately, the emission of PM_{10} was not decreased in Hungary as much as it decreased in Europe.

In this work the effect of the long range transport on the air quality of Budapest and surrounding area was determined using the outputs of EMEP chemical transport model. It was determined that the effect of the transboundary sources on the air quality of Budapest is essential, its fraction is higher than 60% in all three pollutants' cases. These results are proving, that without boundary conditions calculated by a global chemical transport model, an air quality forecasting model is unable to produce realistic air quality forecasts for the area of Budapest.