
Evaluation of European anthropogenic trace gas and aerosol emissions using 4D-var: First results of a full-year re-analysis for 2016

Philipp Franke*¹, Anne Caroline Lange¹, and Hendrik Elbern²

¹Forschungszentrum Jülich – Wilhelm-Johnen Str 52425 Jülich, Germany

²Rhenish Institute for Environmental Research – Aachener Str. 209 50931 Köln, Germany

Abstract

In densely populated areas as in many parts of Central Europe, anthropogenic emissions are the key driver of air pollution. Emission inventories use yearly, reported emission data to provide estimates of spatially distributed emission maps, which include large uncertainties for several reasons: statistical data as proxy for spatial emission distribution, fixed time profiles for temporal distribution, lack of resilience to regional societal or meteorological effects (e. g. change of road transport in dependence on weather conditions). In order to analyze the emission inventory for Europe and for Germany in particular, the four dimensional variational data assimilation system of the EUROpean Air pollution Dispersion – Inverse Model (EURAD-IM) is used to validate the emission data of CO, SO_x, NO_x, NMVOC, NH₃, PM₁₀, and PM_{2.5} against ground-based and space-borne observations. The analysis has been performed for the year 2016 on 15 km (Europe) and 5 km (Central Europe) horizontal resolution. The results provide insights into the spatial and temporal distribution of anthropogenic emission corrections across Europe. Areas of large deviations between emission-driven model data and observations are identified and reasons for the large emission correction factors are discussed. Further, the results will be discussed in view of implications for emission inventories.

Keywords: 4D, var, emission optimization

*Speaker