EGU21-689, updated on 30 Jul 2021
https://doi.org/10.5194/egusphere-egu21-689
EGU General Assembly 2021

Towards polluter group specific emission corrections with 4D-Var data assimilation

Pascal Backes[1], Philipp Franke[1], Anne Caroline Lange[1], Elbern Hendrik[2], and Kiendler-Scharr Astrid[1]

[1]Institute of Energy and Climate Research – Troposphere: Forschungszentrum Jülich GmbH, IEK 8
[2]Rhenish Institute for Environmental Research at the University of Cologne (RIU)

Emission data of trace gases and aerosols are crucial for atmospheric chemistry models. Since in general emissions cannot be measured directly, they are estimated using various proxy data. Available inventories contain annual values of trace gas and aerosol emissions within given areas, and further split into polluter groups such as road traffic or industry. This separation does not take current meteorological and societal effects into account. Thus, the emission data is known to include possibly large uncertainties.

In this work, we develop a system to assess the contribution and their uncertainties of different source categories toe air pollution. As observations of pollutants cannot be directly linked to their source, the four-dimensional variational data assimilation system of the EURopean Air pollution Dispersion – Inverse Model (EURAD-IM) is extended towards a polluter source specific emission correction method. Therefore, the possibility of exploiting different spatial distributions, diurnal cycles, and chemical compositions of the polluter groups is investigated on the model domain of North Rhine-Westfalia, Germany, with 1km x 1km horizontal resolution, where emission by road traffic and industry are the dominant sources for most trace gases and aerosol. As a first approach, we rely on the assumption that pollutants of the same emission sector can be assigned to the same correction factor. From the simulations, separation criteria between different pollution sources are derived as a basis of a decision algorithm applying a random forest method. We found that this system is able to separate emissions between important polluter groups like traffic, industry, and agriculture at least in the cases of high emissions, in well observed areas and during suitable meteorological situations. This means the system performes best when assimilating observations from measurement stations leeward of emission sources and thus integrating sufficient information content to characterize the polluter.