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Evaluation of global models abilities to assess the regional and global sulfate aerosol trends, 1990-2015.

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There have been large changes in the global SO_2 emissions over the last decades, both increase and decrease, depending on region and time period in question. Since SO_2 is a precursor to aerosol sulfate, these changes have also influenced the radiative forcing of aerosols. .Previous model studies have shown that the global mean radiative forcing, due to aerosol changes over the 1990-2015 period, increased by about +0.1 Wm^{-2}, but with larger regional impacts, i.e. an increase of local radiative forcing of 3-4 Wm^{-2} in Europe. (Myhre al, 2017). The trends in the underlying aerosol concentrations calculated by aerosol models have however barely been compared with observed trends, which is needed to give confidence in both historical trends and the predicted scenarios.

In this study, we have compiled monthly average mean sulfate mass concentrations in aerosols from major regional networks. Observed seasonal and annual trends are compared to the calculated trends in six different global models for the period 1990-2015. There are large interregional differences in the sulfate trends consistently captured by both the models and observations, especially for North America and Europe. The ensemble model and observations give comparable annual reductions of sulfate in aerosols of around 5.2%/y and 2.0 %/y in Europe and North America respectively for the period 1990-2000 period. For the 2000-2015 period the ensemble model and observations agree with 3.1 %/y reduction in North America, while in Europe the ensemble model show a higher relative reduction of 3.3 %/y compared to 2.7 %/y in observations, though the absolute changes are similar (-0.025 μgS/y).

The agreement between a bottom-up approach using emissions and process-based models with independent observations gives an improved confidence in the models abilities to predict the changes in sulfate aerosols due to changes in SO_2 emission scenarios. We explore here the variability in the multi-model response to sulfur emission trends and consequences for forcing uncertainty.

Reference

Myhre, G., Aas, W., Cherian, R., Collins, W., Faluvegi, G., Flanner, M., Forster, P., Hodnebrog, Ø., Klimont, Z., Lund, M. T., Mülmenstädt, J., Lund Myhre, C., Olivié, D., Prather, M., Quaas, J., Samset, B. H., Schnell, J. L., Schulz, M., Shindell, D., Skeie, R. B., Takemura, T., and Tsyro, S.: Multi-model simulations of aerosol and ozone radiative forcing due to anthropogenic emission changes during the period 1990–2015, Atmos. Chem. Phys., 17, 2709-2720, https://doi.org/10.5194/acp-17-2709-2017, 2017.