Atmospheric Chemistry and Physics Discussions

Atmos. Chem. Phys. Discuss., referee comment RC1
https://doi.org/10.5194/acp-2021-748-RC1, 2021

Comment on acp-2021-748

Rachel Shelley (Referee)

Referee comment on "Iron from coal combustion particles dissolves much faster than mineral dust under simulated atmospheric acidic conditions" by Clarissa Baldo et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-748-RC1, 2021

The manuscript by Baldo et al., 'Iron from coal combustion particles dissolves much faster than mineral dust under simulated atmospheric acid conditions', presents data from a study to investigate the dissolution of Fe from coal fly ashes (CFAs) and a Saharan dust end member analogue under the low pH of deliquescent aerosols. They use their experimental data to improve the Fe solubility scheme in the IMPACT model. The manuscript is well written and easy to follow, although I suggest that they move their data plots from the SI into the main body for ease of reading. I would also like the authors to be clearer about why they chose a timescale of 168 h for their experiments. It seems on the long side for a deliquescent aerosol.

The authors highlight the fact that CFAs are a heterogeneous class of particles that are emitted to the atmosphere. However, by employing a novel three-reaction rate scheme they are able to significantly improve on the prediction of Fe solubility from combustion aerosols. They link the differences in Fe solubility to the speciation of Fe in the CFAs and a Saharan dust end-member and provide details of how they have used their experimental data to improve the IMPACT model, which they test by comparing model outputs with field observations from the Bay of Bengal.

This study demonstrates that their new scheme can reproduce the results of field observations more accurately that the previous scheme employed in the model. As awareness grows that mineral dust is not the only source of Fe to the open ocean, it is vital that models are able to parameterise Fe solubility from other atmospheric particles which are deposited to the remote ocean, such as coal and oil fly ashes and biomass burning, in order to improve their predictive capacities. This is particularly important in the context of changing atmospheric acidity and changes to the relative proportions of industrial and natural emissions to the atmosphere and the impact that this will have on the input bioaccessable Fe.

My specific comments can be found in the attached pdf.

Please also note the supplement to this comment:
https://acp.copernicus.org/preprints/acp-2021-748/acp-2021-748-RC1-supplement.pdf