Atmospheric dissolved iron (Fe) from coal combustion particles

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https://doi.org/10.5194/acp-22-6045-2022

EGU General Assembly 2022

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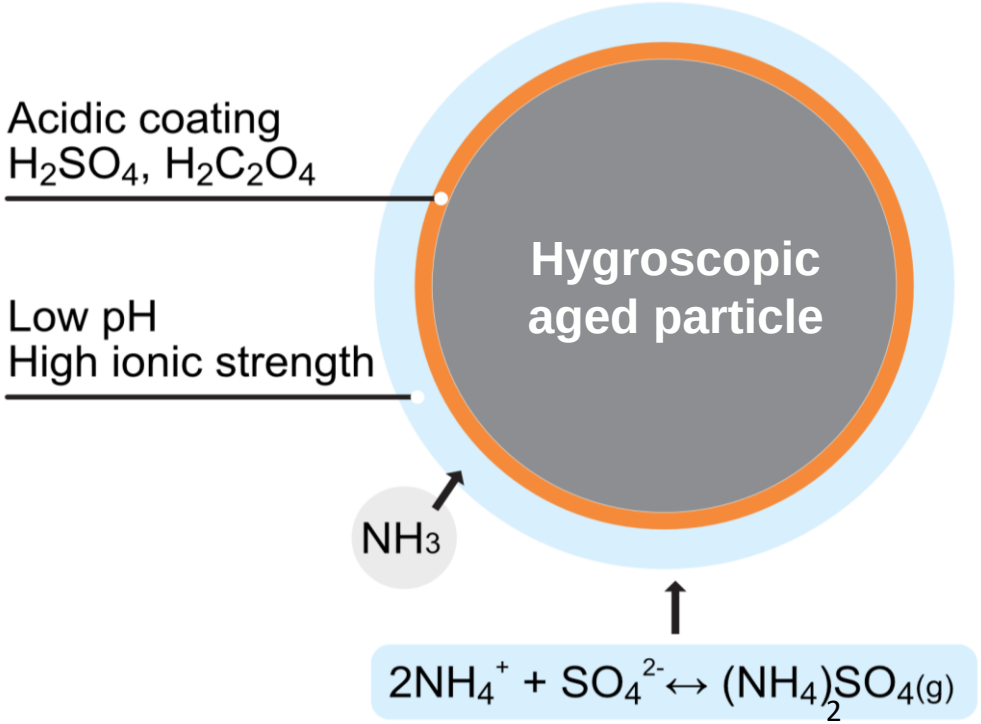
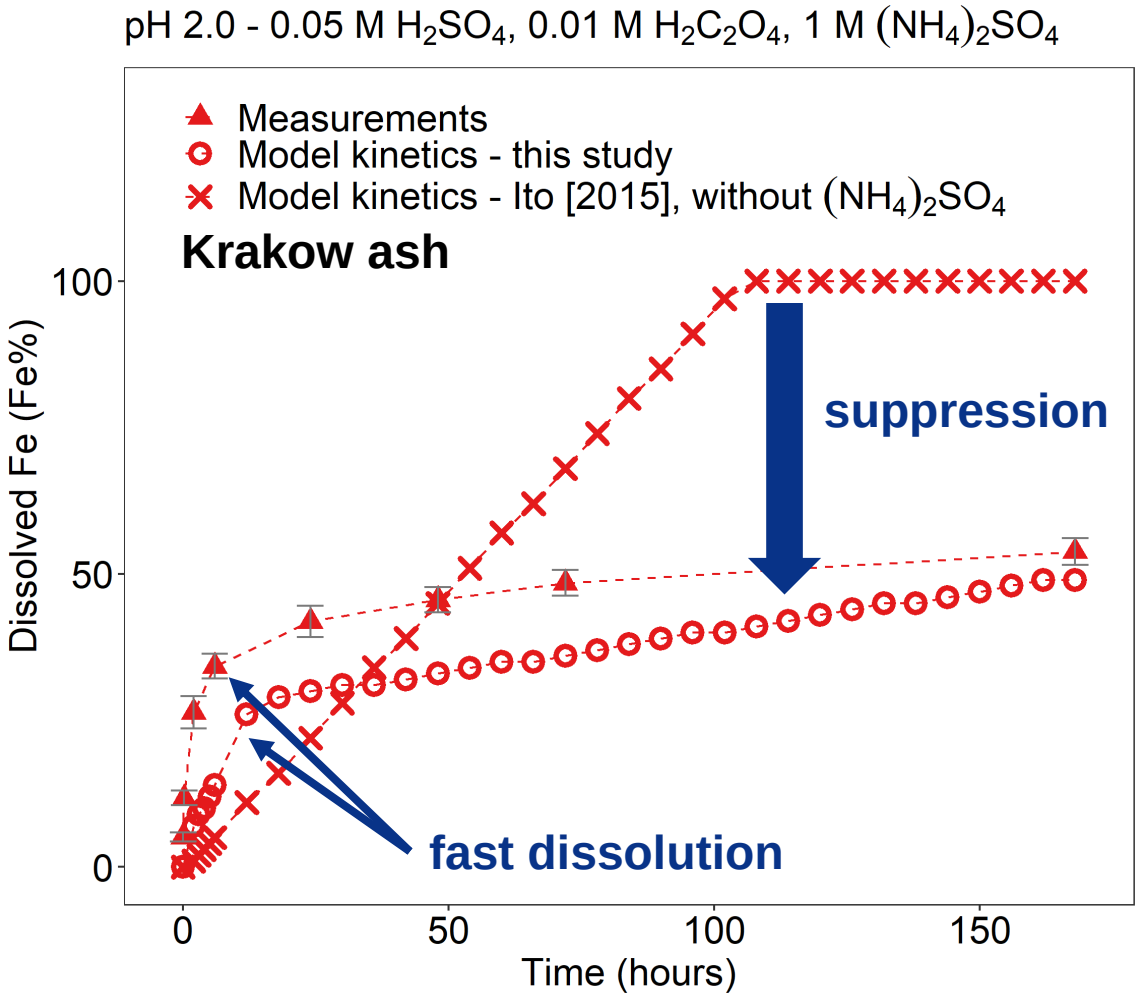
Atmospheric processing of coal fly ash (CFA)

- During long-range transport, atmospheric processing of CFA favours the transformation of insoluble Fe into dissolved Fe
- Here, we investigated the effect of high ammonium sulphate concentrations on the proton-promoted and oxalate-promoted Fe dissolution at low pH conditions

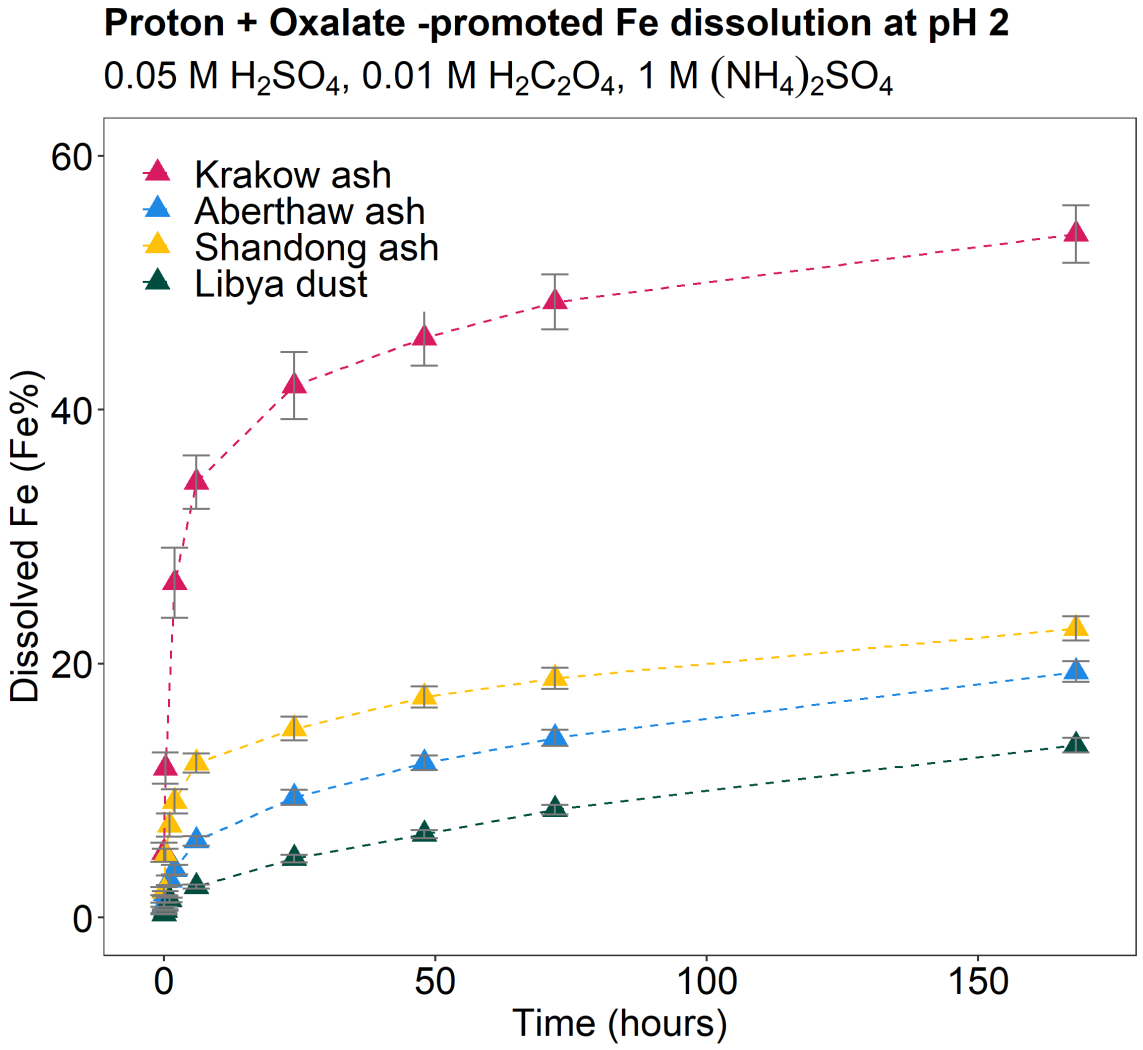


Proton + Oxalate -promoted Fe dissolution in CFA

At low pH (<3), high ionic strength in aerosol water affects the Fe dissolution kinetics of CFA particles

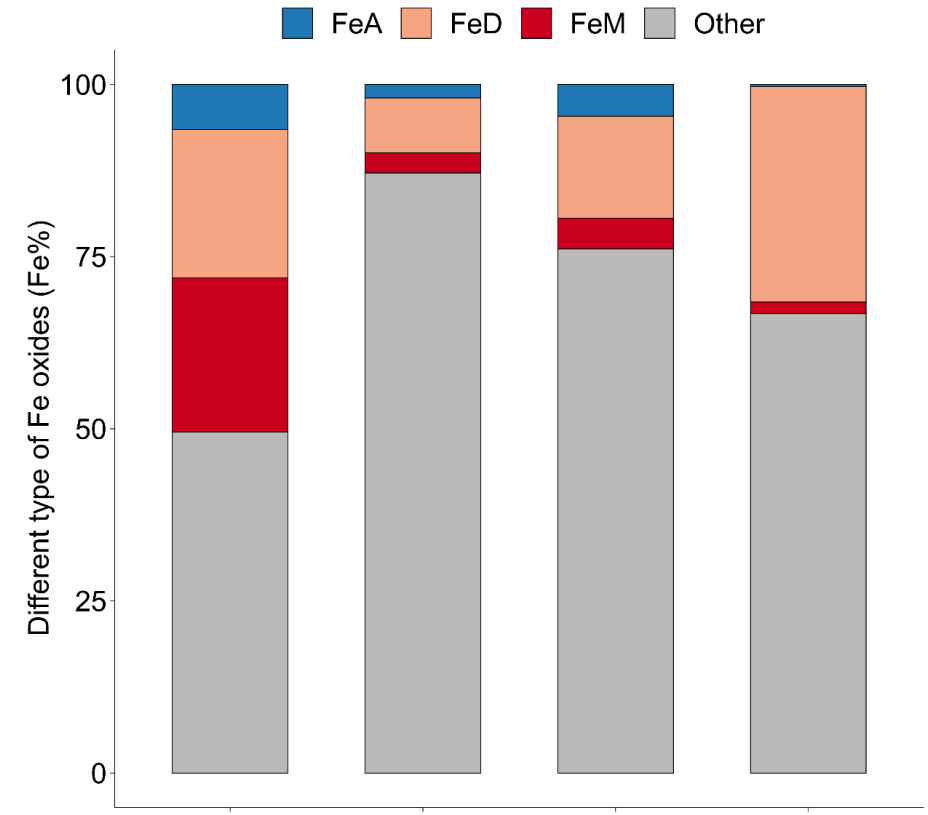


- Fe dissolution depends on the type of CFA
- CFA dissolves faster (<7 times) than Saharan dust



Fe speciation in CFA

- Fe speciation varied significantly in different CFA
- CFA showed higher FeA (highly reactive) and FeM compared to Saharan dust



FeT (wt%)	5.2	3.1	1.6	3.1

FeA: amorphous Fe

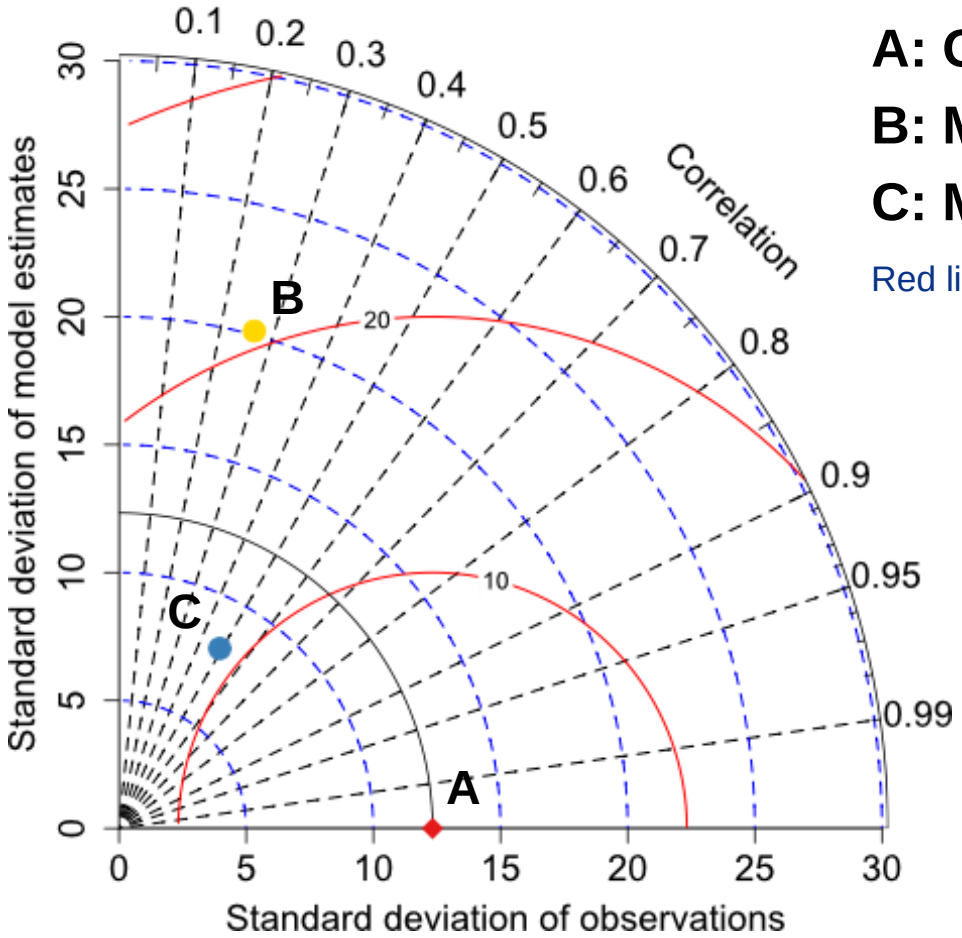
FeD: goethite+hematite

FeM: magnetite Fe

Fe speciation from sequential extraction of Fe

Updated Fe dissolution scheme

The IMPACT model with the updated Fe dissolution rates (**C**) shows better agreement with observations of Fe solubility in aerosol particles over the Bay of Bengal (**A**)



A: Observations [Bikkina et al., 2020]

B: Model kinetics Ito [2015]

C: Model kinetics Baldo et al. [2022]

Red lines in the Taylor diagram indicate RMSE

Summary

- At low pH (<3), high ionic strength in aerosol water enhanced proton-promoted Fe dissolution in CFA but suppressed oxalate-promoted dissolution
- Fe dissolution depends on the type of CFA
- CFA dissolves faster (<7 times) than Saharan dust
- CFA showed higher highly reactive Fe and magnetite compared to Saharan dust
- The IMPACT model with the updated dissolution rates shows a better agreement with observations of Fe solubility in aerosols over the Bay of Bengal

Thanks, any questions?

Baldo et al. (2021):

https://doi.org/10.5194/acp-22-6045-2022

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