

Atmospheric and Marine Controls on Aerosol Iron Solubility and Bioavailability in Seawater

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Acknowledgments

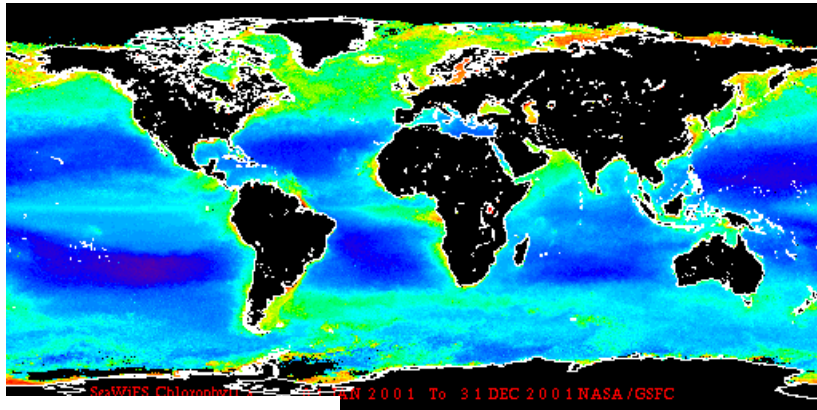
Tim Jickells, Mel Witt, Tim Lesworth, Matthieu Waeles, Karabi Biswas, Claire Powell, Rosie Chance, Chan Yodle

Hermann Bange, Rhiannon Mather, Simon Ussher, Peter Croot

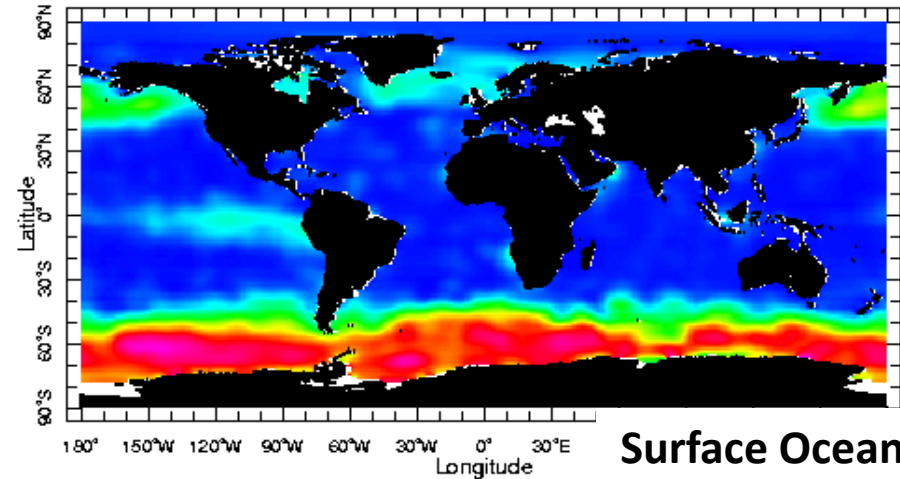
NERC and the EU



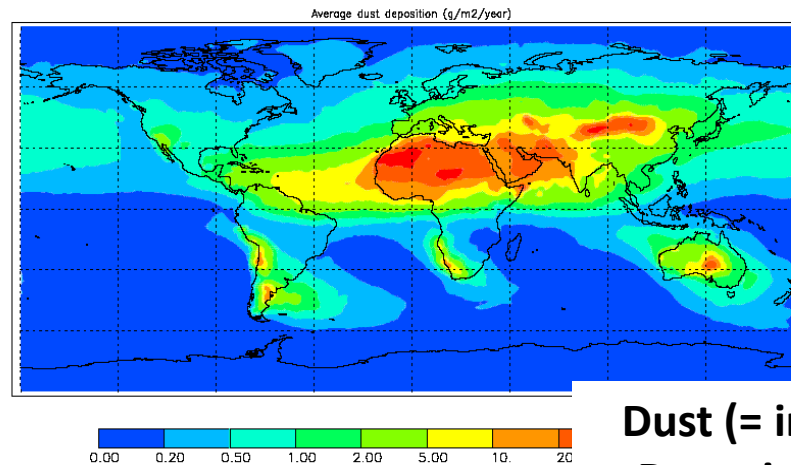
The biogeochemical impact of atmospheric iron input to the ocean does not scale linearly to the magnitude of total Fe input



**Surface Ocean
Chlorophyll**

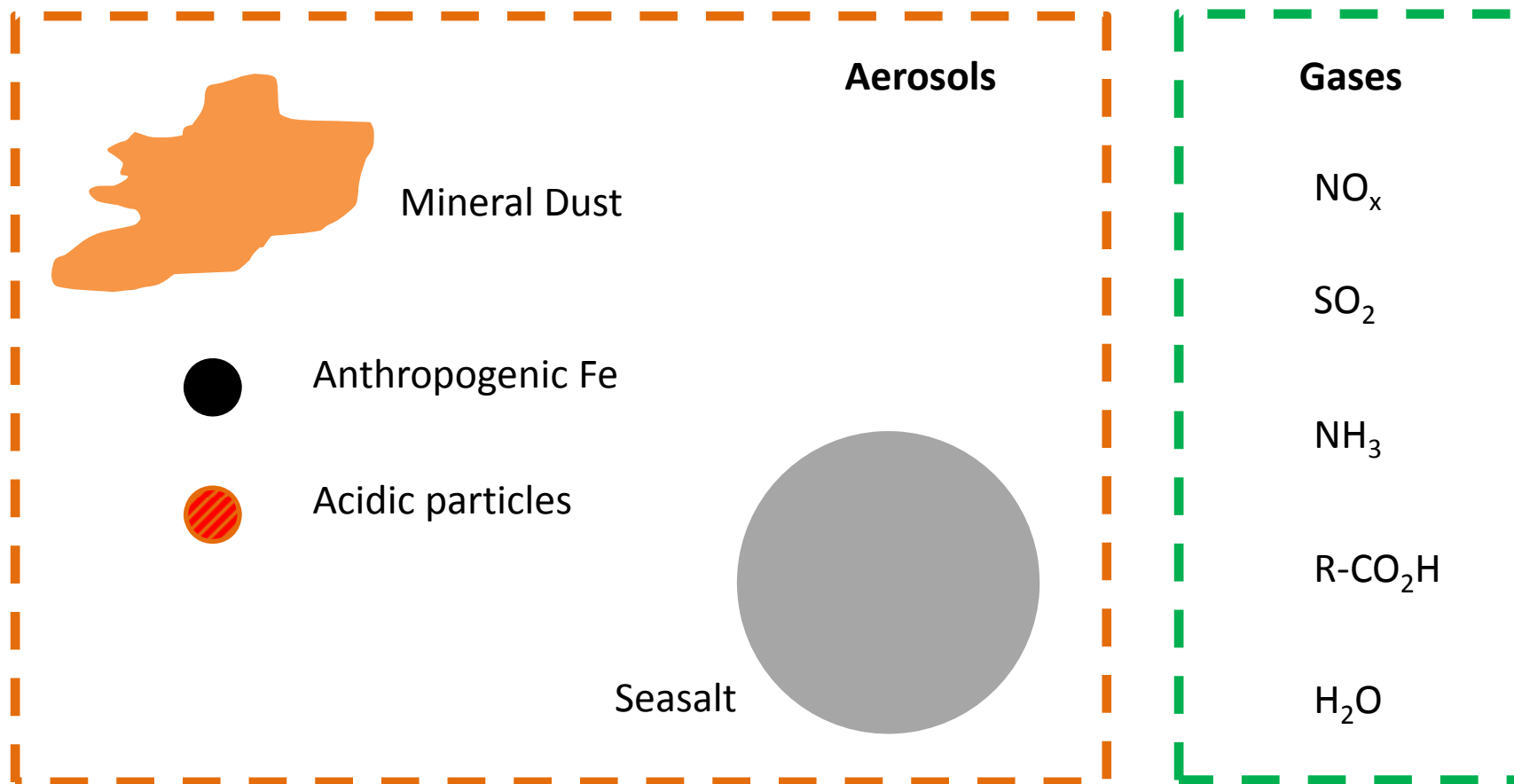


**Surface Ocean
Nitrate**

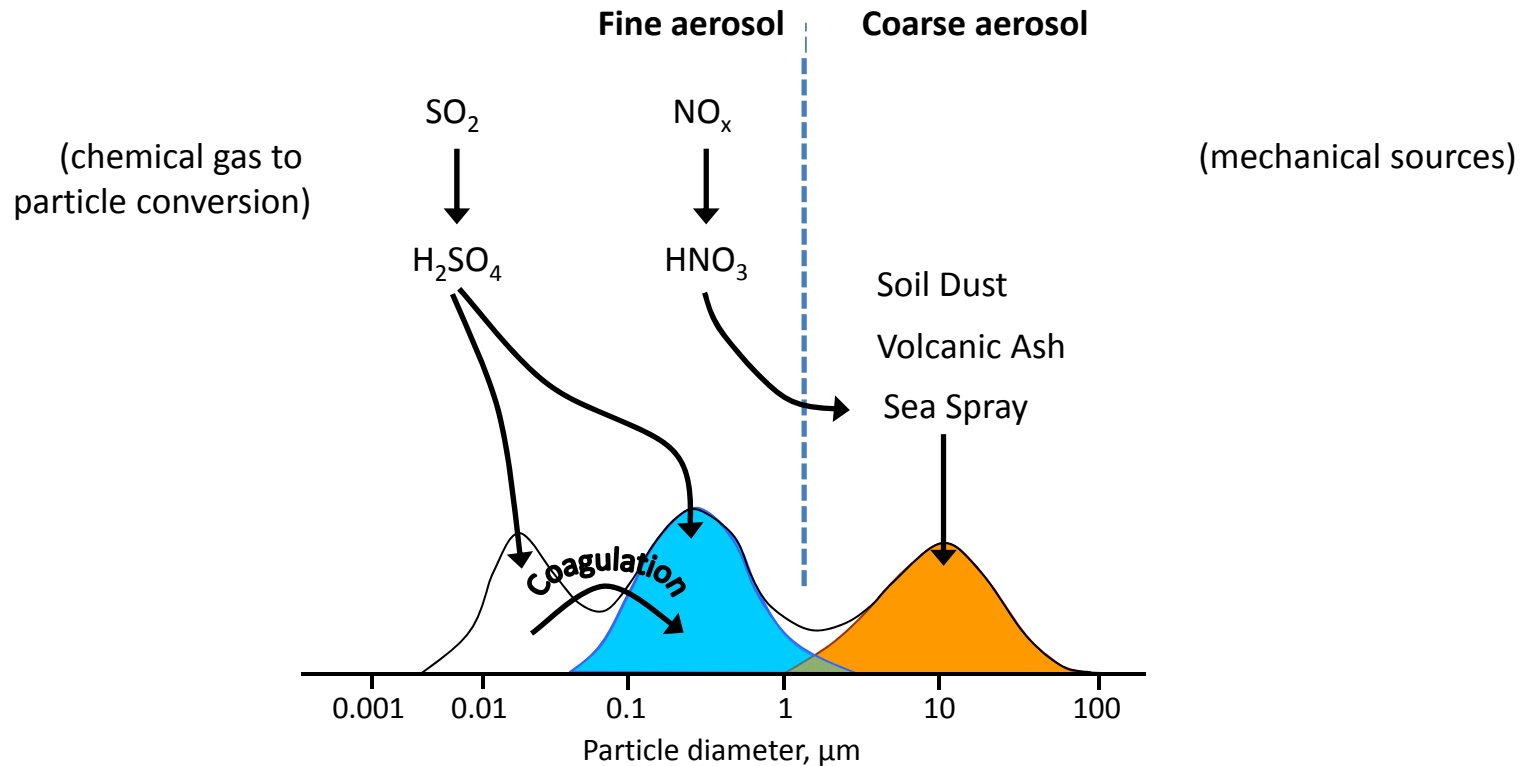


**Dust (= iron)
Deposition**

A (cartoon) cast of characters:

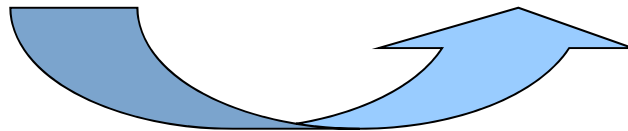
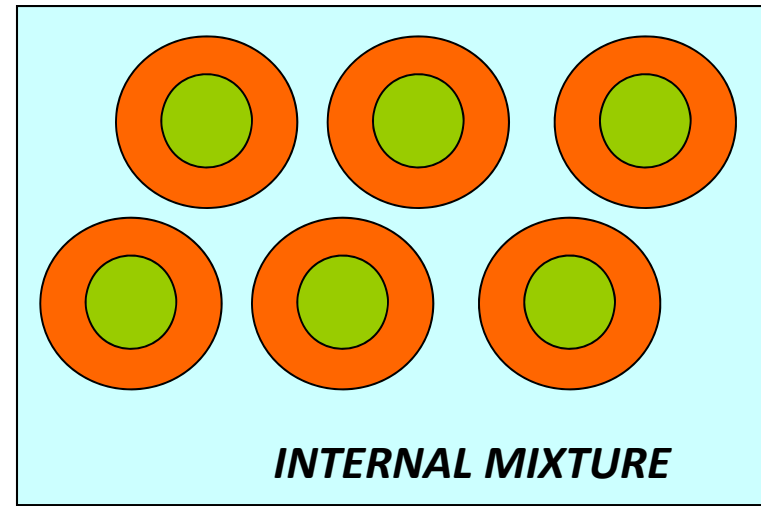
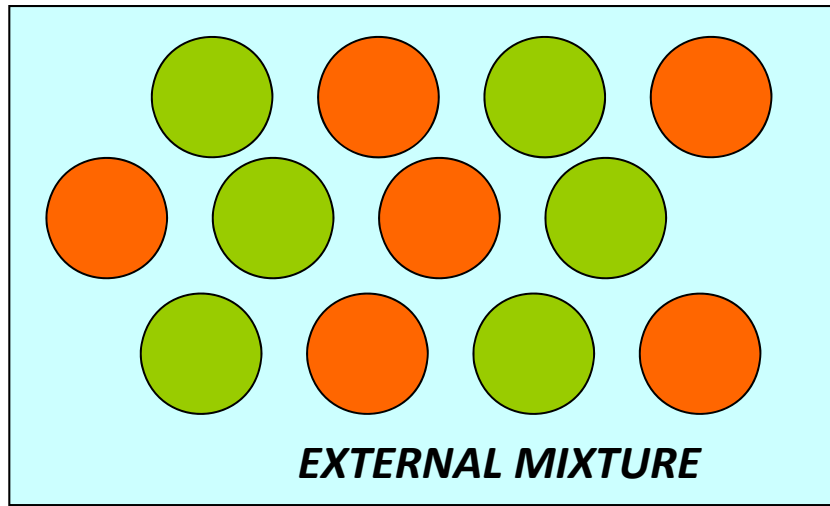


What size are these particles?

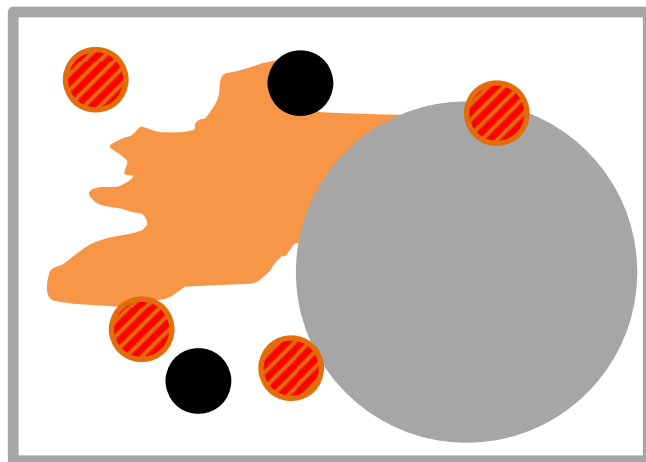


Idealised schematic of the distribution of particle surface area.

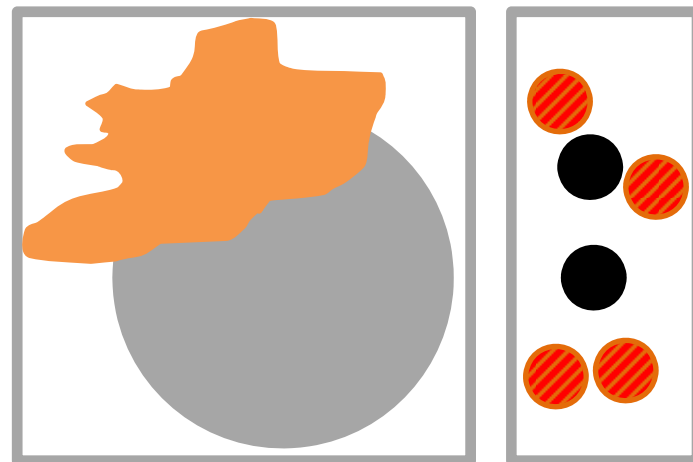
Aerosol mixing state



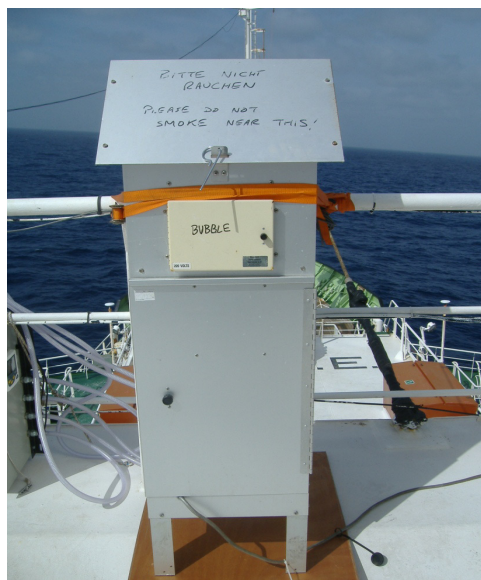
Aerosol sampling limitations



Simple filtration



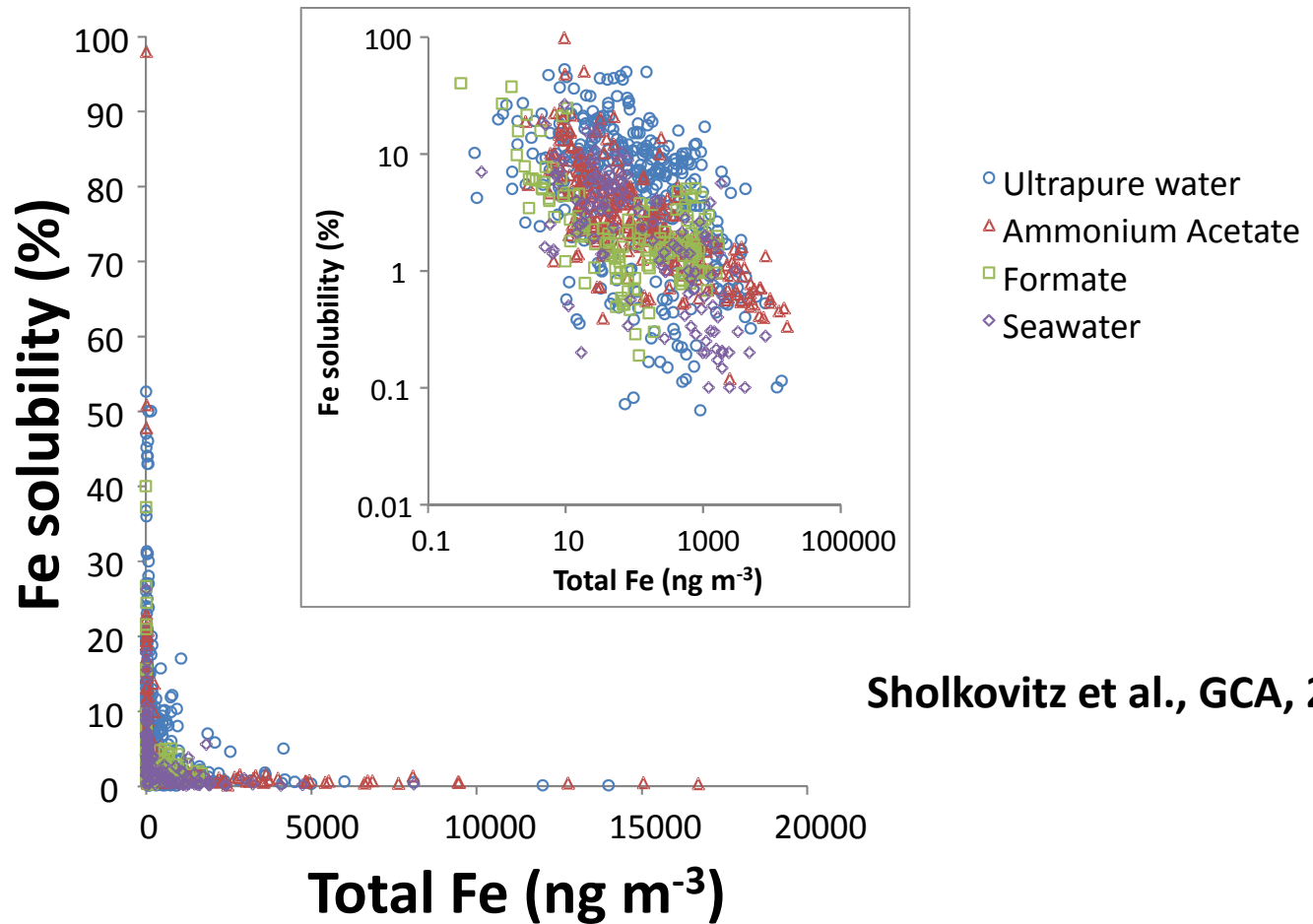
Size separation



What do we know about iron solubility in aerosol?

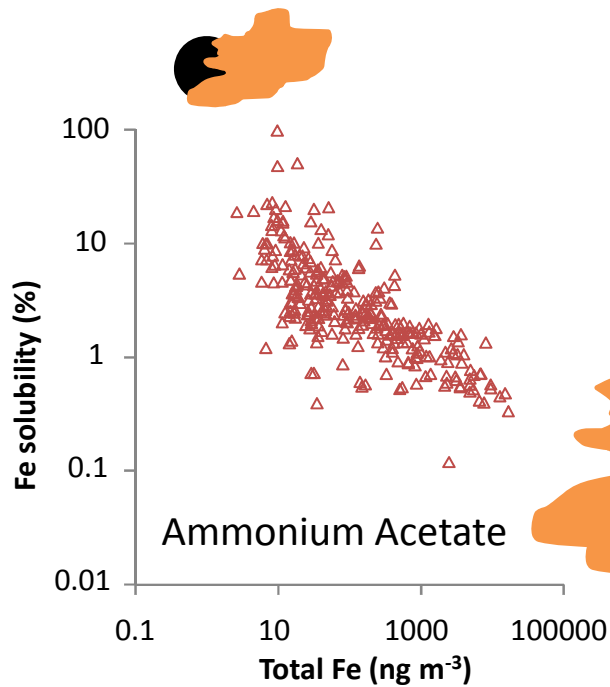
- 1. Fe solubility in dust aerosol is higher than in soil.**
- 2. Fe solubility increases during transport through the atmosphere.**

Solubility increase during transport

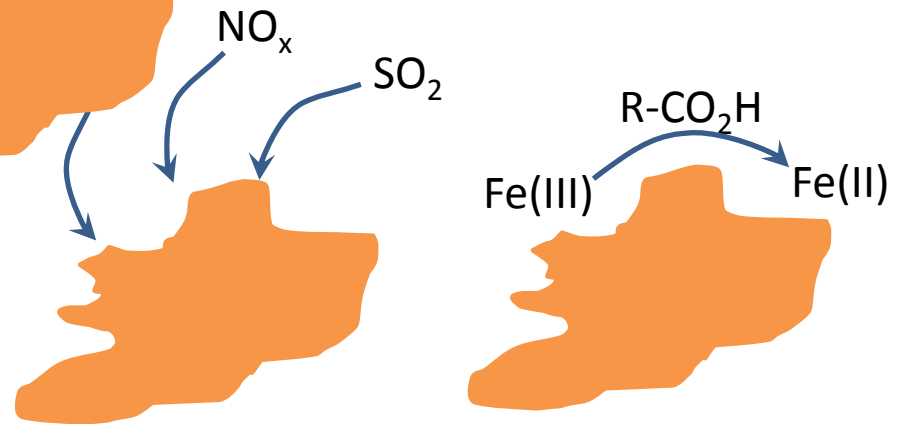


Sholkovitz et al., GCA, 2012

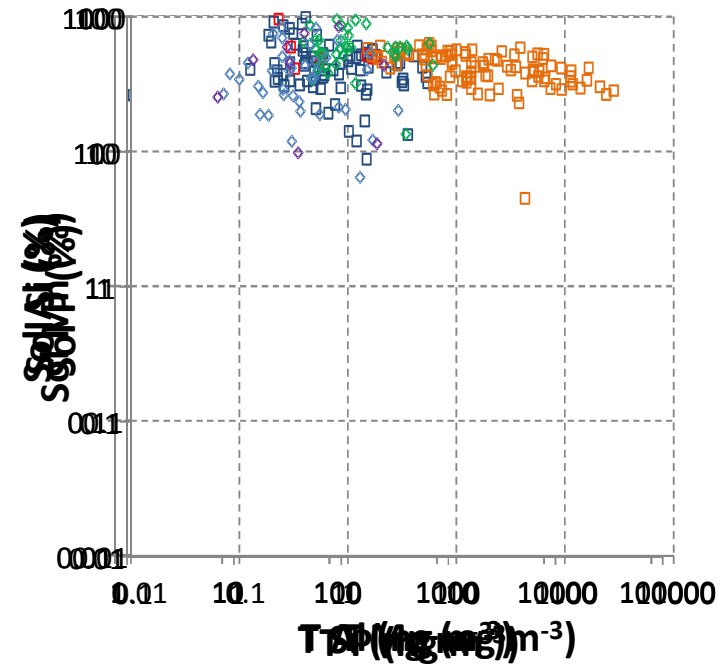
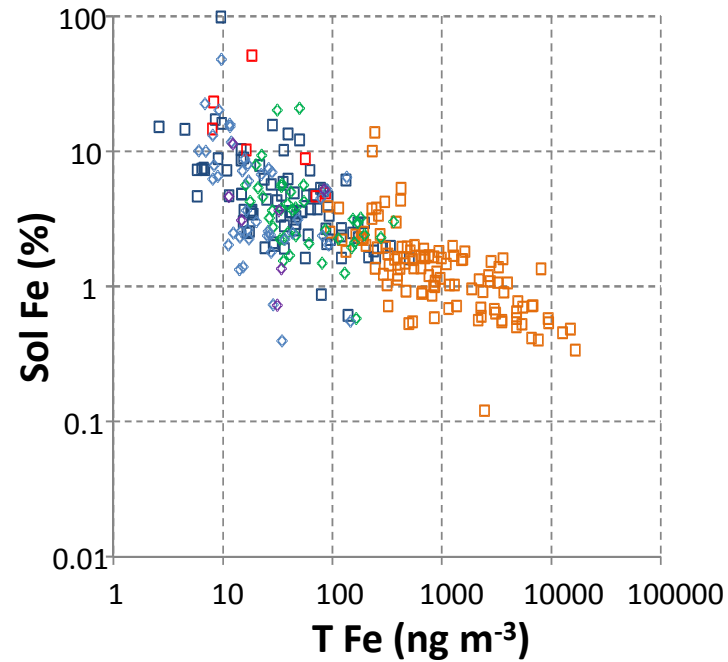
What causes this change in Fe solubility?



- Acid processing
- Mixing of dust with anthropogenic Fe
- Decreasing particle size / changing mineralogy
- Redox chemistry

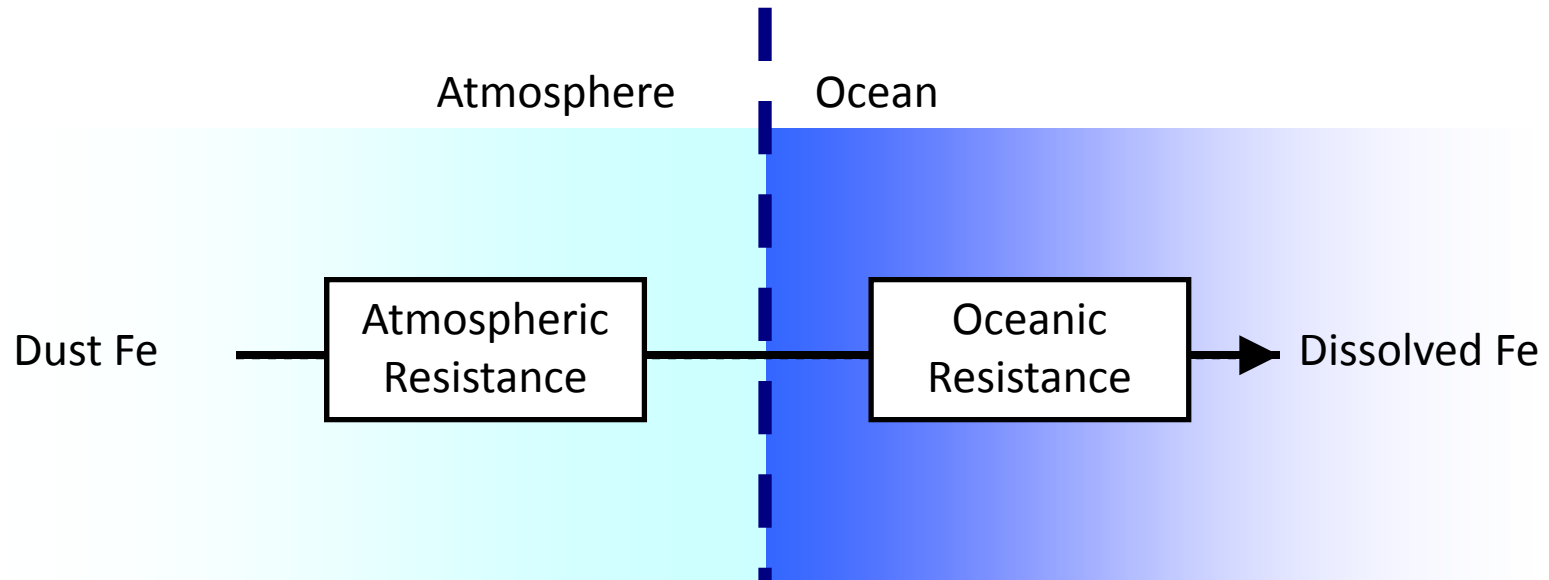


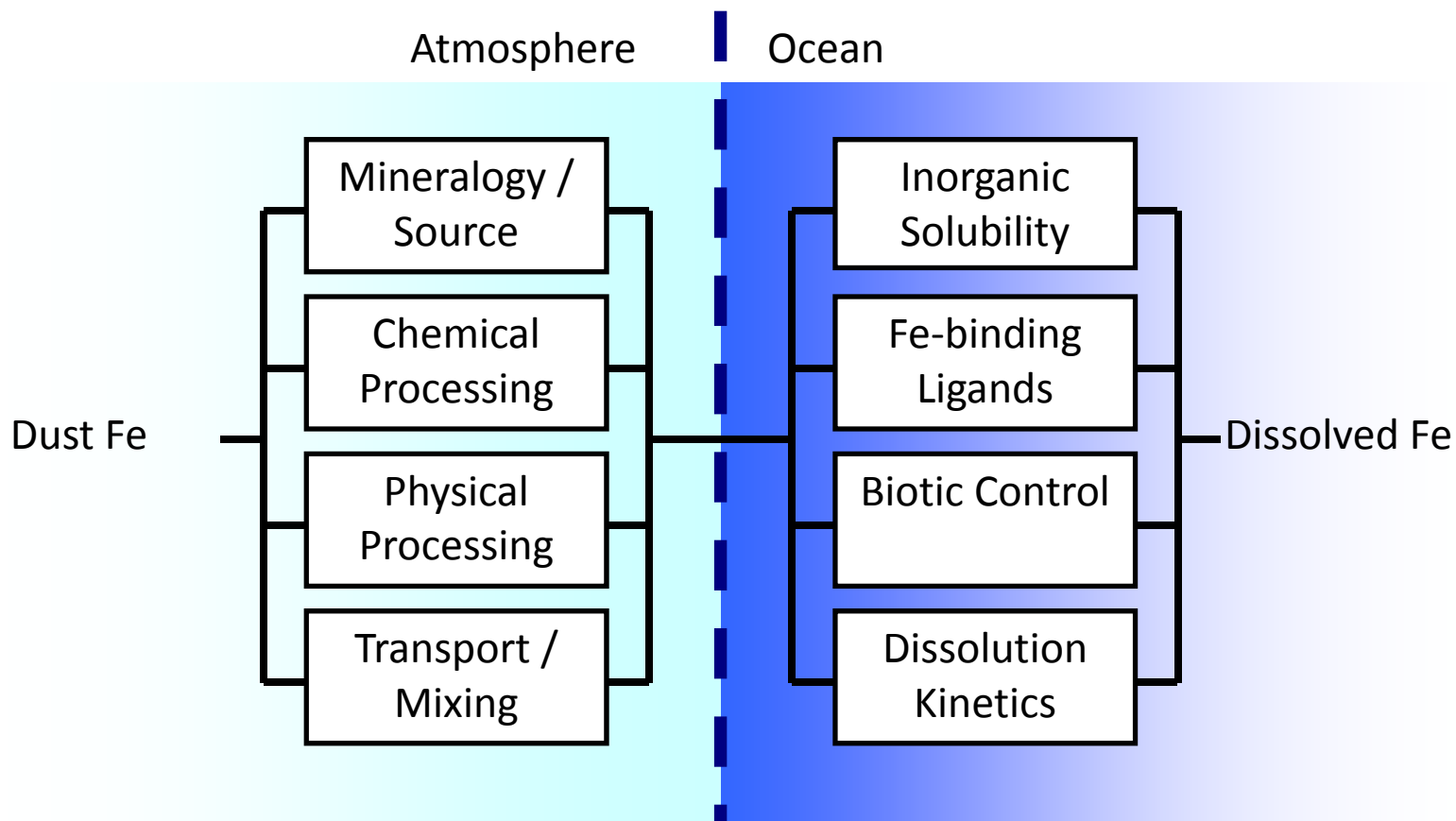
Can we identify the controlling process(es)?



Is there a “simple” way to conceptualise iron solubility?

Electrical resistance as a metaphor for aerosol iron dissolution:





Conclusions / Questions

Fe solubility in aerosol is influenced by several complex processes in the atmosphere. Should we care?

Is organic complexation of Fe in seawater the globally dominant control on aerosol Fe solubility and bioavailability?

Fe is the most “important” marine micronutrient, but it isn’t the only one. Also studying other trace metals makes a lot of sense.

