Ocean – Atmosphere – Land Impacts on Tropical Atlantic Ecosystems TRACES

TRACES is part of the "Pakt für Forschung" of the Leibniz Association as a joint research network project. Participating Institutes are the Leibniz-Institute of Marine Science (IFM-GEOMAR) as coordinating partner, the Leibniz-Institute for Tropospheric Research (IfT), the Baltic Sea Research Institute Warnemünde (IOW) and the Potsdam Institute for Climate Impact Research (PIK).

Foci of the research network project TRACES are the interactions between land, ocean and atmosphere in the region of the tropical Atlantic.
Land, ocean and atmosphere are connected by various interactions, and each interaction itself influences the Earth's ecosystem. In context of TRACES, an interdisciplinary collaboration of the participating institutes will investigate the anthropogenic and biogenic impacts on these ecosystems, their connections and their feedbacks.

Involved institutes and their research topics in the context of TRACES

IfM-Geomar: Lifetime of Fe(II) in tropical sea water

IOW: Role of nitrogen fixing cyanobacteria in marine ecosystems

PIK: Amazonian climate change - carbon fluxes from land to ocean

IfT: **-** Characterizing Saharan dust transport towards the tropical Atlantic (Modeling Department)
- Photochemistry of iron complexes (Chemistry Department)

Characterizing Saharan dust export towards the tropical Atlantic by Meteosat retrievals and regional modeling

In collaboration with the IFM-GEOMAR, the work in context of TRACES at the IfT focuses on characterizing Saharan dust transport towards the tropical Atlantic region. Saharan dust affects the climate system by influencing the oceanic ecosystem. Micronutrients transported by dust (in particular iron) fertilize the marine biota and support nitrogen fixation in tropical ocean regions. Furthermore, atmospheric processes can change chemical properties, which control dust–ocean ecosystem interactions. For estimating effects of oceanic deposition of mineral dust on the climate system, detailed information about dust emission, atmospheric transport processes and the distribution of dust deposition is needed.
Model studies with the regional dust emission, transport and deposition model LM-MUSCAT are carried out to determine the spatio-temporal distribution of dust emission and deposition over the Saharan, Sahelian and the tropical Atlantic regions as well as atmospheric transport processes for typical meteorological conditions at different times of the year. Additionally, the atmospheric dust distribution is investigated by METEOSAT-8 (MSG) remote sensing data.

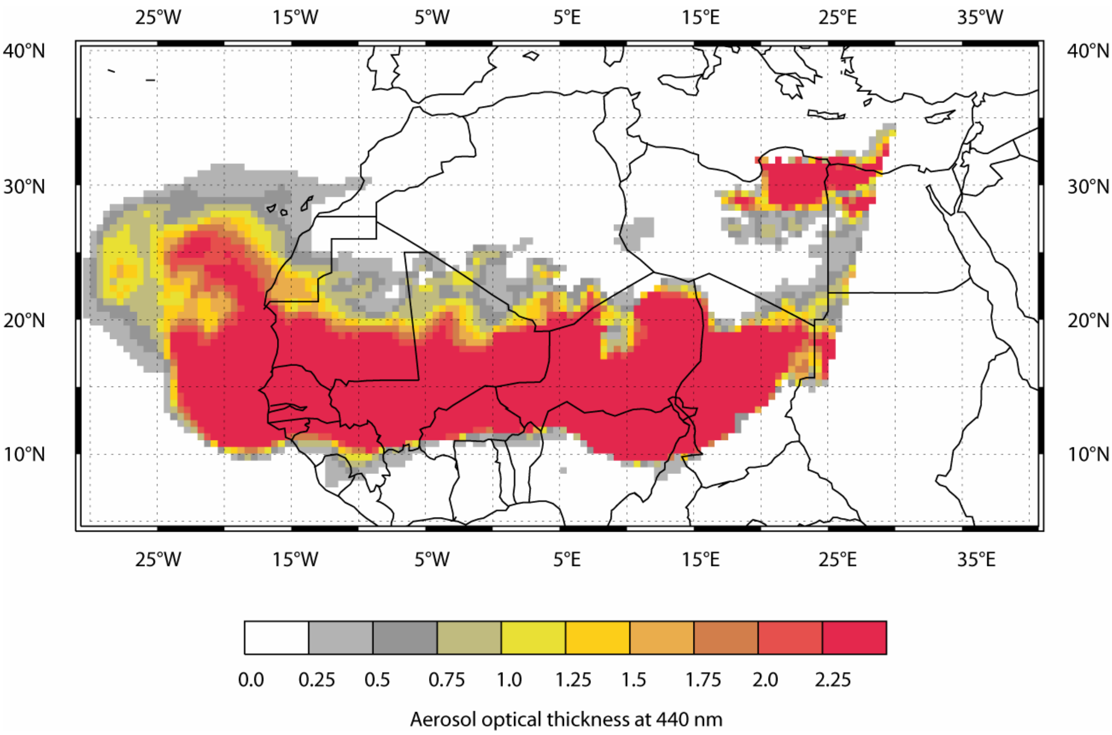
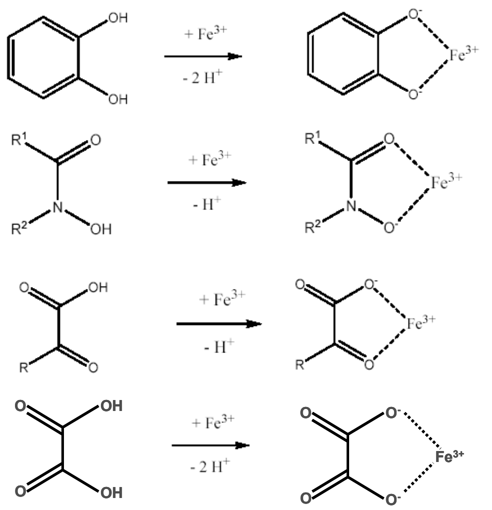


Figure 1: Saharan dust transport towards the tropical Atlantic: modeled aerosol optical thickness at 440 nm, 2006-03-08, 12:00 UTC

Photochemistry of Fe(II) and Fe(II)-complexes in aqueous solution in atmospheric and oceanic systems: radical-quantum yields and organic products

The study aims at clarifying the fate of important organics and iron at the sea-atmosphere interface and in marine aerosol and clouds. Photolysis of iron-complexes with UV-radiation initiates radical production in the atmospheric liquid phase and in the surface ocean. It plays an important role in the redox-cycling of iron and the availability of iron as a phytoplankton nutrient. Model ligands in the categories polycarboxylates, keto-carboxylates, hydroxymates and catecholates (see Fig.2) were chosen for Fe-complexation to measure their radical quantum yields and organic products in laboratory experiments.



Catecholate (Catechol)

Hydroxymate (Hydroxyurea)

Keto-carboxylate (2-ketoglutaric acid)

Polycarboxylate (Oxalic acid)

Fig. 2 Model ligand structures for iron (III)-complexation

Extinction coefficients of the organic-iron complexes will be measured for each model ligand in the UV-Vis range. The experiments will be performed with excimer laser single wavelength photolysis. Different radical species and peroxyradicals will be formed depending on the nature of the ligand. Probe compounds are planned to be used as scavengers to form easily detectable species which will be measured with a long path absorption set-up. Peroxyradicals are planned to be detected spectrophotometrically. There is also the option to measure the kinetics of radical reactions such as •OH and halogen containing radicals with potentially important organic compounds. The measured parameters will be used in modelling studies.