Project: **909**

Project title: **Learning on cloud brightening under risk and uncertainty: Whether, when and how to do a field experiment (LEAC)**

Project lead: **Johannes Quaas**

Report period: **1.1.2014 - 31.12.2015**

The project aims at an assessment of the radiative forcing, side impacts and options to learn about especially the geoenineering scheme by spraying marine boundary-layer clouds with sea salt.

In the report period, we assessed the possible side-effects comparing two different geo-engineering schemes, namely increase in stratospheric aerosol, and spraying marine boundary-layer clouds, with respect to extreme values (Aswathy et al., 2015).

A main result is shown in Fig.1, namely, that, according to the model simulations, broadly the two tested geoengineering schemes mitigate the projected climate warming for the 2040-2069 period, except for the Northern hemisphere high latitudes. The new result in particular is that the upper extreme (90^{th} percentile of the temperature distribution) is mitigated to a similar degree as the mean, or even better than the mean – which is expected since the two geoengineering schemes act in the solar spectrum and are particularly effective in polar day. In turn, the lower extreme (10^{th} percentile of the temperature distribution) is less well mitigated than the mean, particularly since the two geoengineering schemes are not effective during polar night.

Early results for the detectability and optimisation of the signal-to-noise ratio for a possible field campaign indicate that the seeding intensity needs to at least double the cloud droplet number concentrations in the marine clouds unless a very large domain is chosen.

References

*Aswathy, V. N., O. Boucher, M. Quaas, U. Niemeier, H. Muri, J. Mülmenstädt, and **J. Quaas**, Climate extremes in multi-model simulations of stratospheric aerosol- and marine cloud brightening climate engineering, Atmos. Chem. Phys., 15, 9593-9610, doi:10.5194/acp-15-9593-2015, 2015.*

Figures

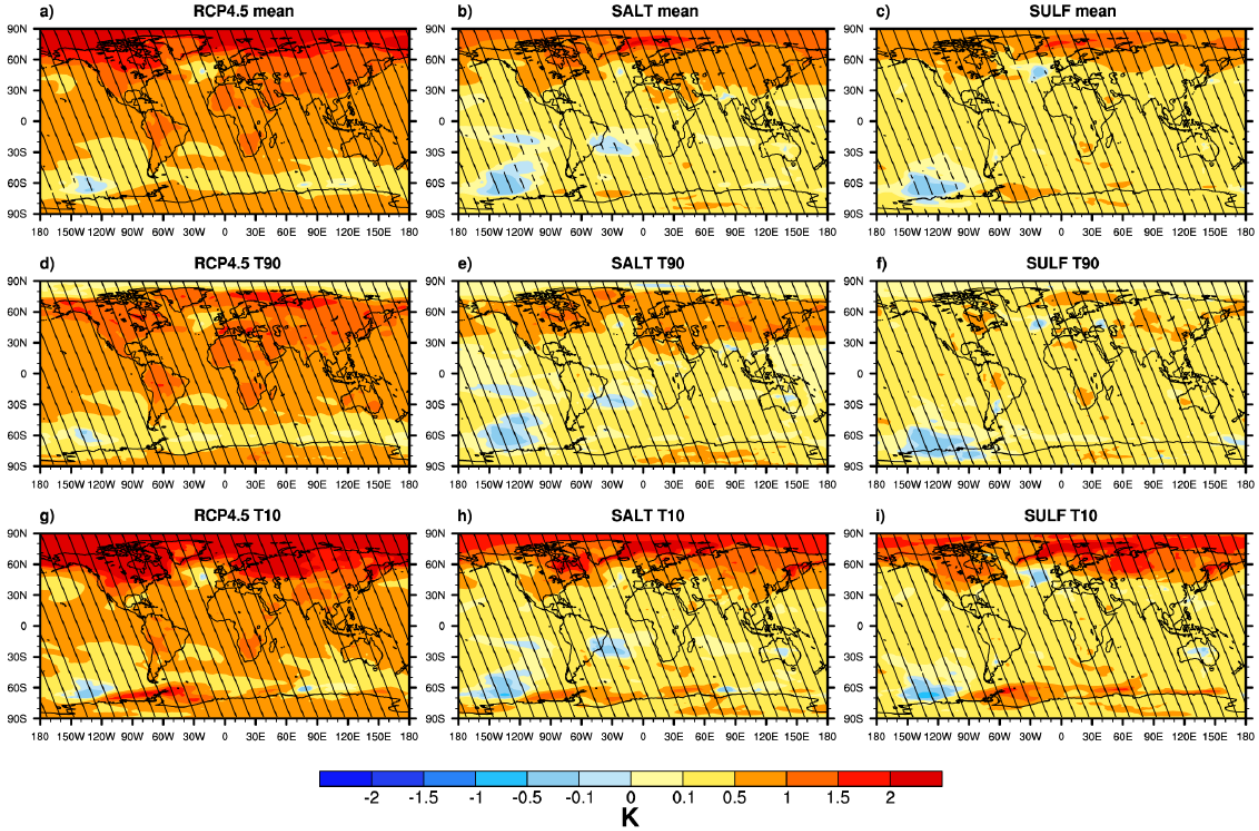

Fig. 1: Mean change in near-surface temperature (K) for the IPCC RCP4.5 future scenario (left column), spraying marine boundary-layer clouds with sea salt in the Tropics (middle) and increasing stratospheric sulfate aerosol concentrations globally (right column) for 2040–2069 minus the RCP4.5 control period (CTL; 2006–2035). Panels (a) to (c) denote changes in mean values, (d) to (f) same as (a) to(c) but for the 90th percentile of the temporal distribution for monthly-mean values, and (g) to (i) same as (a) to (c) but for the 10th percentile of the temporal distribution at each model grid point. Hatches denote regions where the changes are 95 % statistically significant.(From Aswathy et al., 2015).