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: **1.1.2019 – 31.12.2019**

In the reporting period, with a very idealized setup, the efficacy and risks of climate engineering (CE) at a local scale in space and time have been investigated using MPI-ESM (Giorgetta et al., 2013) along with a six-member ensemble simulations, which assumes that regional radiation management (RRM) via cloud modification is technically possible. The implemented RRM (Quaas et al., 2016) resulted in a net local radiative forcing and a local cooling over the targeted region. However, substantial climate impacts are also simulated outside the target area, with Arctic warming and pronounced precipitation change in the western Pacific (Dipu et al., revised). Also, the RRM simulation is extended to other regions in northern and the southern hemisphere (Manuscript is under preparation).
The ensemble analysis shows the teleconnection between local RRM cooling over the United States and pronounced precipitation change in the western Pacific along with warming in the Arctic region (Fig. 1).
The work also led to a Bachelors thesis (Kraulich, 2019).

References

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Kraulich, F., Impact of Regional Climate Engineering on Global Circulation, Bachelorarbeit, Institute for Meteorology, University of Leipzig, 32 pp., available at http://research.uni-leipzig.de/climate/kraulich_florian__bachelorarbeit__2019.pdf, 2019.

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Figures

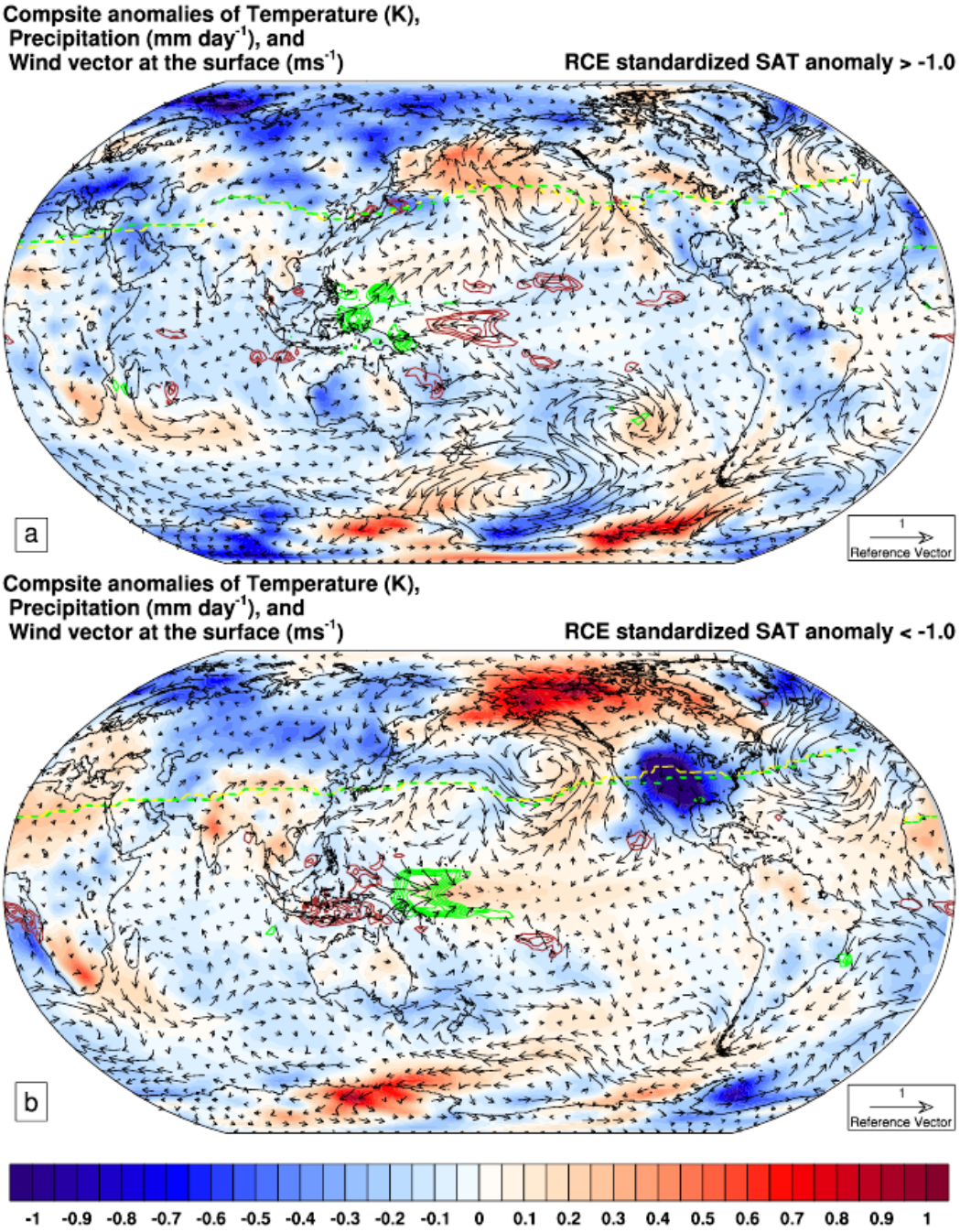

Fig. 1. Composite anomalies of (a) surface air temperature (SAT in K, shaded), precipitation (mm/day, green contours are for positive and brown contours for negative anomalies, contours from −2.0 to 2.0 with a spacing of 0.25), and wind vector (m s^{-1}) at the surface for conditions in which the standardized SAT in the RRM region > −1.0 K, (b) same as (a) except for conditions in which the standardized SAT in the RRM region < −1.0 K. The green (experiment) and yellow (control) dotted lines represent the core of the jet stream (m s^{-1}, max. zonal wind between 300 and 200 hPa). (c) Composite anomalies of the stream function (m s^{-1}, shaded), geopotential height (m, green contours are for positive and red contours for negative anomalies) and wind vector (m s^{-1}) at 200 hPa for conditions in which the standardized SAT in the RRM region *> −1.0 K, and (d) as (a), but for conditions in which the standardized SAT in the RRM region < −1.0 K. From Dipu et al. (revised).*