FASSI

Fingerprint Analysis of Extreme Events Caused by Stratospheric Sulfur Injections

- Prof. Dr. Ulrich Cubasch // Freie Universität Berlin (FU)
  cubasch@zedat.fu-berlin.de
- Dr. Gerd Bürger // FU Berlin
- Janina Körper // FU Berlin

General Description

Using a suite of climate model simulations we assess the side effects of stratospheric aerosol injections as a means of Climate Engineering (CE). From existing simulations of the GeoMIP project a time horizon is estimated after which these measures become detectable. Because this horizon lies in the future the detection analysis takes place exclusively in the synthetic model world, thereby departing significantly from conventional approaches and requiring extra care for the statistical setup.
Our main interests are effects on climatic extremes and certain “hot-spots” of the climate system such as the Monsoon rainfall or droughts in the Sahel. If successful, we will be able to provide estimates of the waiting time after which CE side effects on a given hot-spot become significant. Our analysis shall provide threshold criteria as a tool for decision makers.

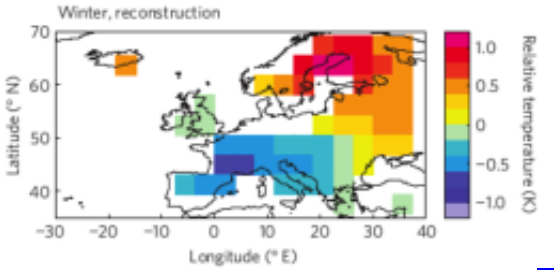
CORE QUESTIONS

- **Are typical negative side effects of Climate Engineering, such as changes of the Monsoon**

rainfall or droughts of the Sahel, detectable, and what is the waiting time until a signal emerges?

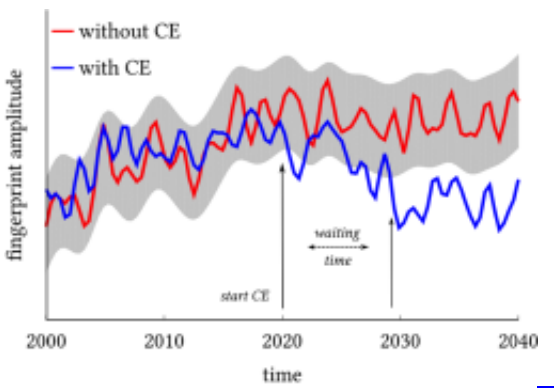
- **How much confidence do we have in the signal, and is it robust enough to serve as policy advice?**

Methods



_ Fig. 1: Typical fingerprint in a detection study (Hegerl et al. 2011).

Our detection will be done within the general GeoMIP framework, which contains already a number of climate simulations that are suitable for our purpose. We use optimal fingerprinting as a standard method for detecting CE side effects (Fig. 1).



_ Fig. 2: Temporal amplitude of CE fingerprint (schematic). What is the waiting time until a signal (blue) emerges?

This method crucially hinges on an independence of fingerprint definition and detection, so that it is free of random features and a selection bias. Therefore, the detection will be done in independent realizations of the same climate (of which several are available in GeoMIP), and we will use as many of them as

possible.
From the temporal amplitude of the fingerprint (Fig. 2) one can derive a waiting time for the CE side effects to become a robust and detectable signal.

Hegerl, G. C, J. Luterbacher, F. Gonzalez-Ruoco, S.F.B. Tett and E. Xoplaki (2011): Influence of human and natural forcing on European seasonal temperatures. Nature GeoScience, 4, 99-103