Long term and climate variability
Two types are considered:
1. Physically forced
2. Chaotic oscillations

Physically forced climate variability
• Assumption: Chaotic oscillations in the climate system have little impact on the decadal scale
• Before the industrial period, explosive volcanic eruptions were the largest source of forced climate variability globally on interannual to centennial timescales. 

Sulfate aerosols
• Sigl et al. (2015) studied historical ice core sulfate loads. Following their approach we use a scaling factor of 0.011 AOD/(kg/km²)
• They found 159 eruptions with AOD > 0.1 during 2500 years
• The e-folding time (decay time) is assumed to be 1 year (Crowley & Untermaier 2013)

Discussion
• Future volcanic eruptions are not included in the CMIP6 models
• The GCM’s representations of aerosol and aerosol-cloud effects differ very much
• Sulfate emissions have been decoupled from greenhouse gas emissions to a large extent
• Future work: aerosol-cloud effect scenarios

References


Kikiselli, 1888. Dämmerungs-Untersuchungen. The background image of a sunrise on 4 September 1884. It shows the effect on sunlight following the Krakatau eruption.