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Climate engineering: Uncertainties and limits

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In 2015, negotiators meeting in Paris agreed on a goal of keeping global average temperatures from increasing more than 1.5K above pre-industrial levels. This would require a very fast transition to a fossil-free economy. But attempts in recent years to reduce CO2 emissions have not been very successful. Additionally, carbon capture and storage has not been proven yet to be available on a large scale in the near future. In this situation, solar radiation management (SRM) may become an important strategy. Among the various proposed techniques of reducing incoming solar radiation, the injection of sulfur into the stratosphere is the most studied. We have calculated limits and uncertainties of stratospheric sulfate injection, using the global climate model ECHAM5, which includes an aerosol microphysical model. The reductions in radiative forcing that can be achieved with stratospheric sulfate injection depend on the amount of sulfur injected. Our calculations show that the efficiency of this technique, expressed as the ratio of the magnitude of sulfate aerosol forcing to injection rate, decays exponentially as more sulfur is injected. However, efficiency also varies depending on injection strategies, such as varying injection height or area. The heating of the aerosols in the stratosphere also impacts stratospheric dynamics, including the quasibiennial oscillation, which impacts again the transport of the tracer distribution of aerosol, and thus the efficiency.

Date: Monday, November 28, 2016
Time: 3:15 refreshments, 3:30 seminar
FL2-1022, Large Auditorium

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