Using observations to better understand processes relevant to SAI

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Related to SAI, we don't fully understand:

1) How aerosols will form/evolve over time.
2) How the plumes will disperse.
3) How continued injection into an established enhanced aerosol field differs from a point injection (ie, like a volcanic eruption or a pyroCb).
4) How aging of the aerosols impacts radiative and chemical properties.
5) How to most effectively deploy SAI material.

Question decision makers need answers for:

1) What is the effectiveness of any proposed strategy?
2) What are the impacts on stratospheric ozone?
3) What are the impacts on high altitude clouds?
4) What are the impacts (and the distribution of those impacts) at the surface (temp/hydrologic cycle/ecosystems/air quality)?
5) How can SAI implementation be identified/monitored?

To answer these questions, basic scientific understanding is needed. Note that similar questions are relevant for other methods (ie: MCB, CCT, space mirrors, surface albedo modification.)

Measurements are needed to verify/validate the models being used to assess SAI impacts

1) Aerosol measurements that help to elucidate processes that are included in models, either explicitly or parameterized

2) Measurements that give an indication on how a plume disperses

3) Measurements that indicate the chemical evolution of the air parcel

4) Measurements that validate the global satellite retrievals

5) Baseline measurements, of the stratospheric unperturbed by SAI (we need to understand current processes before perturbing the stratosphere)

6) Laboratory work on particles is needed, in particular for aerosols other than sulfate (ie, soot or organic carbon from fires, or aerosols designed to minimize heating). What are the heterogenous reactions occurring under stratospheric conditions?

Targets of opportunity can advance understanding

Volcanic eruptions, wildfire generated convection, and rocket launches all provide potential targets that can be used to study stratospheric aerosol processes.

These require:

1) existing deployment ready instrumentation and platforms (to allow rapid response)
2) for rocket plumes, assorted permissions to sample where the plume is fresh
3) ability to follow a plume to assess evolution
4) a modeling component that uses the data collected to validate/improve process representation
5) a satellite component that allows extrapolation of process understanding to a global scale

Monitoring capabilities need to be developed

1) Platform development
   this is also needed for deployment, there is not currently a viable fleet
2) Instrument development (both in situ and space based)
   instruments that are better, lighter and cheaper
3) Continued space based observations are critical to give a global picture
   replacement of aging satellite instruments likely needed
4) Development of monitoring strategies (how to identify SAI deployments done by other parties, how to monitor intentional deployments)

Things to fund besides modeling studies: instrument development, platform development, measurement campaigns, laboratory work, space based platforms, measurement networks