SSiRC
Stratospheric Sulfur and its Role and Climate

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The Team

Activity leaders
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Steering committee
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- John Barnes (NOAA, Hawaii)
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- Fred Prata (Nicarnica Aviation AS, Norway)
- Marc von Hobe (Forschungszentrum Juelich, Germany)
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- Juan- Carlos Antuna (Instituto de Meteorología, Cuba)
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- Thomas Peter (ETH, Switzerland)
- Alan Robock (Rutgers University, USA)
- Graham Mann (University of Leeds, UK)
SSiRC Activity

Mission
SSiRC is a SPARC activity aimed at facilitating international research activities leading to improved understanding of the role that stratospheric sulfur, and its close companion aerosol, play in climate at levels from the non-volcanic to mega eruptions.

http://www.sparc-ssirc.org/
SSiRC – Building a community

Community
SSiRC brings together a diverse group of scientists from those making observations at Earth’s surface to those that observe the composition and changes in the stratosphere as well as those that model the impact of stratospheric sulfur and aerosol on chemistry and climate.

Different mailing list to target specific activities:

- Generic - SSiRC (ssirc@mpimet.mpg.de) – 255 subscribers
- Volcanic response (ssircvolcano@mpimet.mpg.de) – 152 subscribers
- Multi-model assessment of climate model performance under strong volcanic forcing conditions - VolMIP (volmip@gwdg.de) – 94 subscribers
SSiRC – Achievements

• SSiRC proposal to ISSI (International Space Science Institute), Bern, Switzerland to become part of ISSI International Teams was successful (again). http://www.issibern.ch/teams/ssirc2/
  - Most recent ISSI Team meeting - 30 Jan to 2 February 2017 in Bern, Switzerland.

• SSiRC submitted a proposal to AGU for a Chapman Conference which has been accepted. The Chapman Conference on ‘Stratospheric Aerosol in the Post-Pinatubo Era: Processes, Interactions, and Importance’ is scheduled for 18 to 23 March 2018, Tenerife, Spain.

• SSiRC organized a Workshop on the Measurement of Stratospheric Aerosol (WOMSA) - 6 to 8 September 2017 in Boulder, Colorado.
SSiRC – Achievements

• Under the umbrella of SSiRC, ETH Zurich and NASA have compiled a new stratospheric aerosol forcing data set for CMIP6. The observation-based part of the climatology has been archived at the NASA Atmospheric Sciences Data Center where it has a DOI (10.5067/GloSSAC-L3-V1.0).

SSiRC – Related Field Activities (1)

• Balloon measurement campaign of the Asian Tropopause Aerosol Layer (BATAL) at Gadanki and Hyderabad (South/Central India) - 31 July and 30 August 2017
  • marks the beginning of the established agreement between NASA and Indian Space Research Agency for the next 4 years
  • 15 balloons flights to investigate transport of pollution into the stratosphere via monsoon and their potential impact on stratospheric ozone chemistry and climate - first deployment of medium duration balloon
  • Data will also be used for satellite measurement validation (CALIPSO and SAGE III/ISS)

• StratoClim aircraft campaign - mid July to mid August 2017 in Kathmandu, Nepal.
  • First airborne campaign in South Asia – up to 20 km altitude
  • 8 flights measuring trace gases and aerosol properties (inside Asian Monsoon Anticyclone)
Efforts to refurbish the Grupo de Óptica Atmosférica de Camagüey (GOAC) stratospheric lidar system are on-going.

- MPI of Meteorology donations of lidar parts required have been approved by Cuba authorities – more approvals required
- Redesign of the GOAC lidar completed and parts prepared for shipment
- GOAC team performed maintenance and testing of the electric system – new air conditioning system installed
SSiRC – Modelling Activities

- VolMIP (http://volmip.org/) – aims to coordinate the activities of different research institutes involved in numerical climate modelling focused on a multi-model assessment of climate models’ performance under strong volcanic forcing conditions.
  - VolMIP experiments are on hold as CMIP6 core experiments have first priority
  - First VolMIP results expected in 2018
  - Four state-of-the art stratospheric aerosol models simulated stratospheric aerosol size distribution after the 1815 Tambora eruption (Marshall et al. 2017). Results indicate large differences between models in both formation and transport of sulfate aerosol. → emphasizes the need for an internal model intercomparison to improve models.

SSiRC – Modelling Activities

- ISA-MIP – aims to coordinate internal global aerosol model model intercomparisons to improve models and provide a sound scientific basis for future work (lead Claudia Timmreck, Graham Mann)
  - Coordinated experiments simulating stratospheric aerosol properties, assessing volcanic SO$_2$ emissions and quantify uncertainty in predicted volcanic forcings
  - Experimental design of ISA-MIP is described in Timmreck et al. 2017: A co-ordinated intercomparison of Interactive Stratospheric Aerosol models: Motivation, experiments and specifications, to be submitted to GMD late 2017.
  - ISA-MIP experiments are expected to begin in late 2017.

<table>
<thead>
<tr>
<th>Background Strat. Aerosol</th>
<th>10 year climatology to understand sources and sinks of stratospheric background aerosol, assessment of sulfate aerosol load under volcanically quiescent conditions</th>
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<tbody>
<tr>
<td>Transient Strat Aerosol [TAR]</td>
<td>Evaluate models over the period 1998-2012 with different emission data sets. Understand drivers and mechanisms for observed stratospheric aerosol increase since 2000</td>
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<tr>
<td>Historic Eruption SO$_2$ Emission Assessment [HErSEA]</td>
<td>Assess how injected SO$_2$ for historical eruptions perturbs stratospheric aerosol properties and radiative forcings in different complexity global strat. aerosol models, Link emission uncertainties to forcing uncertainties</td>
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<tr>
<td>Pinatubo Emulation in Multiple Models [PoEMS]</td>
<td>Intercompare Pinatubo perturbation to strat. aerosol properties with full uncertainty analysis over PPE run by each model. Quantify sensitivity of simulated Pinatubo effective radiative forcing</td>
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Motivation:

Volcanic eruptions are a potential source of uncertainty in future climate projections as they cannot be predicted in advance, but eventually will occur, causing short-term climatic impacts on both local and global scales (source: IPCC, AR5).

VolRes – aims to prepare a response plan regarding modelling and measurements that need to be undertaken during/after the next major volcanic eruption.

- Outline of the report has been completed and lead-authors have been identified.
- Finalize report at the beginning of 2018 and release the report mid-2018.
- Side meeting of the VolRes group is planned during the Chapman conference in March 2018.
- Attention by threat of Mt Agung eruption.
SSiRC – Mt Agung Eruption Threat

SSiRC volcano group (lead Jean-Paul Vernier, Claudia Timmreck)

- Mt Agung last erupted in 1963, is threatening to erupt again
- SSiRC Volcano is coordinating and motivating research activities to understand the impact of a potential eruption by Mt Agung (but also any future large eruptions)
- Response has been huge, with scientists across the world contributing their response plans if Mt Agung decides to erupt:
  - Balloon observations (e.g. POPS can be launched any time from American Samoa)
  - HALO aircraft measurements if Mt Agung erupts before 20 Oct
  - Lidar/FTIR measurements in the path of the plume
  - Space-based measurements (CALIPSO)
  - Recommendations of emission profiles based on measurements
  - Coordinated model activities

Mt Agung, Bali, 27 September 2017
SSiRC – Mt Agung Eruption Threat

HYSPLIT forecasts if Mt Agung would have been erupted on 1 October
SSiRC – Planned meetings

- **Chapman Conference** ‘Stratospheric Aerosol in the Post-Pinatubo Era: Processes, Interactions, and Importance’ – 18 to 23 March 2018, Tenerife, Spain
  - Convenors: Terry Deshler, Larry Thomason and Mian Chin
  - Website: http://chapman.agu.org/stratospheric-aerosol/
  - Side event for Early Career Researchers planned during the conference
  -> SPARC travel support required especially for ECRs, scientists from developing countries and non-US originating participants

- **SSiRC ISSI Team Meeting** – 14 to 18 May 2018, Bern, Switzerland
  -> SPARC travel support (~$3,000) to support attendance of SSG member from Cuba

- **SSiRC workshop** in Havana, Cuba in 2019.
  - Capacity building to involve Latin American Lidar Network
  -> SPARC travel support required especially for ECRs and scientists developing countries

- **Joint workshop** with other SPARC activities – ACAM & OCTAV-UTLS
  -> SPARC to facilitate communication across activities
Thank you for your attention!