

# Report on the 24<sup>th</sup> SPARC Scientific Steering Group Meeting

## 1-4 November 2016, Berlin, Germany

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The 24<sup>th</sup> SPARC Scientific Steering Group (SSG) meeting was hosted at the Max Planck Institute's Harnack House in Berlin, Germany, from 1-4 November 2016. The meeting followed a one-day science workshop focused on SPARC's contribution to the WCRP Grand Challenges (see page 8, this issue).

### WCRP update

The WCRP continues to focus on its mission of facilitating analysis and prediction of the Earth system through its core projects and grand challenges, which now include two recently approved grand challenges on near-term climate predictions and carbon cycle-climate interactions (Boram Lee, WCRP/SPARC liaison). The WCRP will undergo a major review by its sponsors in 2018 and so a document outlining WCRP's achievements and future strategic direction is currently being drafted. All WCRP projects, working groups, and grand challenges will provide input to this document, which is to be completed by the 38th session of the WCRP Joint Scientific Committee to be held in April 2017. Part of this process will be to establish best practices for assessing progress of the grand challenges as well as core projects. Furthermore, WCRP is working to refresh its communications, both internal and external, and is currently carrying out a survey to establish where to make effective improvements.

Participation in the survey is most welcomed at: [www.wcrp-climate.org/wcrp-communication-survey](http://www.wcrp-climate.org/wcrp-communication-survey).

WCRP recently held a scoping meeting on regional activities, which highlighted the fundamental gap in the availability of data for providing regional climate information, as well as the difficulty in doing so even when data is available. A call for a regional climate information coordinator has been made, with the hope of establishing a clear contact point for all WCRP regional activities. These activities are strongly linked with WCRP's capacity development strategy, which has also recently focused on supporting early career researchers by actively engaging them in WCRP strategic discussions and officially endorsing YESS (the Young Earth System Scientists community). This group has been very active, recently having published a white paper on the frontiers of Earth system science, and helping to organise a very successful early career symposium at the CLIVAR Open Science Conference, amongst other things.

The WCRP Data Advisory Council (WDAC) coordinates all data and observation activities across WCRP and ensures cooperation with major partners such as the Global Climate Observing System (GCOS). Over the past few years SPARC has continuously highlighted the possible looming

gap in limb-sounding observations (**Susann Tegtmeier**) and this has now been noted in the new GCOS implementation plan. This plan also includes several action items, two of which are relevant to this issue: a review of the availability of climate data records, and the identification of gaps in the availability of these records. Together with WDAC, GCOS has established a data prize to recognize an early- to mid- career scientists for outstanding work in data generation, management, preservation or monitoring. WDAC has also recently established a Task team on the Intercomparison of Reanalysis (TIRA), with Masatomo Fujiwara serving as the SPARC representative. First results from this effort will be presented at the 5<sup>th</sup> WCRP international reanalysis conference, which will take place from 13-17 November 2017 in Rome, Italy.

The WCRP Model Advisory Council (WMAC) plays a similar role to WDAC, but is focused on modelling (**Judith Perlwitz**). After a very successful model development summer school held in 2015, the group is organising a second school in 2017 in Brazil. The next WMAC meeting will be held together with several other WCRP modelling working groups to facilitate planning for the next 5-10 years and provide input to WCRP's future strategic plans. They will also work on trying to coordinate several of activities within WCRP focused

on making decadal predictions, including the new grand challenge on near-term climate predictions. Discussion during the SPARC SSG meeting also focused on raising awareness about the relevance of including chemistry in models on various timescales. How important chemistry is for various prediction purposes is still very much an open research question, and one that WCRP, together with the World Weather Research programme (WWRP), should certainly continue to focus on.

**Quentin Errera** represented SPARC at the 2016 meeting of the Working Group on Numerical Experimentation (WGNE), which is joint between WCRP and the WMO Commission for Atmospheric Sciences. This link could prove useful to encourage more climate modelling groups to get involved in the WGNE focus areas, particularly as more and more modelling centres are moving towards seamless models that can be used across all timescales. In this regards, WGNE is organising a systematic errors workshop that will be held from 19-23 June in Montreal, Canada, and hopes to bring representatives from both the weather and climate modelling communities together.

### SPARC activity reports

The Stratospheric Network for Atmospheric Predictability (SNAP) has concluded the first phase of the project, which produced several well-cited papers examining the influence of the stratosphere on climate predictability at various timescales (**Andrew Charlton-Perez**). They have also been encouraging cooperation with other projects, including the SPARC DynVar and QBOi activities (see below) as well as the WCRP/WWRP Sub-seasonal to Seasonal

(S2S) project. Their revamped website ([www.sparsnap.org](http://www.sparsnap.org)) now has real-time diagnostics of annular modes and the probability of occurrence of sudden stratospheric warmings. Amy Butler will be joining Andrew as new co-lead of the activity, while Greg Roff, who steps down, is warmly thanked for his leadership of the activity.

The Stratospheric Reanalysis Intercomparison Project (S-RIP) also has new co-leads, with Gloria Manney and **Lesley Gray** joining Masatomo Fujiwara in running the activity. The group has been working hard on the interim S-RIP report, which is nearing completion and will be published in 2017. To complement the report, which will include many technical details, there is an S-RIP special issue open in Atmospheric Chemistry and Physics that includes papers that serve as an “entry point” to the reanalyses and science covered in more depth in the report.

S-RIP has held joint meetings with the Data Assimilation Working Group (DAWG; **Quentin Errera**) for the past two years, and will do so again in 2017 with a workshop that will be held in Reading, UK, from 23-27 October 2017. The themes of the workshop are yet to be decided, but may focus on things such as the representation of the stratosphere and mesosphere in data assimilating models or novel assimilation techniques. John McCormack will join Quentin to co-lead and further develop the activity.

The second Water Vapour Assessment activity (WAVAS-II) is finalising much of its work, with several papers having been or going to be submitted to a special joint journal issue between Atmospheric Chemistry and Physics, Atmospheric Measurement

Techniques, and Earth System Science Data (**Gabriele Stiller**). These papers include descriptions of the various satellite and *in situ* water vapour products available, comparisons of these data, and analyses of variability and trends. The group have also been cooperating with the GEWEX G-VAP activity, which also focuses on comparing and understanding water vapour records, but mainly for the troposphere.

The Chemistry-Climate Modelling Initiative (CCMI), a joint SPARC-IGAC (International Global Atmospheric Chemistry) activity, has worked hard over the last year to ensure most of the phase-1 model data are available on the British Atmospheric Data Centre (BADC) server (**Michaela Hegglin**). They have also refreshed the steering committee, with Bryan Duncan replacing Jean-François Lamarque as co-lead with Michaela, and improved communication within the activity by issuing quarterly news emails. The group contributed to the overview paper describing the Coupled Model Intercomparison Project – Phase 6 (CMIP6) AerChemMIP project, and are working to finalise the CCMI ozone forcing dataset in support of CMIP6. CCMI will continue analysing the available model data over the coming year, with results being presented in a joint special issue between Geophysical Model Development, Atmospheric Chemistry and Physics, Atmospheric Measurement Techniques, and Earth System Science Data. This work has been facilitated by three focus groups that will produce key publications on tropospheric OH and ozone budgets, the specified dynamics simulations, and an overview of the entire CCMI activity. The group will hold its next workshop from 12-17

June 2017 in Toulouse, France.

The SOLARIS-HEPPA activity is also actively engaged in analysing the CCMI output (see also page 30, this issue), with five different working groups focusing on aspects ranging from the stratospheric solar signal to the impact of energetic particles on climate (**Katja Matthes**). Over the past year SOLARIS-HEPPA has produced the solar forcing dataset for CMIP-6, as well as a number of key papers outlining the impact of the solar signal on climate variability and predictability. This includes an overview paper of the DAMIP, a CMIP-6 project, that will cover experiments looking at the impact of solar forcing on detection and attribution of climate change. The activity will hold their next workshop in Paris, France, from 6-8 November 2017.

**Michelle Santee** provided an overview of progress made by the Polar Stratospheric Clouds Initiative (PSCi). So far the group has met three times, with the last two meetings being focused on a review paper that they are aiming to submit to *Reviews of Geophysics* by January 2018. The paper is being led by Michael Pitts and Ines Tritscher, and will provide a comprehensive overview of the distribution, formation processes, composition, and chemical processing of polar stratospheric clouds.

During 2016 the Atmospheric Composition in the Asian Monsoon (ACAM; also joint with IGAC) activity transitioned its formation committee into a scientific steering committee, which includes members from the four ACAM working groups (**Laura Pan**). ACAM helped organise a very successful workshop on Dynamics, Transport, and Chemistry in the Asian Monsoon Upper Troposphere/

Lower Stratosphere in March 2016 and is working on organising the third biennial workshop to be held in Guangzhou, China, from 5-9 June 2017. Associated with this workshop will be the second ACAM training school. The group continues to work on developing capacity in the Asian Monsoon region, particularly through involvement in various field campaigns.

The Stratospheric Sulfur and Its Role in Climate (SSiRC) activity has, similar to several other SPARC activities, been involved in developing CMIP-6 projects (**Claudia Timmreck**). Their focus has been on VolMIP, which aims to understand the climatic responses to volcanoes. In 2016, SSiRC also produced a review paper on stratospheric aerosols and worked on a paper regarding the atmospheric sulfur budget, which is to be submitted soon. The group has also been very involved in several observational campaigns and in developing a response plan for a future campaign in the event of a major volcanic eruption. SSiRC is hoping to organise a Chapman Conference focused on “Stratospheric aerosols during the past 20 years” in 2018 on the island of Tenerife, Spain.

**Amanda Maycock** presented the Atmospheric Temperature Changes (ATC) activity, which she is co-leading with Andrea Steiner and Bill Randel. The activity is focused on understanding atmospheric temperature variability and trends in climate records and attribution of changes to radiative and dynamical drivers. Recent progress was presented at the group’s first workshop in April 2016. This includes the production of new long-term merged temperature records for the stratosphere and mesosphere, comparison of model

and satellite observations in terms of the magnitudes of tropospheric temperature changes, and an analysis of the consistency of GPS radio occultation observations. The group is organising a session at the European Geophysical Union’s 2017 Conference and will likely plan a second ATC workshop for 2018 as well.

This year the Dynamical Variability (DynVar) activity held a major workshop in Helsinki, Finland, from 6-10 June 2016, which brought together the DynVar community, including representatives from various modelling centres (**Alexey Karpechko**; see page 26 for a full report). DynVar were also heavily involved in developing the DynVarMIP as part of CMIP-6. This MIP specifies an extra list of output diagnostics that will be used to help understand consistent model biases of various aspects of atmospheric dynamics, such as sea level pressure change or the mean position of the mid-latitude jets.

The Quasi-Biennial Oscillation initiative (QBOi) has largely focused on their phase one experiments over the past year (**Scott Osprey**). These experiments were designed to better understand differences between models able to reproduce the QBO and will serve as a basis for several papers to go into a special collection of the *Quarterly Journal of the Royal Meteorological Society* in 2017. The background work already done made it possible to very quickly put together a paper in response to the disruption in the QBO in mid-2016 (Osprey *et al.*, 2016). Together with SNAP and the Gravity Waves activity, QBOi would like to organise a joint workshop on the 2016 QBO disruption event, likely to be held in Asia in late 2017. More news on this workshop will be posted on the

SPARC website and in the eNews bulletin.

The SPARC Gravity Waves activity organised one of its major five-year conferences in 2016 at Penn State University (**Joan Alexander**). The symposium brought together a large number of scientists from both the weather and climate communities to focus on topics ranging from convective gravity wave generation to new observational results from the DEEPWAVE campaign and PANSY radar system (see page 22 for more details). Results from recent studies indicate that typical gravity wave parameterisations underestimate the amplitudes of these waves by up to a factor of 10, with even the most advanced parameterisations still underestimating amplitudes by up to a factor of 3. They also found that vertical resolution and numerical schemes play a very important role in accurately resolving waves and reducing dissipation in models. In the coming years the group, with Fuqing Zhang joining as a third co-lead, will focus on model predictability, particularly through encouraging modelling groups to incorporate newer gravity wave parameterisations.

**Marv Geller** presented progress

made by the emerging Fine-Scale Atmospheric Processes and Structures (FISAPS) activity. Over the past year they have been developing an overview paper outlining recent progress made using high-resolution radiosonde observations as well as areas for new research that the activity will focus on. This includes, for example, recovering higher resolution signals from lower resolution historical data using spline-fitting techniques to extend records back to the 1960s. In addition to completing the paper, the group will be working on extending membership, in particular to help obtain further data, and will be organising a joint workshop together with the QBOi in 2017. The SSG accepted FISAPS as a full activity given the progress made over the past year.

#### New SPARC activities

A record number of five proposals for new SPARC activities were presented, on various topics across SPARC's three scientific themes. **Daan Hubert** gave an overview of the Long-term Ozone Trends and Uncertainties in the Stratosphere (LOTUS) activity, which developed

in response to issues raised in the last WMO/UNEP Ozone Assessment and the completed SPARC Si2N activity. These include differences in trend estimates as well as the uncertainties associated with these estimates. The activity will be coordinated by Daan, Irina Petropavlovskikh, and Sophie Godin-Beekman, with two science teams focused on “multi-instrument dataset integration” (MIDI; led by Viktoria Sofieva and Robert Damadeo) and on “regressions of ozone analysed for stratospheric trends” (ROAST; led by Robert Damadeo and Birgit Hassler). The MIDI team aims to extend and update ozone profile datasets to correct them as best as possible before running trend analyses, while the ROAST team will then use these datasets to assess the impact of using different statistical techniques to estimate long-term trends. Overall, it is hoped that an ensemble of datasets (including uncertainties) and techniques will be developed to provide a much better estimate of long-term ozone trends in the stratosphere. The activity will publish its results in peer-reviewed journals in time for the WMO/UNEP 2018 Ozone



**Figure 1:** Participants at the 24<sup>th</sup> SSG meeting held in Berlin, Germany. (Photo: Hans Volkert, DLR).

Assessment. It was accepted as a full activity.

An activity focused on Short-Lived Climate Forcers (SLCFs; **Bill Collins**) aims to understand the climate system's physical response to changes in radiative forcing from SLCFs. This includes aspects of the surface climate, such as surface temperature and precipitation, as well as other large-scale atmospheric features such as circulation patterns. For the moment, most of the planned activities are model-based, with experiments loosely based on the protocols developed for the Precipitation Driver Response Model Intercomparison Project (PDRMIP). There is however, plenty of scope to combine investigations with observational estimates of radiative forcing and emissions studies. The activity is very much in the development phase, with planning of experiment design to follow on from the CMIP-6 AerChemMIP project in 2018 and model simulations to be started in late 2018. The activity would clearly link with IGAC (see below) as well as the WCRP grand challenges on Clouds, Circulation, and Climate sensitivity; Carbon-climate interactions; and near-term climate predictions. Results from the activity would also be highly relevant to understanding the climate impacts of various air quality policies around the world.

**Peter Hoor** presented a proposal for an activity on Observing Composition Trends And Variability in the Upper Troposphere/Lower Stratosphere (OCTAV-UTLS). The region is very sensitive to changes in radiatively active gases such as ozone, methane, and water vapour and thus has a significant impact on much of the atmosphere. However, the UTLS is a highly variable region and definitions of the tropopause can

have significant results on estimates in trends of chemical species. The activity aims to address the issue of understanding which tropopause definitions are ideal for various radiatively active species and using this information to reconcile and better understand limitations in the available observational datasets. They will use data from satellites, balloon- and aircraft-borne instruments, as well as ground-based remote sensing.

The fourth proposed activity called Towards UNified Error Reporting (TUNER) was presented by **Thomas von Clarmann** on behalf of his co-leads Doug Degenstein and Nathaniel Livesey. The activity aims to assess the best ways to report satellite measurement uncertainty estimates, since currently there is a very wide range in how these are reported. The activity team so far includes investigators from 12 satellite missions who will then implement the recommendations developed into their datasets. TUNER thus provides a key link between data providers and users, with strong links to many of SPARC's other activities as well as NDACC (see below), who have faced similar challenges in terms of their ground-based observational networks.

Historically, SPARC activities on stratosphere-troposphere exchange have focused on the mid-latitude regions, where balanced dynamics prevail. The Stratospheric and Tropospheric Influences On Tropical Convective Systems (SATIO-TCS; **Marv Geller**) activity aims to focus rather on the tropical regions, where weather systems involved multi-scale interactions with moist convection. Many studies over the past decade have shown that the stratosphere can significantly influence tropospheric variability

in the tropics, and vice versa. This activity aims to better understand and predict stratosphere-troposphere interactions in the tropics using coordinated observational data analyses, theoretical studies, and experiments with a hierarchy of numerical models. SATIO-TCS links well with the WCRP Grand Challenges on Clouds, Circulation, and Climate Sensitivity; Near-term Climate Predictions; and Climate Extremes. The activity will also help develop capacity, particularly in the Asian region, where they already organized one training school in 2016. SLCFs, OCTAV-UTLS, TUNER, and SPATIO-TCS were all accepted as emerging activities.

### Partner projects

The International Global Atmospheric Chemistry project (IGAC; **Mark Lawrence**) has been redefining itself, particularly in light of IGBP's move to Future Earth. The project continues to facilitate atmospheric chemistry research across the globe and functions in a similar way to SPARC, with two joint activities between both projects: CCMI and ACAM. A major focus for IGAC in 2016 was its biennial science conference, held in Breckenridge, Colorado, in late September. Of almost 500 participants, 200 were early career researchers and a very successful early career programme was organised both before and during the conference. The 2018 IGAC conference will be held the week prior to the 2018 SPARC General Assembly and also in Takamatsu, Japan, just 2.5 hours away from Kyoto, the location of the SPARC conference. The science programmes will be developed to encourage participation from the SPARC and IGAC communities in both conferences.

**Martine de Mazière** presented an overview of the Network for the Detection of Atmospheric Composition Change (NDACC), whose observations are used widely throughout the SPARC community. Most recently, measurements of carbon tetrachloride and carbonyl sulfide were used in SPARC Report No. 7 (“Solving the Mystery of Carbon Tetrachloride”) and the SSiRC stratospheric sulfur overview paper, respectively. New products from the network include temperature and wind profiles from microwave radars, which can be obtained under most atmospheric conditions and therefore provide good data coverage. NDACC are completing an activity homogenising long-term ozonesonde records, and hope that the data will be made available soon. NDACC is maturing as a reference network and recognised as a key data provider for supporting validation activities around the globe, including by the Copernicus Atmospheric Monitoring System. Finally, to celebrate 25 years of NDACC/NSDC (the NDACC precursor network) observations, a joint special issue has been opened in Earth System Science Data, Atmospheric Chemistry and Physics, and Atmospheric Measurement Techniques.

### Space observations

The issue of a looming gap in limb-sounding observations of atmospheric composition was touched on again by **Joan Alexander**. These observations are vital for monitoring essential climate variables such as water vapour, as well as for assessing the efficacy of the Montreal Protocol. Although the SAGE-III instrument will be launched on board the international space station soon, its sampling will be very sparse.

The only instrument that is planned to continue into the future is OMPS, which measures ozone and aerosols, however, there are no firm plans for any instrument that could measure water vapour, methane, or other species important in the stratosphere and UTLS. The SPARC community has kept advocating for the continuation of limb-sounding observations wherever possible, including most recently as input for the NASA decadal survey.

To discuss this survey and give an update on a wide range of other NASA activities, **Kenneth Jucks** joined the meeting remotely. The Aura science team will be reviewed in the coming months as part of the regular biennial “senior review” process. There is also an ongoing review of the SAGE-III launch system, which was found to have a fault preventing it from launching as planned in November 2016. NASA is currently selecting a commercial telecommunications satellite for launch of the TEMPO instrument, the first of Earth Venture instrument series and which is aimed at observing air pollution around the globe. Several other missions stemming from the last NASA decadal survey will launch in the near future, including NISAR, SWOT, GEI, ECOSTRESS; CLARREO-pathfinder, and the OCO-3 which will be installed on board the international space station. The final report for the upcoming NASA decadal survey will be released in late 2017 and it is possible to still provide input to the various committees involved in providing the report. NASA has also conducted a large number of airborne campaigns over the past year, including KORUS-AQ, focused on air quality; POSIDON; ATOM, which has obtained global-scale cross-sections of atmospheric constituents including several

reactive gases; ORACLES, focused on aerosols and their interaction with clouds and impacts on radiative forcing; and ACTA, aimed at measuring greenhouse gas fluxes over the Americas.

**Quentin Errera** briefly outlined the Altius mission, which will go some ways to ‘fill the gap’ in limb-sounding observations of the stratosphere. The mission was officially recognised as part of the ESA Earth Watch programme in December 2016 and will be based on PROBA micro-satellites on a polar orbit making both limb and occultation observations. The team expects to measure ozone and hopefully also water vapour, methane, aerosol, and polar stratospheric clouds. A third group of constituents, including OClO, BrO, and NO<sub>3</sub>, will be measured if possible. The aim is to launch the instrument in late 2020 with a proposed lifetime of approximately three years.

### Other SPARC news

2016 was a busy year in terms of SPARC’s capacity development efforts (**Fiona Tummon**). The SPARC website now includes a ‘How to get involved’ page, which also provides a useful page of links to SPARC-related online courses and teaching material. SPARC has been actively promoting the Young Earth System Scientists (YESS) community and, as usual, has supported many early career researchers to attend SPARC workshops and a training school on atmospheric composition and dynamics, held on Réunion island. The Asia-Pacific working group is still growing and was involved in the “Southeast Asia School on Tropical Atmospheric Science (SEASTAS)”, which was held joint with a workshop on Extreme

Weather in a Changing Climate in the Maritime Continent (Seok-Woo Son). Work is underway to develop a university-level course on middle atmosphere dynamics in southern Africa, which will hopefully stimulate interest across the region in SPARC-related science (Thando Ndarana). Several activities are planned for 2017, including the 2<sup>nd</sup> ACAM training school (Guangzhou, China), an atmospheric dynamics training school (Cape Town, South Africa), the 3<sup>rd</sup> SEASTAS school in Singapore, as well as regional science workshop joint with the 25<sup>th</sup> SPARC SSG meeting, which will be

held in Seoul, Korea, in September or October 2017.

In other good news, the Deutsches Luft- und Raumfahrt (DLR; German space agency) have offered to host the international SPARC project office as of mid-2017. **Hans Volkert** will serve as director and, together with the current team in Zurich, will help ensure a smooth transition to the new location in Oberpfaffenhofen. The DLR team will take over all duties as of 2018.

The 2018 SPARC General Assembly will be held from 1-6

October 2018 at the Miyakomesse, a major conference centre in Kyoto, Japan (**Kaoru Sato**). Organisation of the event is already underway, with the science programme to be made public in mid-2017. Various early career researcher events are also being planned, potentially in collaboration with IGAC.

The meeting was brought to a close on Friday afternoon. The 25<sup>th</sup> SPARC SSG meeting in conjunction with a regional science workshop will be held in Seoul, Korea, in late 2017.

