Report on the 20th Session of the SPARC Scientific Steering Group 27-30 November 2012, Buenos Aires, Argentina

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The 20th Session of the SPARC SSG (Scientific Steering Group) was held at SIGEN (Sindicatura General de la Nación) in Buenos Aires, Argentina, from 27-30 November 2012, hosted by the 'Centro de Investigaciones del Mar y la Atmósfera', of the University of Buenos Aires.

Opening session and WCRP/ SPARC update

Greg Bodeker (SPARC co-chair) opened the Scientific Steering Group (SSG) meeting by welcoming all participants, particularly those from South America who joined the first session, and thanked the local organisers. A new format for the meeting was introduced, requiring the activity leaders to provide a short report detailing their main scientific achievements, an outlook for the future, and any financial requests for the coming year. These reports were distributed to all participants prior to the meeting, while during the meeting brief scientific presentations were then made in plenary and logistical aspects were discussed separately in small groups with the SSG members. This allowed more focus on coordination and logistical issues. The reports have now been compiled to produce the very first SPARC Annual Report 2012.

Carolina Vera (a member of the WCRP's Joint Scientific Committee (JSC)) provided an update of WCRP activities on behalf of Antonio Busalacchi (JSC Chair), who was unable to attend the meeting. She mentioned the very successful WCRP Open Science Conference (OSC), which took place from 24-29 October 2011, in Denver, USA (**http://conference2011.wcrp-climate.org**). The new WCRP structure was discussed in a short JSC meeting following the OSC, and in further detail at the next JSC meeting, which took place from 17-20 July 2012 in Beijing, China (for more details see the meeting report in SPARC Newsletter no. 40[1]). Under the new structure, six Grand Challenges (GCs) will play a critical role, enabling the development of targeted research efforts that will provide successful results on 5-10 year timescales. Two new councils have also been established, the WCRP Modelling Advisory Council (WMAC) and the WCRP Data Advisory Council (WDAC) (see below for further details). A teleconference later during the meeting with Antonio Busalacchi confirmed SPARC's vital role in the WCRP's GCs. Carolina closed by discussing the emerging Future Earth initiative, to which the WCRP will contribute significantly. Later, she also presented a summary of the one and a half-day local workshop, which took place prior to the SSG meeting (see article later in this issue).

Ted Shepherd (SPARC co-chair) began his presentation by summarizing SPARC's goals and organisation, and then continued by mentioning SPARC's name change (again, see below for further details). He further discussed SPARC's role in the new WCRP GCs. SPARC will contribute to several GCs, including 'Regional Climate Information' (led by the Working Group on Regional Climate), through research focusing on atmospheric circulation changes, and to the GC 'Cryosphere in a Changing Climate' (co-led by CliC, the Climate and Cryosphere project), through the Polar Climate Predictability Initiative (PCPI, see below). SPARC will also contribute to the GC 'Science Underpinning the Prediction and Attribution of Extreme Events' (led by GEWEX), as well as to the GC 'Clouds, Circulation and Climate Sensitivity' (led by WGCM, see below), through research focused on circulation analyses, upper tropospheric water vapour, and sulphate aerosol microphysics. Together with GEWEX, IGAC (the International Global Atmospheric Chemistry project), and other research partners, SPARC is expected to take a lead on aerosol-re-

[1]**http://www.sparc-climate.org/fileadmin/customer/6_Publications/Newsletter_PDF/40_SPARCnewsletter_Jan2013_web.pdf**

lated research in support of the GCs.

Monica Rabolli made a presentation on behalf of CONAE (Comision Nacional de Activitas Espaciales, the Argentinian Space Agency), providing an overview of the AQUARIUS satellite mission, a common project between CONAE and NASA. The main scientific goal of this mission is to improve understanding of the interactions between ocean circulation, the water cycle and climate. The satellite was launched on 10 June 2011 and provides global information on sea surface salinity and soil moisture. AQUARIUS instruments also measure sea-ice concentration, rainfall rate, wind speed, water vapour, cloud liquid water content and fires can be detected. These observations have provided detailed information on tropical instability waves, the Amazon outflow plume and hurricanes. Examples from recent studies showed that it was possible to identify hurricane Gordon using AQUARIUS rain rate observations, while hurricane Sandy was observed using water vapour column data. Argentinian research using AQUARIUS data will focus on the Rio de la Plata outflow plume.

Jürgen Scheer presented an overview of the Network for Detection of Mesospheric Change (NDMC: **http://wdc.dlr.de/ndmc/**), which provides a framework for international cooperation to study the mesopause region (extending from 80-100km altitude). The NDMC was established in 2007 through an initiative of the ICSU/WMO-World Data Centre for Remote Sensing of the Atmosphere, which is operated by the German Aerospace Centre. The NDMC is a global programme aimed at identifying and quantifying atmospheric change by monitoring key parameters for the early characterisation of climate signals in the mesosphere. NDMC is focused on coordinating the study of mesospheric variability on all timescales, as well as the coordinated development of improved observation and analysis techniques and modelling of the mesosphere. NDMC science is currently focused on the following topics: (1) planetary waves, (2) gravity waves, (3) vertical coupling, (4) inter-hemispheric coupling, (5) infrasound, (6) climate change signal detection, and (7) network intercomparison. Jürgen presented some results from various NDMC studies and then finished by making proposals for collaborations between SPARC and the NDMC.

SPARC activity reports

Ted Shepherd presented the new Chemistry Climate Modelling Initiative (CCMI) on behalf of Veronika Eyring. The initiative, jointly supported by IGAC and SPARC, was discussed with the community and plans were approved at a workshop that took place from 21-24 May 2012, in Davos, Switzerland. The specific goals of the Davos workshop were to: (1) assess improvements in process-oriented evaluation and understanding of Chemistry Climate Models (CCMs; extending the CCMVal approach to the troposphere), (2) identify observations for model evaluation and new methods for improved comparability between models and observations, and (3) define community-wide simulations in support of the upcoming WMO Ozone and future IPCC Climate Assessments, as well as for process studies. The outcome of the workshop is described in further detail in a recent SPARC Newsletter article[2]. More generally, the goals of CCMI are to: (1) promote the use and development of global models that include chemistry and dynamics of the stratosphere and troposphere, as well as a coupled ocean, such models are expected to become more common; (2) to compare tropospheric, stratospheric and coupled chemistry-climate models with observations, as well as with each other; and (3) to better coordinate stratospheric and tropospheric modelling activities and to address specific scientific questions in the context of comprehensive stratosphere-troposphere resolving models including atmospheric chemistry. A CCMI website has been created (**http://www.pa.op.dlr.de/CCMI**) and a 2nd workshop was held in Boulder, USA, from 14-16 May 2013. Veronika Eyring and Jean-François Lamarque act as co-chairs of the activity, and a CCMI scientific steering committee has been formed.

Claire Granier, a member of the IGAC Scientific Steering Committee and SPARC liaison, presented a short overview of IGAC's main projects, including CCMI, to which IGAC is strongly committed. IGAC proposed that Veronika Eyring and Jean-François Lamarque are formally recognized as co-chairs of CCMI and intends to comment on the CCMI leadership plan to ensure the widest possible IGAC engagement. Allen Goldstein (incoming IGAC co-chair) was also involved in supporting the 2nd CCMI workshop. CCMI science will be vital to IGAC's focus on air pollution and climate, which is a theme of growing importance for IGAC. As part of the International Geosphere-Biosphere Programme (IGBP), IGAC will be integrated into the Future

[2] Eyring *et al.* (2013) Overview of IGAC/SPARC Chemistry-Climate Model Initiative (CCMI) Community Simulations in Support of Upcoming Ozone and Climate Assessments. *SPARC newsletter* No. **40**

Earth initiative, but this will not affect IGAC's commitment to CCMI.

Paul Newman presented the 'Lifetimes of Halogen Source Gases' activity. This SPARC activity is the first re-evaluation of the lifetimes of ozone-depleting substances (ODSs) since 1998 (WMO/UNEP Ozone Assessment, 1999) and first in-depth modification since 1994 (Kaye *et al.*, 1994[3]). Results show that different approaches result in different lifetime estimates, but overall there is good consistency, and uncertainties have been significantly reduced, through, for example, the re-evaluation of photochemical data. The lifetime estimates of certain species, for example CCl_4 and CFC-11, have changed significantly since the last WMO Ozone Assessment. The third draft of the report has been completed and reviewed, and work on the final report is in progress. The lifetimes recommendations will be finalized in mid-2013 and new ODS scenarios will be completed for the CCMI activity after this finalization. Results from this activity will also be included in the upcoming 2014 WMO/UNEP Ozone Assessment.

Julie Arblaster presented the SOLARIS-HEPPA activity (SOLARIS: SOLAR Influences for SPARC, HEPPA: High Energy Particle Precipitation in the Atmosphere) on behalf of Katja Matthes and Bernd Funke. She started by presenting results from a joint study looking at recent solar spectral irradiance variability and its impact on climate modelling[4]. The main uncertainty in spectral solar irradiance lies in the 220-400nm wavelength range, where substantial differences between different satellite measurements remain. While the number of numerical simulations taking into account spectral solar irradiance is increasing, comparisons of available model simulations are hampered by slightly different experimental setups, motivating new coordinated SOLARIS-HEPPA simulations. Using measurements from the SORCE (SOlar Radiation and Climate Experiment) satellite instrument leads to simulated atmospheric temperature responses being up to three times larger than when using other data. Julie also reported on the HEPPA-II coordinated intercomparison study, which suggests that the proton forcing (*i.e.* direct influence of solar proton events) is well represented in the participating models and should be considered in all models. In contrast, electron forcing data constraining ionization below 100km remains uncertain. Ongoing efforts are focused on constructing an observations-based energetic particle precipitation (EPP) NOy source parameterization for models with lids below 100km. In 2013, the SOLARIS-HEPPA activity aims to publish a white paper, continue the HEPPA model-measurement intercomparison study, evaluate the solar cycle signal in the CCMI hindcast simulations as well as in satellite observations, and provide recommendations for including EPP indirect effects in low-top models.

Karen Rosenlof reported on the WAVAS-2 activity (WAter Vapour ASsessment 2), which focuses on two main topics: (1) super saturation and *in situ* measurement data quality, and (2) upper troposphere and stratosphere climatologies, trends and radiative effects. As part of topic 1, controlled, refereed, blind intercomparisons of the principal airborne field instruments were made using the AIDA chamber, and strict quality checks of in-situ aircraft observations of relative humidity showed that many of the highest relative humidity values (except at very low temperature) are questionable (AquaVIT White Paper, 2009[5]; Krämer *et al.*, 2009[6]). This work shows that at very high relative humidities even state-of-the-art instrumentation introduces uncertainties that are too large, and thus many field measurements indicating supersaturation may not be reliable. There is therefore a strong need to improve current field instrumentation. The shifts in aircraft measurements generally preclude their use for trend analyses. However, comparisons with a stable satellite record may be useful for verifying or discounting extreme aircraft campaign anomalies. The second focus of this activity has been recently reorganised and now falls under the leadership of Gabrielle Stiller. This topic aims to analyse and combine long-term satellite observations of stratospheric water vapour for use as model boundary conditions, as well as for model comparison. They are currently aiming to produce a satellite climatology using SAGE II, HALOE and Aura MLS observations. Gaps in this data set may be filled with ACE, SAGE III and possibly other, shorter period satellite records. Ultimately, the aim is to perform trend and variability analysis on these data, and to carry out an assessment of uncertainties. An authors' meeting is to be held in

[3]Kaye, J. A., S. A. Penkett, F. M. Ormond (eds.) (1994) Report on Concentrations, Lifetimes, and Trends of CFCs, Halons, and Related Species. NASA Reference Publication 1339, Washington, D.C.

[4]Ermolli *et al.*, 2013: Recent variability of the solar spectral irradiance and its impact on climate modelling. *Atmos. Chem. Phys.*, **13**, 3945-3977

[5]**https://aquavit.icg.kfa-juelich.de/WhitePaper/AquaVITWhitePaper_Final_23Oct2009_6MB.pdf**

[6]Krämer *et al.*, 2009: Ice supersatuarations and cirrus cloud crystal numbers. *Atmos. Chem. Physics*, **9**, 3505-3522

Boulder, USA, in 2013, to finalize a review paper covering super saturation and data quality issues.

Michaela Hegglin and **Susann Tegtmeier** presented progress on the "Data Initiative". This activity focuses on comparing stratospheric and upper tropospheric/lower stratospheric satellite measurements of many important species, and is carried out in close collaboration with the satellite science teams. The comparison entails determining a zonal and monthly mean climatology using all available overlapping data, and then comparing the individual satellite records to this climatology. This allows a characterisation of measurements from individual instruments, while statistical analyses of the differences also provide an overall assessment of the respective species. Michaela presented the results of the water vapour analysis and provided an overview of the status of the activity. The activity is hoping to finish its final report in late 2013.

Johannes Staehelin presented the status of the SI2N initiative, which focuses on understanding past changes in the vertical distribution of ozone. The activity is supported by SPARC, the International Ozone Commission (IO_3C), Integrated Global Atmospheric Chemistry Observations (IGACO-O_3/UV), and the Network for the Detection of Atmospheric Composition Change (NDACC). A challenge for this project is to assess the consistency of satellite measurements suitable for deriving reliable information on ozone profile changes. This is particularly difficult since chemical ozone depletion reversed during the second part of the 1990s as a result of the successful implementation of the Montreal Protocol. Research is conducted by several working groups focusing on improving satellite observational records from the past decade, producing long-term merged satellite data series, data quality assessment of long-term ozonesonde records, and the analysis of long-term ground-based observations (including Umkehr, lidar, microwave and FTIR observations). A final review meeting will be held in Helsinki, Finland, in September 2013. The activity will present its final results through special issues of three journals (*Atmospheric Chemistry and Physics*, *Atmospheric Measurement Techniques* and *Earth System Science Data*), which will be published in time for the 2014 WMO/UNEP Ozone Assessment.

Dian Seidel presented an update of the stratospheric temperature trends activity. A NOAA team produced a new record of stratospheric temperatures derived from AMSU (Advanced Microwave Sounding Unit) and SSU (Stratospheric Sounding Unit) instruments. These data show remarkable differences compared to an earlier analysis by the UK Met Office, particularly in terms of the evolution of stratospheric temperature between 25-45km after the middle of the 1990s. The agreement between stratospheric satellite temperature records and chemistry climate models is also rather poor for this period. A Nature article by Thompson *et al.*[7] called into question our understanding of observed stratospheric temperature trends, which are thought to be caused by changes in ozone, carbon dioxide, and, at lower altitudes, also by water vapour. The activity encourages the publication of independent methods for merging SSU and AMSU data, and will attempt to recover tapes of overlapping SSU observations from the UK Met Office. They may also link with work on stratospheric reanalysis activities.

Joan Alexander (SPARC co-chair, as of 1 January 2013) presented progress of the SPARC gravity waves activity. Gravity waves influence global circulation and climate through changes in gravity wave momentum forces in the stratosphere and mesosphere, which can lead to changes in stratospheric and tropospheric circulation. Over the past year global distributions, and seasonal and interannual variations of gravity wave momentum fluxes in various global data sets and model estimates were analysed and compared in a project supported by the International Space Science Institute (ISSI). Because gravity waves are intermittent events, accurately determining gravity wave momentum fluxes requires information regarding both the amplitude and frequency of occurrence of wave events. Models that fully resolve the middle atmosphere were found to have similar gravity wave momentum fluxes, likely because they require similar forces to obtain realistic circulations. However, a simple increase in horizontal resolution is insufficient to produce realistic gravity wave fluxes. Other factors such as dissipation, model numerics, and vertical resolution also need to be improved. The analysis indicated that (1) observed fluxes decrease more rapidly with height than parameterized fluxes; (2) waves that can be observed have longer horizontal wavelengths and may dissipate lower in altitude; (3) the CAM5 global model's stratosphere acts as a "sponge" layer, and therefore dissipation is unrealistic; and (4) even high resolution models still under-resolve important orographic waves. The ISSI group is preparing a new paper compar-

[7]Thompson *et al.*, 2012: The mystery of recent stratospheric temperature trends. *Nature*, **491**, 692-6972

ing intermittency in gravity waves in models and observations. In future, the activity will focus on gravity wave forcing on circulation using global assimilation methods, as well as regional foci on wave source regions, including high latitude southern hemisphere winter waves and tropical waves.

Mark Baldwin began his presentation on the DynVar (Dynamical Variability) activity, on behalf of Elisa Manzini, by asking several fundamental questions related to dynamical coupling of the stratosphere and troposphere: What is the role of dynamical and radiative coupling with the stratosphere in extended-range tropospheric weather forecasting and in determining long-term trends in tropospheric climate? By what mechanisms do the stratosphere and troposphere act as a coupled system? What will the role of the stratosphere be as climate changes? In an attempt to answer some of these questions, DynVar has focused much attention on the analysis of the role of the stratosphere in CMIP5 output. Key results from DynVar activities (described in Manzini *et al.*, 2012[8], and Charlton-Perez *et al.*, 2013[9]) confirm previous projections, which indicate that by the end of the 21st century, lower stratospheric polar winds will weaken at high latitudes and strengthen at low latitudes. Categorising models as high- or low-top did not reveal significant differences in simulated polar winter stratospheric changes. Interestingly, the CMIP5 models were found to be more usefully subdivided according to projected winter polar stratospheric changes, since changes in the strength of the winter polar vortex can be an important factor for the projection of surface changes. In terms of mean climate, the skill of high- and low-top model ensembles was found to be similar, but the skill in simulating stratospheric climate variability on daily, interannual and decadal timescales was significantly better in the high-top ensemble. This is particularly the case in regions and seasons during which wave-driven stratospheric dynamical variability is substantial. In addition, in the extra-tropical lower stratosphere, the region most critical for communicating stratospheric changes to the troposphere, the mean climate was almost identical between low- and high-top ensembles. The DynVar activity held its 3rd workshop in Reading, UK, from 22-24 April 2013 (see report, this issue).

David Jackson presented developments in the SPARC Data Assimilation (DA) activity, out of which two new SPARC activities (SNAP and S-RIP, see below) are evolving. The activity held a workshop in Socorro, USA, in June 2012 (see the article in SPARC newsletter No. 40[10]). At the workshop, two new areas of potential research were proposed: (1) an intercomparison of the missing body force due to sub-grid scale gravity wave drag (which may partly be dealt with by the Gravity Wave activity, see above), and (2) a study of model vertical resolution, although this would need to be further refined to become realistic, for example, by focusing on the impact of vertical resolution on the QBO. A study looking at the changes in surface ozone simulated by the GEOS-CHEM model when assimilating MLS and TES satellite ozone observations was presented. Results indicate that biases decrease by 5-15%, although more work is required to understand what the data assimilation can tell us about vertical mixing. At present, the interaction between the chemical data assimilation and satellite retrieval communities is still rather informal, but the activity is aiming to further develop links between the two. The DA group will also produce a summary report on the representation of the stratosphere in numerical weather prediction models.

Emerging activities

Markus Rex reported on the progress of the Stratospheric Sulfur and its Role in Climate (SSiRC) activity. Since the SSG meeting in Zürich, in which SSiRC was endorsed as an emerging SPARC activity, a white paper has been published, a kick-off meeting took place, and an implementation plan has been developed. This activity will improve our understanding of the processes that sustain the stratospheric aerosol layer (largely made up of sulphur), as well as their variability and long-term changes. SSiRC will include the following major components: *in situ* aircraft and balloon measurements, ground-based remote sensing, satellite remote sensing, microphysical lab studies, process and global modelling, and a database housing all related data. Results from new research examining how sulphur is transported into the stratosphere were presented. They indicate that one of the most efficient pathways for sulphur transport to the stratosphere may be in the tropical Western Pacific. In this region, extremely low ozone mixing ratios

[8]Manzini *et al.*, 2012: Stratosphere-troposphere coupling at inter-decadal time scales: Implications for the North Atlantic Ocean. *Geophys. Res. Letters*, **39**, DOI: 10.1029/2011GL050771

[9]Charlton-Perez *et al.*, 2013: On the lack of stratospheric dynamical variability in low-top versions of the CMIP5 models. *J. Geophys. Res.*, **118**, DOI: 10.1002/jgrd.50125.

[10]http://www.sparc-climate.org/fileadmin/customer/6_Publications/Newsletter_PDF/40_SPARCnewsletter_Jan2013_web.pdf.

suggest very low OH levels (the so-called "OH-hole"), a feature which is expected to slow the oxidation of key tropospheric species, including SO_2 and its precursors, and thus might provide a potentially efficient pathway for these species to enter the stratosphere. Further measurements and modelling studies are needed to confirm these results. The SSiRC implementation plan was extensively discussed and SSiRC was approved as a new SPARC activity.

David Jackson reported on the SNAP activity (Stratospheric Network on Assessment of Predictability), on behalf of Andrew Charlton-Perez. This activity aims to quantify: (1) current skill in extra-tropical stratospheric forecasts, (2) the extent to which accurate forecasts contribute to improved tropospheric predictability, and (3) the partitioning of any gains in predictability between improvements in initial conditions and the forward forecast. Critical questions include: Is it really stratospheric influence or other model changes that improve tropospheric forecast skill? Is the improvement due to improvements in the modelled stratosphere or to the observations? Results are likely model dependent, and therefore prompts the question of how generic are improvements? Further questions include: Are stratosphere-troposphere coupling effects important throughout the winter season or only when major stratospheric dynamical events occur? How far in advance can major stratospheric dynamical events be predicted and usefully add skill to tropospheric forecasts? Which stratospheric processes, both resolved and unresolved, need to be simulated to gain optimal stratospheric predictability? To address these questions, multiple model comparisons and case studies will be needed. SNAP has recently formed a Steering Committee, held an initial workshop from 24-26 April 2013 in Reading, UK (see article, this issue), and will write a review paper on the role of the stratosphere in predictability. The planned stratospheric predictability modelling experiments are expected to start in June 2013.

Continuing on, David discussed the plans of the SPARC-Reanalysis/Analysis Intercomparison Project (S-RIP), on behalf of Masatomo Fujiwara. Reanalyses contain key information on the time-evolving state of the atmosphere and are widely used by a large community. At present, several reanalysis products exist, and S-RIP is a coordinated activity aimed at comparing these data sets for various "key" diagnostics. The activity aims to: (1) understand the causes of differences between reanalyses; (2) use the results to provide guidance on appropriate usage of various reanalysis products in scientific studies; (3) better coordinate with data users, which hopefully will lead to improvements in the next generation of reanalysis products; and (4) establish a closer collaboration between the data users and reanalysis centres. Over the past year S-RIP research activities have been discussed at several meetings, including the 2012 DA workshop (see above), and the activity held a planning workshop from 29 April to 1 May 2013 in Exeter, UK (see report, this issue), where the final S-RIP report structure, time schedule, analysis guidelines, and chapter lead authors were discussed. The final activity report is planned to be finished by 2015.

Other Presentations

On behalf of Scott Osprey, Neal Butchart and Kevin Hamilton, **Ted Shepherd** presented a proposal for a new SPARC activity focused on modelling the Quasi-Biennial Oscillation (QBO). The QBO is directly linked to how well a model simulates circulation and transport of chemical species throughout much of the atmosphere. QBO variability is a function of model discretisation, diffusion, resolved waves, and various parameterization schemes (*e.g.* gravity waves, convection). Very few models are able to produce internally-generated QBOs, and there has been little recent progress to improve this aspect. The proposed plan included the design of a coordinated set of numerical experiments to systematically explore the effects of: (1) vertical resolution, (2) resolved waves, (3) parameterized small-scale (gravity) waves, and (4) diffusion, on the morphology of the tropical QBO and projected changes thereof. Similar experiments with intermediate complexity models, which can explore the parameter space more efficiently than GCMs, were also welcomed. The goal of the activity would be to provide a better understanding of what is needed to produce a reliable QBO in climate models, in terms of model details such as vertical resolution, wave parameterizations, *etc*. The SSG strongly affirmed the importance of these goals. However, it was felt that any SPARC efforts focusing on the QBO had to be closely integrated with DynVar, given the strong role of the QBO in many DynVar research topics, and the recommendation was therefore made to bring these issues to the attention of DynVar at its workshop in April 2013, to help inform DynVar's future plans, rather than launching a separate QBO initiative.

Ted also presented an update on the WCRP Polar Climate Predictability Initiative (PCPI). In polar regions the agreement between models and observations is generally poor, and

some observations remain puzzling. For example, in September 2012 a record sea-ice minimum was observed in the Arctic, while a record sea-ice maximum was observed simultaneously in the Antarctic. The PCPI is aimed at understanding such differences and whether sources of climate predictability on seasonal and decadal time scales exist in the polar regions, since they are of importance to global climate. Although several international programmes focusing on the polar regions already exist, the WCRP brings a global perspective and adds significantly to the global modelling capacity. PCPI will constitute a major sub-initiative of the 'Cryosphere in a Changing Climate' GC (see above), and will work synergistically with the World Weather Research Programme's Polar Prediction Project, which is focused on polar predictability from hourly to seasonal scales. To this end, they will share a common project office. Key scientific questions include: How predictable is Arctic climate? Why are the Arctic and Antarctic climates changing so differently from each other and from global climate? Why are climate models generally unable to describe important observations in polar regions? What are the implications of polar climate change for low latitudes? Is the stability of the ice sheets changing? New measurements and modelling capabilities in combination with significant community interest will hopefully help answer these questions. A planning meeting was held in Toronto, Canada, in April 2012, and a draft implementation strategy was published in November 2012.

In his report on the Working Group on Numerical Experimentation (WGNE), **David Jackson** summarized WGNE feedback regarding requests from specific SPARC activities. WGNE provides general support for work on improving stratospheric physics and the understanding of errors in numerical simulations. To this extent, WGNE could possibly verify S-RIP analyses against their own analyses, since these may be quite different from reanalysis data. This aspect could become integrated into the S-RIP activity, or WGNE could initiate a complementary study. In terms of an investigation of model vertical resolution, WGNE has some previous experience researching the effects of vertical resolution in the Tropical Tropopause Layer and may be willing to refocus on such a topic in response to SPARC requests. WGNE also offered to help design numerical experiments looking into gravity waves. It was mentioned that WGNE focuses on improving the understanding of the sources and physics of convective and shear-generated gravity waves, and it was suggested that a link could be made with Global Atmospheric System Studies (GASS, part of GEWEX), which has a wide research scope including a focus on convection, aerosols and gravity waves.

Ted Shepherd made a presentation on the Working Group on Coupled Modelling (WGCM) on behalf of Veronika Eyring. The WGCM's broad mandate covers reviewing and fostering the development of coupled climate and Earth System Models, coordination of model experiments and intercomparisons (*e.g.* CMIP5), as well as the promotion and facilitation of model validation. Experience from CMIP5 was briefly summarized. CMIP5 produced an extremely large volume of data, which was managed and made available through the Earth System Grid Federation (ESGF) architecture. In a parallel effort, the obs4MIP database was created for model comparison purposes. This database mainly contains gridded, monthly-average NASA observational data. In tandem with WGNE, the WGCM has put together a model metrics panel to focus on model performance metrics and to liaise with other WCRP groups. Brief results regarding the simulation of stratospheric ozone by CMIP5 models was also presented. In contrast to CMIP3, where half of participating models used a prescribed stratospheric ozone climatology, all CMIP5 models considered either prescribed time-evolving ozone (*i.e.* past ozone depletion and future ozone recovery), or simulated ozone changes interactively, resulting in substantial improvements in simulated stratospheric ozone. This progress led to a more realistic representation of the effects of anthropogenic forcings on stratospheric temperatures and subsequent impacts on tropospheric climate. The representation of tropospheric chemistry in CMIP5 models was largely addressed by the Atmospheric Chemistry-Climate Model Intercomparison Project (ACCMIP), coordinated by Jean-François Lamarque and Drew Shindell.

Standing in for Kaoru Sato, **Greg Bodeker** presented the main aims and goals of the recently created WCRP Data Advisory Council (WDAC). WDAC will act as a focal point for all WCRP data and observation activities and will advise the JSC on all issues pertaining to observations and climate data. The council will also coordinate high-level aspects across the WCRP, ensuring cooperation with the WCRP's main partners, such as the Global Climate Observing System (GCOS), and other observing programmes. Furthermore, WDAC will work together with WMAC (see below) to promote effective use of observations for model comparison and to address issues related to the coordinated development

Figure 1: Participants of the 20th SPARC Scientific Steering Group meeting, Buenos Aires, Argentina.

of data assimilation, reanalysis, observing system sensitivity experiments, and of paleoclimate data. At the first WDAC meeting it was concluded that (1) there is a significant need for measurements of ocean biogenic trace gas and aerosol emissions; (2) a more uniform and formal approach needs to be established for assessing the quality of observational data sets used to validate models; (3) global environmental change data sets, both from models and observations, should be made available through the ESGF; (4) funding agencies need to ensure the long-term storage, management and preservation of collected data; and (5) efforts need to be made to improve the traceability of data sets. There was also discussion regarding the governance of the ESGF, which is an open source effort to provide a robust, data distributed and computation platform enabling world wide access to peta/exa-scale scientific data. The need for a thorough assessment of reanalysis water vapour data sets was endorsed. Furthermore, the ESA SPARC Initiative (SPIN) will be invited to present their approach to WDAC. WDAC's 2nd meeting took place in Darmstadt, Germany, from 4-5 March 2013.

Ted Shepherd reported on the WCRP Modelling Advisory Council (WMAC), who, in partnership with the WCRP core projects and working groups, will serve as a focal point for WCRP modelling activities and will advise the JSC and WCRP community on all issues pertaining to modelling. It will regularly assess modelling capabilities within WCRP; identify gaps, overlaps, opportunities for synergy as well as provide advice on priorities for modelling across the WCRP. WMAC aims to facilitate effective communication on modelling issues both within the WCRP and with the broader community. In addition, it will promote capacity development in terms of model development, evaluation, and application. Outcomes of the first WMAC meeting included: (1) WMAC will form a task team with IGBP on prediction of the Earth system; (2) WMAC and the WGNE will act complementarily: WGNE is focused mainly on atmospheric modelling while WMAC addresses the Earth system as a whole; and (3) interactions with end users would generally be dealt with in the existing modelling groups, but if WMAC identifies gaps, it would advise the JSC on appropriate action. It was emphasized that the WMAC is primarily an advisory body and will not take on activities itself.

Shigeo Yoden presented results from a meeting on Sudden Stratospheric Warmings (SSWs) that took place in Kyoto, Japan, in February 2012. He also advertised: (1) a WCRP Regional Workshop on stratosphere-troposphere processes and their role in climate, which took place in Kyoto, Japan, from 1-3 April 2013; (2) the Asia Oceania Geosciences Society meeting, held from 24-28 June 2013, which had a Middle Atmosphere Science session; (3) a SSW symposium that took place during the Davos Atmosphere and Cryosphere Assembly, held from 8-12 July 2013 in Davos, Switzerland; and (4) a meeting during the International Association of Geomagnetism and Aeronomy's General Assembly, to be held in Merida, Mexico, from 26-31 August 2013.

Pablo Canziani advertised the WCRP Special Workshop on Climatic Effects of Ozone Depletion in the Southern Hemisphere: Assessing the evidence and identifying gaps in the current knowledge. The workshop took place from 25 February to 1 March 2013, in Buenos Aires, Argentina (see article this issue).

SPARC items

The SPARC Data Center was established in 1999 and contains a number of important SPARC data sets (see **http://www.sparc-climate.**

org/). A mirror website and ftp database are maintained at Kyoto University, Japan, providing both an external backup and enhanced accessibility. Marvin Geller recently submitted a proposal to NASA for three years of further funding for the SPARC Data Center. The submitted proposal will also serve to continue research activities related to high vertical resolution radiosonde measurements (archived at the SPARC Data Center). A workshop regarding the scientific analysis of these observations was held from 27-29 May 2012 at Stony Brook University. Marvin also proposed a three-year transitioning strategy, which could be applied to migrate the data from the SPARC Data Center to the British Atmospheric Data Centre to ensure the continuity of the provision of these data to the community. At the end of the three transition years, all data storage would cease at Stony Brook University.

Joan Alexander discussed ideas for a new SPARC implementation plan, which needs to be prepared to address new science foci, the WCRP's restructuring, including the Grand Challenges, as well as SPARC's new mandate. This might imply finding a new structure under which SPARC research activities may be integrated (*i.e.* a replacement of the themes in the present implementation plan). The implementation plan should envisage a time frame of approximately 10 years.

The contribution of SPARC to aerosol-related research under the WCRP GCs was also discussed. There are different aspects regarding the influence of aerosols on climate and climate change, one being related to aerosol, cloud and precipitation interactions. SPARC's involvement in this aspect of the "Clouds, Circulation and Climate Sensitivity" GC was discussed at the CCMI workshop (held in Boulder, USA, from 14-17 May 2013). It was also suggested that SPARC may want to connect with AeroCom activities, with mention of a possible collaborative workshop. In addition, SPARC may want to consider greater focus on studies looking at transport and circulation changes that might lead to changes in precipitation patterns.

Carolin Arndt made a short presentation about SPARC communication activities, including the SPARC website (**http://www.sparc-climate.org/**), SPARC eNews and the SPARC Newsletter. Website statistics show that from August to November 2012 the SPARC website was viewed over 9 500 times. To avoid overloading the SPARC community with emails from the SPARC office, workshop and meeting announcements are usually advertised on the SPARC website and then included in the eNews bulletin (sent out via email to about 400 recipients approximately every 2 months). To be sent out through the eNews, announcements need to be sent to the SPARC Office a few weeks before the event takes place (or the deadline for registration expires), so as to reach the SPARC community in a timely fashion.

Carolin Arndt then continued by reporting on ideas for expanding SPARC's capacity development strategy. Several mechanisms were identified, such as mentoring and visiting programmes for scientists from developing countries and the establishment of a SPARC capacity development fund. The possibility of networking with potential partners such as START, APN and the ICTP, amongst others, was also proposed. However, since no SSG members are directly engaged in SPARC capacity development activities it was decided to postpone the discussion of suitable topics to include new SSG members who will begin terms from January 2014. Furthermore, after considerable investigation, it was found that establishing a SPARC capacity development fund at the ETH Zürich (the SPARC Office's current host institution) would not be feasible.

Joan Alexander introduced a joint SPARC-IGAC workshop on Atmospheric Chemistry and the Asian monsoon. The Asian summer monsoon plays a significant role in chemistry-climate interaction, however experimental studies in the region are extremely challenging. The goal of the workshop is to improve collaborative efforts across the international community. This workshop took place in Kathmandu, Nepal, from 9-12 June 2013.

Carolin Arndt and **Greg Bodeker** discussed SPARC's new name, "Stratosphere-troposphere Processes And their Role in Climate", which was selected after consultation with the SPARC community (the SPARC acronym will, however, remain unchanged). For the new SPARC logo, a competition has been run. Initially the SPARC community was asked for contributions and then professional designers were asked to provide and adapt new versions. The SPARC SSG and activity leaders were asked to vote on several options and the final version will be launched at the SPARC General Assembly in January 2014.

Fiona Tummon presented the progress of the implementation of the SPARC community data base, which is currently in the final stages of development. The concept of a new SPARC members' database was presented by Greg Bodeker at the 19th SPARC SSG meeting, held in Zürich (see SPARC newsletter No. 39[11]). Implementation of the

database with an additional web-interface is planned for mid-2013.

The SPARC Office team agreed to produce the first SPARC annual report using updated material from the activity leaders. The demand for such a document and the time required for its preparation will be assessed. The annual report is now available online[12].

Greg Bodeker presented plans for the next SPARC General Assembly, which will take place from 12-17 January 2014 in Queenstown, New Zealand. The outline of the scientific programme was also discussed with Veronika Eyring and Adam Scaife, co-chairs of the Scientific Organising Committee.

After a short discussion regarding action items, **Greg Bodeker** asked the participants about their thoughts on the new format of the SPARC SSG meeting (*i.e.* a short description of activities being provided before the meeting, and then separation of scientific presentations and programmatic discussions during the meeting). All participants approved of the new procedure.
The next SSG Meeting will take place from 19-21 January 2014 in Queenstown, New Zealand, following the 5th SPARC General Assembly.

[11]http://www.sparc-climate.org/fileadmin/customer/6_Publications/Newsletter_PDF/39_SPARCnewsletter_Jul2012_web.pdf
[12]http://www.sparc-climate.org/fileadmin/customer/6_Publications/ProgPlan_PDF/SPARC_Annual_Report_2012_small.pdf

Report on the Regional WCRP/SPARC Workshop with focus on the Southern Hemisphere and South America

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From 26-27 November 2012 the Workshop on Southern Hemisphere and South American Climate was held in Buenos Aires, Argentina, back-to-back with the SPARC SSG Meeting, hosted by the "Centro de Investigaciones del Mar y la Atmósfera" (CIMA). SPARC provides expertise in several key areas related to climate variability and climate change, such as dynamical variability, ozone, stratosphere-troposphere dynamical coupling, gravity waves, temperature trends, and data assimilation, amongst others. The southern hemisphere (SH), and in particular South America, are regions of the world in which research of these key themes is highly relevant, and needs to be expanded and strengthened because the current South American research community addressing these issues is relatively small. The main goal of the Workshop was to gather local researchers interested in different aspects of current and future SPARC research together with participants of the SPARC SSG meeting to promote interaction among researchers and to identify the main SPARC-related research topics of relevance to the region. The Workshop included 22 oral talks and 5 posters, with contributions from Argentina, Brazil, Uruguay, Bolivia, Colombia and Uruguay, combined with contributions from SPARC scientists. The Workshop agenda was broad, covering several different research topics.

Gravity Waves

Biases in SH middle atmosphere winds still exist in many climate models, but in other types of models these biases have been reduced through the application of gravity wave drag parameterizations. One of the key observational quantities used to constrain gravity wave (GW) parameterizations is wave stress or wave momentum flux (MF). **Alejandro La Torre** and **Peter Alexander** identified and simulated GW events above the southern Andes and Antarctic Peninsula, with significant MF occurring at low levels and then decreasing with height. Partial reflection, wave breaking and absorption at critical layers seem to explain the momentum deposition accompanying decreases in GW MF. A prevailing negative zonal component of MF was observed almost everywhere, in agreement with the orographic source hypothesis.