



## Report on the 17<sup>th</sup> Session of the SPARC Scientific Steering Group

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The 17<sup>th</sup> Session of the SPARC Scientific Steering Group (SSG) was held at the University of Kyoto, hosted by SSG member Professor Masato Shiotani. This year the SPARC SSG meeting was held concurrently with the IGAC SSC meeting in the same location. These meetings were immediately preceded by a local workshop, jointly sponsored by the Japanese SPARC and IGAC communities. This workshop was well attended and featured invited and contributed talks from the Japanese and international SPARC and IGAC communities as well as an excellent poster session.

The SPARC and IGAC groups met separately except for a joint day during which issues of common interest were discussed. However, break periods and social events were held in common. This was an effective way to promote interactions between the two groups.

### WCRP Update

Following a brief opening session, **V. Ryabinin** and **G. Asrar** presented an update on recent developments and new perspectives within the WCRP and outcomes of the World Climate Conference-3 (WCC-3; see the report on WCC-3 by V. Ryabinin in this Newsletter). The WCRP perspective on planning includes two time periods with different overarching foci. In the next 3-5 years (2010-15), the emphasis will be on

implementing the WCRP Strategic Framework (COPEs) through the WCRP Implementation Plan for the Core Projects and Panels and Cross-WCRP Initiatives. In the longer term (post 2015 period) a restructuring of the WCRP will likely be required to ensure a continuing effective alignment with the scientific issues of the time and to achieve the long-term goal of more effective interactions with users of climate information products.

Within the past two years substantial effort has gone into developing the WCRP Implementation Plan. The broad aims of this plan are: (a) to outline the major challenges in research on physical components of the climate system: the oceans, cryosphere, water and energy cycle, atmospheric chemistry and dynamics, and the complex interactions within and among them; (b) to list specific activities that will help WCRP to deliver science in support of societal needs; (c) to identify and facilitate new scientific thrusts: decadal predictability, sea-level variability and change, climate extremes, and atmospheric chemistry-climate interactions; and (d) to maintain ongoing areas of investigation: climate change projections, seasonal predictions, monsoons, and polar research.

All of the WCRP Core Projects contribute in varying degrees to some or all of the topics in (c) and (d), which represent the inte-

### Contents

Report on the 17<sup>th</sup> Session of the SPARC Scientific Steering Group, by N. McFarlane *et al.*.....1

The Next SPARC General Assembly, by T. Peter and T. Shepherd .....8

WCC-3, not just “another climate conference,” by V. Ryabinin .....9

SPARC Volcano Workshop, by P. Heckendorn *et al.*.....10

Report on the SPARC data assimilation meeting at MOCA-09, by S. Polavarapu and D. Jackson.....15

The Stratosphere-Troposphere Analyses of Regional Transport 2008 (STRAT08) Experiment, by L. Pan *et al.*.....18

The EU project SHIVA (Stratospheric ozone: Halogen Impacts in a Varying Atmosphere), by K. Pfeilsticker *et al.*.....24

Future Meetings.....28

grating themes of the Implementation Plan. (The SPARC contribution is summarised in Newsletter No. 33 and also posted on the SPARC web site: <http://www.atmosph.physics.utoronto.ca/SPARC/index.html>) While details of the long-term (post 2015) strategy remain to be worked out, the new WCRP functions and structure will be determined to facilitate research on the frontiers of the climate/Earth system and promote the availability and use of science-based climate information, products and services.

An important upcoming event is the WCRP Science Conference 2011, which will have as its main theme “Scientific Knowledge for Climate Adaptation, Mitigation and



Risk Management". The main motivations for holding this conference are to provide input to IPCC AR5, to evaluate progress on implementing COPEs, to facilitate the future strategic evolution of the WCRP, to strengthen cross-connections between WCRP activities, and to mark the 30<sup>th</sup> anniversary of the WCRP. The conference will be comprised of symposia on cross-cutting themes/topics. The likely location will be in the USA. Jim Hurrell (Co-Chair of CLIVAR) has agreed to chair the Scientific Organising Committee.

**T. Peter** summarised key outcomes of the last WCRP JSC meeting and their importance for future SPARC activities and evolution (see the report on the 30<sup>th</sup> Session of the JSC in SPARC Newsletter No. 33, July 2009). From a SPARC perspective, the direction for future development of WCRP is seen to be a very positive one, which recognises the value of past WCRP achievements and provides stability for future planning.

### SPARC-IGAC Regional Workshop

2 **M. Shiotani** presented an overview of the IGAC-SPARC regional workshop. The theme of this workshop was "The One Atmosphere". The workshop was very successful and highlighted the strengths and impressive achievements of the IGAC and SPARC communities in both measurement and modelling. In particular, Japanese modellers are world leaders in the development and use of high-resolution global atmospheric models for a wide range of applications.

### Overview of SMILES and PANSY

M. Shiotani also reported on observational data from the Japanese Superconducting Submillimeter-Wave Limb-Emission Sounder (SMILES) which was designed to be aboard the Japanese Experiment Module on the International Space Station (ISS). SMILES was successfully attached to ISS, and has been performing very well. Comparison with reference data and validation data will enhance the confidence in the retrieval results.

**K. Sato** reported on the Program of the Antarctic Syowa Mesosphere - Stratosphere - Troposphere (MST) / Incoherent Scatter (IS) Radar (PANSY) for which an operating budget has been approved. This radar will cover the height range from 1 km in the

troposphere to 500 km in the ionospheric F region. It has capability of both MST and IS radars to provide observations of three-dimensional winds and plasma parameters such as electron density and plasma (electron and ion) temperatures with fine time and height resolutions. It is expected to enable a wide range of science projects that will elucidate features of Antarctic weather and circulation patterns.

### Joint SPARC/IGAC Day

At their joint session the SPARC SSG and IGAC SSC reviewed progress on activities of common interest and explored areas where closer interaction and collaboration is desirable.

### Cross-cutting SPARC/IGAC Activities and Issues

#### CCMVal

**V. Eyring** presented an overview of the SPARC CCMVal activity. A major focus of CCMVal is supporting the WMO/UNEP Ozone Assessments (2006, 2010) and the IPCC Assessment Reports (AR4, AR5) through coordinated chemistry-climate model (CCM) simulations for the recent past and present, and projections for the remainder of the 21<sup>st</sup> century, accompanied by a diagnostic evaluation. Output from CCMVal-1 simulations has been collected in the central CCMVal database at the British Atmospheric Data Centre (BADC). Evaluation diagnostics have been obtained from various observational data sets. Currently around 60 CCMVal Collaborators are working with CCMVal output, and numerous CCMVal-1 papers have been published.

Multi-model evaluations have revealed important differences among models and have demonstrated the advantage of a multi-model evaluation strategy, but the results of CCMVal-1 were somewhat unsatisfying from an assessment perspective. This led to an effort to develop quantitative performance metrics. The CCMVal metrics development has come at an opportune time to mesh with other similar efforts within the WCRP and the IPCC. A WGNE/WGCM metrics panel has been established and an IPCC Expert meeting on "Metrics" and "Assessing and Combining Multi-model Climate Projections" will be held in January 2010, at NCAR, Boulder, USA.

CCMVal-2 is now well underway with 18 models participating. The reference time period for the simulations begins earlier (1960) than for CCMVal-1 and most simulations extend throughout the 21<sup>st</sup> century. The earlier starting date allows a more accurate determination of the milestone when total ozone returns to pre-1980 levels. The extended period of the simulations allows systematic multi-model ozone projections and an analysis of the causes of these projected changes throughout the 21<sup>st</sup> century.

A major undertaking of CCMVal this year has been the production of the SPARC CCMVal Report on Evaluation of CCMs. The report timelines have been followed with the final review meeting in Toledo, Spain held in November 2009, followed by final revisions in December and a projected publication in the second quarter of 2010. The CCMVal Report will provide critical input to the 2010 Ozone Assessment.

The draft outline for IPCC WG1 AR5 has been prepared and includes a number of entry points for CCMVal and IGAC-SPARC activities. In addition, an interesting entry point of AR5 WG2 may be the combined effects of ozone recovery and climate change on human health.

### Atmospheric Chemistry and Climate (AC&C)

The AC&C activity is a cross-cutting initiative between the WCRP and IGBP with IGAC and SPARC having joint responsibility for it. **P. Rasch**, IGAC co-chair of AC&C, reported on the status of this activity. A. Ravishankara has stepped down as the SPARC co-chair and Martyn Chipperfield has replaced him.

Phase I of AC&C involves a number of modelling activities: (1) 20-year hindcast; (2) determination of what controls the vertical distribution of species in the upper troposphere; (3) cloud-chemistry interactions; and (4) sensitivities and uncertainties of future scenarios. Plans were firmed up at the 2<sup>nd</sup> AC&C workshop held jointly with HTAP in June 2008. From the perspective of IPCC assessments, the paradigm for the Phase I activities has been shifted from preparing models for IPCC runs to facilitating, and coordinating some of the model runs relevant to IPCC.

The interface of Phase I hindcast activities with CCMVal is that, for 'whole at-

mosphere' models, the chemistry needs to build on recent CCMVal REF-B1 simulations (1960-2005). Full chemistry specifications need to include stratospheric forcings and boundary conditions. Other remaining issues include the starting time (CCMVal hindcasts start in 1960 while those with a tropospheric focus start in 1980; in order to harmonise these specifications, tropospheric emissions would need to be prescribed from 1960).

#### *IPCC and CMIP5*

The WCRP JSC/CLIVAR Working Group on Coupled Modelling (WGCM) facilitates intercomparison and evaluation of coupled ocean/atmosphere/land models (CGCMs) for climate studies. Because of its close ties to the major modelling groups and centres, WGCM also coordinates CGCM modelling support for the IPCC assessments. SPARC SSG member V. Eyring is also a member of WGCM, which provides a liaison between AC&C, SPARC and WGCM activities.

The GCM input to IPCC AR5 will be provided in the context of CMIP5. The forcing data sets for CMIP5 (accessible via the CMIP web site <http://cmip-pcmdi.llnl.gov>) will include the AC&C / SPARC Ozone Databases that have been constructed to provide a merged tropospheric / stratospheric ozone time series from 1850 to 2100 for use in CMIP5 simulations without interactive chemistry. The future database (2010-2099) utilises a multi-model CCMVal-2 mean for the stratosphere combined with tropospheric ozone projected using the Community Atmosphere Model (CAM) version 3.5

#### *Halogen Chemistry Activity*

**M. Kurylo** summarised the issues that motivated the SPARC Halogen Chemistry Initiative and its major outcomes. The ClOOCl photodissociation cross section has been the largest source of uncertainty in the description of the polar ozone loss chemistry. Recent laboratory measurements fell clearly outside the range of uncertainty defined by prior studies, leading to much debate within the atmospheric chemistry community. A detailed report from a SPARC workshop that was held in Cambridge (June, 2008) is available electronically under <http://www.atmosp.physics.utoronto.ca/SPARC/index.html>. Results of several new laboratory studies (published or about to be published) convincingly show that the previous understanding of chlorine-catalyzed ozone

loss in the polar stratosphere was correct. The SPARC Initiative played an important role in fostering this new work.

#### *Laboratory Studies*

**P. Monks** commented on the role and status of laboratory-based studies in atmospheric science and summarised some recent developments. He noted that, although laboratory studies are fundamental to atmospheric science and drive innovation, they are under threat due to the indifference of funding agencies. There is an urgent need to highlight this situation with respect to laboratory work in the international arena.

The EUROCHAMP consortium is an exemplary laboratory collaboration. It links 14 European institutes, each of which possess unique, well equipped, custom-built chambers for studying atmospheric processes. This consortium has integrated existing chambers into a Europe-wide infrastructure that is continuously open to new members/users within EUROCHAMP-2. This has led to creation of the first large-scale open data base of experimental data from atmospheric simulation chamber studies.

#### *The Extratropical UTLS, Convection and the TTL*

**M. Barth** presented a brief overview of the workshop entitled "The Extratropical UTLS: Observations, Concepts and Future Directions", which was held in Boulder CO, October 19-22, 2009. The workshop was co-sponsored by the NSF and SPARC and well attended (approx. 90 participants). The program consisted of overview talks, contributed talks and posters organised under the topics of dynamical structure, chemical structure, transport and stratosphere-troposphere exchange, chemistry and microphysics. A SPARC Newsletter article reporting in more detail on the workshop is in preparation. Plans for additional publications include an "IGACTivities" article and a summary white paper.

M. Barth also presented an overview of recent studies of the role of convection and chemistry in the tropical tropopause layer. The 2006 SPARC/IGAC/GEWEX workshop (reported upon in Newsletter No. 28) brought together scientists from the three communities and produced a list of longer term goals, which included establishing a working group composed of members of each of the three communities to develop a framework for collaborative research.

Although this working group has not come into being, the workshop has influenced activities within each of the communities. The GEWEX community has implemented suggestions from the 2006 workshop (higher model top, tracers in CRMs). Large-domain, cloud-resolving-scale simulations are beginning but are at early stages – none so far include tracers and/or chemistry. Several of the presentations in the regional workshop attest to Japanese leadership in this field.

For future work there have been suggestions of promoting an idealised case study that would explore the role of cloud microphysics in the TTL water vapour budget, but not with chemistry. An AMMA case study may also meet the needs of large-scale dynamics, cloud physics and chemistry. Another TTL-UTLS workshop may be timely. The AC&C Activity would be an appropriate context for a rejuvenated focus on the role of convection in the TTL.

#### **Discussions on WCRP/SPARC, IGBP/IGAC perspectives and programmatic issues**

Discussion periods were scheduled at several points to ensure an effective exchange of thoughts and ideas on a wide range of issues for SPARC as well as those of common interest to SPARC and IGAC and their parent programmes.

**S. Seitzinger**, Executive Director of IGBP, summarised recent developments in IGBP. The ICSU review of IGBP in 2009 highlighted the need to prioritise and engage in strategic interactions with other partner programmes in GEC research. Initial topics for the IGBP Integration, Synthesis and Exploration theme were identified at the 2009 SC meeting for IGBP, three to receive initial funding from IGBP (Earth-system impacts from changes in the cryosphere, Megacities and coastal zones, GEC and needs of least developed countries). These will contribute to the ICSU Visioning Process which addresses five grand challenges: (1) create the capability to forecast future global environmental conditions and their consequences for people; (2) develop the observation systems needed to manage Global Change; (3) determine how to anticipate, avoid and cope with dangerous Global Change; (4) determine how to achieve collective social action in response to Global Change; (5) develop and evaluate innovative responses

to Global Change. An IGBP Open Science Conference will be held in 2012. Its theme will be “Planet Under Pressure: New Knowledge, New Solutions”.

For the WCRP, G. Asrar emphasised the need to foster excellence and progress in science, while addressing the demands from sponsors to respond to societal needs and challenges. Funding agencies relate to science if they perceive that new knowledge is being integrated into efforts to address these demands. He noted again the main features of the WCRP Implementation Plan in which the overarching theme of prediction engages the whole range of current WCRP activities. Important emerging issues include determining what is required of future generations of Earth system models and engaging, supporting, and training young scientists.

**K. Law** summarised key outcomes from the workshop on IGAC Future Directions, held in London in September, 2009. The background for this workshop included the ending of IGBP Phase 2 in 2012/13 and ICSU’s reflections about a future structure. The workshop objectives were to examine IGAC science priorities and possible future implementation strategies and structure for coordination of research in atmospheric chemistry. The basic features of the future IGAC structure suggested from deliberations at the London workshop can be summarised as a combination of thematic projects driven by societal needs and coordination of fundamental science addressing big picture questions.

Ideas for thematic projects addressing societal needs could be developed and implemented within AC&C as joint SPARC and IGAC activities. Possibilities for future logistical linkages with SPARC were also discussed at the London workshop. Some possible options include: (a) stay the same as at present with independent IGAC and SPARC projects; (b) stay the same plus create a common coordination structure for fundamental research (*e.g.* related to Atmospheric Chemistry in the Earth System for shorter term foci < 2-3yrs); (c) evolve into a new structure with cross-cutting thematic programmes and common coordination (longer term > 5yrs); (d) merge into one programme on Atmospheric Chemistry in the Earth System (longer term). Although there were mixed opinions on structure options, the London Workshop revealed

strong support for closer coordination between SPARC and IGAC and further discussion.

T. Peter summarised the SPARC Legacy document that was prepared as part of the forward-looking process. It emphasises three issues of abiding concern for SPARC: (a) chemistry-climate model validation, (b) assessment of key uncertainties in measurements, and (c) linking various scientific communities.

In the general discussion it was evident that both SPARC and IGAC and their parent organisations (WCRP and IGBP) have recognised the need to embrace new perspectives and objectives. A key principle for success in programmatic developments is that organisational forms and structures must serve the functional requirements that evolve from the combined demands of the science and societal needs. These are continuously evolving and pose ongoing challenges for programme development.

While SPARC and IGAC have much in common, have complementary activities, and benefit by strong ties with each other, they also have distinct foci. The SPARC and IGAC communities may also have different perceptions of how their respective programmes and objectives could benefit (or be harmed) by major changes such as a merger of SPARC and IGAC. Regardless of future programmatic developments, their shared responsibility for the WCRP/IGBP cross-cutting AC&C initiative mandates continued close interaction. In particular, the role of CCMVal should be enhanced in the future to involve a stronger connection to tropospheric chemistry climate models. Although it will continue to focus on climate issues, SPARC may be able to contribute to and complement the strong IGAC focus on air quality through CCMVal.

Whilst it is clear that addressing tropospheric processes in a comprehensive way is beyond its present scope, SPARC must continue to contribute to the understanding of the close dynamical and physical/chemical coupling between the stratosphere and troposphere. These interactions occur on a wide range of spatial and temporal scales, which underlines the importance in this context of devoting more attention to shorter time scale effects, for example the role of the stratosphere in short to medium range prediction and the coupling between

stratosphere and troposphere in such prominent tropospheric circulation systems as the monsoons.

## SPARC Themes

### *Detection/Attribution/Prediction*

#### WAVAS-2

**C. Schiller** summarised progress on the WAVAS-2 Assessment, which is proceeding well. Author and Planning meetings were held in 2009. Chapter meetings will be held in spring and summer of 2010 with a final review meeting to be held near the end of 2010. The expected publication date for the report is mid 2011.

The WAVAS-2 report will have five chapters. In addition to an ‘Introduction and Synthesis’ chapter, it will include chapters on Data Quality, Supersaturation, and UTS Climatology and Trends. The AquaVIT intercomparison will be discussed among other topics in the Data Quality chapter. A white paper on this campaign is available at <https://aquavit.icg.kfa-juelich.de/AquaVIT/>.

#### *Seasonal and decadal prediction/WGSIP*

**A. Scaife** presented an overview of the activities of the CLIVAR Working Group on Seasonal to Interannual Prediction (WGSIP). There are three main foci for WGSIP activities: numerical experimentation for seasonal-to-interannual variability and predictability; data assimilation, initialisation and seasonal-to-interannual forecasts; advising the CLIVAR SSG on the status of seasonal-to-interannual forecasting.

It is now well recognised that accounting for the influence of the stratosphere remains a largely untapped source of predictability. Key elements of interannual to decadal variability are strongly influenced by stratospheric processes.

The Climate-system Historical Forecast Project (CHFP) would benefit from SPARC participation. The models involved hitherto have been typical of those used for IPCC assessments. A stratospheric extension of the CHFP is now being undertaken by WGSIP. This will involve hindcasts parallel to the WGSIP-CHFP with extended models using the same initial ocean data. Several of the major modelling groups have indicated intentions to participate. SPARC contribu-

tions to key diagnostic projects utilised the model output would be very valuable.

## Stratosphere-Troposphere Dynamical Coupling

**S. Yoden** summarised some recent work by Japanese scientists in the general area of stratosphere-troposphere dynamical coupling. The Japanese research project entitled “Assessment of the Stratospheric Effects on Climate Change and Elucidation of their Dynamical Role” includes a group of leading Japanese dynamicists and modellers as coinvestigators. S. Yoden also noted that the XXV IUGG General Assembly (28 June - 7 July 2011, Melbourne, Australia) will include a number of middle atmosphere symposia proposed or co-sponsored by ICMA as well as an ICMA-SPARC joint symposium entitled “Stratospheric Processes and Their Role in Climate Focused on the Southern Hemisphere” and an IAMAS-IAGA joint symposium entitled “External Forcing on the Middle Atmosphere and Lower Ionosphere”.

### *DynVar*

P. Kushner has stepped down as coordinator for the DynVar activity. **E. Manzini** has agreed to take over this responsibility. She reported on the status and plans for the DynVar activity. A full-scale model intercomparison was initially planned. However, given the emphasis by many of the modelling groups on CCMVal activities in the last few years, additional coordinated runs were not feasible, and a DynVar workshop was not held in the past year. A substantial amount of the applied and theoretical research that was proposed for DynVar has actually been done by different groups in the past two years. While the long-term goals of DynVar are unchanged, E. Manzini has undertaken a restructuring of the DynVar activity to facilitate future efforts. The running of the activity is conducted by the coordinator in consultation with the DynVar Committee (Marco Giorgetta, Judith Perlwitz, Lorenzo Polvani, Fabrizio Sassi, and Adam Scaife), who provide a broad array of expertise.

A new aspect of DynVar is to establish a SPARC-CLIVAR connection focused on the role of the stratosphere on weather and climate predictability. In the coming years, an optimal way for DynVar to pursue its goals is to exploit the data sets that will be produced for assessment purposes,

such as the high-top CMIP5 runs, and the stratospheric seasonal prediction hindcasts produced as part of WGSIP's Stratosphere Historical Forecast Project (SHFP) with high-top models. A DynVar workshop is being planned for late 2010, likely in Boulder, CO, USA. Further details and information on the DynVar activity and forthcoming workshops will continue to be posted on the SPARC DynVar website, [www.sparcdynvar.org](http://www.sparcdynvar.org).

## Chemistry-Climate Coupling

### *WMO/UNEP Ozone Assessment Update*

**G. Bodeker** presented an update on the status of the 2010 WMO/UNEP Scientific Assessment of Ozone Depletion. There will be a number of key SPARC contributions to the report. It will be the first assessment to consider the effects of stratospheric change on climate. The availability of the CCMVal report on Evaluation of Chemistry-Climate Models removes the requirement to include model evaluations as part of the assessment. The availability of the Report on Halogen Chemistry resolves the recent disconcertment about the CIOOCI UV absorption cross-section measurements. The availability of CCMVal sensitivity simulations would allow a more refined analysis of the effects of climate change on ozone recovery. The target date for the availability of the final version of the assessment report in preprint form is December 30, 2010 with a final distribution of printed copies by March 2011.

The SPARC special report on CCM validation will be valuable to the 2010 ozone assessment. It is now timely to include its role in the 2014 ozone assessment in the planning for CCMVal-3 in concert with other AC&C activities.

## Cross-Cutting Issues

### *The Polar Initiative*

The role of the polar regions in climate was raised by SPARC at the 2008 meeting of the WCRP JSC as an important cross-cutting issue for the WCRP in the near future. The JSC endorsed an effort aimed at using IPY results and other available knowledge and capacity to undertake an assessment of polar predictability at various time scales. V. Ryabinin reviewed progress and current efforts to move this initiative forward. Follow-on discussion between SPARC, JPS, and other WCRP projects have suggested

an overall focus on the interaction of polar regions with lower latitudes, processes that affect the poles, and interactions between various components of the climate system in the polar regions. The initiative will take advantage of opportunities such as the revolution in ocean *in situ* observations and their assimilation, IPY data, and the possibility of an International Polar Decade (IPD).

A scoping workshop is planned to exchange thoughts and information between various WCRP communities on polar prediction. T. Shepherd has agreed to serve as chair of the Scientific Organizing Committee (SOC). The target date for the workshop is late 2010. A Polar Initiative web site will be established and maintained by the SPARC Office.

### *Geoengineering*

Because of the inadequacy of global CO<sub>2</sub> emission reductions, the potential need to look to geoengineering to mitigate the surface warming due to increasing atmospheric CO<sub>2</sub> has become a topic of serious discussion in the broader scientific community. This has motivated the forthcoming comprehensive Royal Society report on geoengineering. T. Peter gave an overview of this discussion, and of recent modelling results relevant to the effect of the Crutzen proposal to introduce and maintain an artificial stratospheric aerosol layer as a means of offsetting the surface warming associated with increasing CO<sub>2</sub>. The aerosol size distribution is important in determining any such effect. The validity of the particle size assumptions in the Crutzen proposal and some other initial modelling studies have been questioned in more recent studies that account for microphysical processes in the evolution of the aerosol size distribution. Formation of larger particles than after volcanic eruptions may accompany continuous SO<sub>2</sub> emissions in the stratosphere. Potential repercussions include a warmer tropopause, moister stratosphere, changed dynamics, and more ozone loss.

The question of what role SPARC should play in the debate on geoengineering (specifically in response to the Crutzen proposal) was first raised, but not resolved, at the 2007 SSG meeting in Bremen. As government interest in geoengineering is growing rapidly, it is vital for organisations such as SPARC to facilitate research that clarifies the benefits, dangers, unintended conse-

quences, feasibility, and other scientific aspects of the issues, so that policy-makers can make well-informed decisions.

### *Gravity-wave Initiative*

**J. Alexander** reviewed progress and current objectives of the gravity-wave activity. A major outcome of the 2008 workshop (see the report in SPARC Newsletter No. 31) has been the preparation of a review paper: "A Review of Recent Developments on Gravity Wave Effects in Climate Models and the Global Distribution of Gravity Wave Momentum Flux", which has been submitted to the Quarterly Journal of the Royal Meteorological Society.

A number of key issues remain to be explored further and understood better. This has motivated additional new activities for the coming two years. The Gravity Wave Project - An International Team for Merging Space-Based Observational Constraints for Gravity Wave Parameterizations in Climate Models has been funded by the International Space Science Institute (ISSI). The goal of the project is to create a self-consistent data set of atmospheric gravity wave momentum fluxes and propagation properties suitable for climate and weather forecasting applications. The SPARC SSG has endorsed this project. Complementary to this new activity a Chapman Conference proposal has been submitted to the American Geophysical Union for a conference entitled "Atmospheric Gravity Waves and their Effects on the General Circulation and Climate". There have been recent advances on this topic and the community is growing. The meeting would provide a chance for this community to come together to assess the recent results and forge the interdisciplinary collaborations that are needed to address the current issues. The SPARC SSG endorsed co-sponsorship of this conference.

### *Solaris*

**K. Kodera** presented an update on the SOLARIS activity. The modelling initiatives within this activity have been to a considerable extent superseded by the CCMVal requirements in the past year. There are a number of outstanding issues concerning observing and modelling the atmospheric response to variability of solar forcing. Inhomogeneity in long-term observational data and the stability of analyses using short-term data are factors in evaluating solar variability signals. Some

analysis methods (*e.g.* multiple regression) may also be problematic because forcings may be correlated (*e.g.* both SSTs and the QBO have decadal-scale variations) and responses are nonlinear and dependent on the basic state. Model biases (*e.g.* the tendency for planetary waves to propagate too easily toward the equator in some CCMVal-2 simulations) are also a factor in simulating the response to solar variability. The importance of resolving the spectrum of solar variability in modelling experiments needs to be assessed. The next SOLARIS workshop will be held in March, 2010 at the GFZ German Research Centre for Geosciences in Potsdam, Germany.

In a brief presentation, **M. Geller** drew attention to recent discussions between SCOSTEP, IAGA, and other parts of IUGG to assess how well the IPCC has looked into the role of solar forcing in global climate change.

### *Data Assimilation Working Group (SPARC-DAWG)*

**S. Polavarapu** summarised aspects of presentations in the SPARC-DAWG meeting that was held in conjunction with MOCA-09, as well as from selected data assimilation papers in the MOCA-09 conference. Invited talks in the SPARC-DAWG meeting dealt with using data assimilation (DA) to identify sources of error in tropospheric climate predictions, using DA to identify missing or incorrectly represented forces in climate models, and the role of DA in prediction. Although holding the SPARC-DAWG meeting in conjunction with the MOCA-09 meeting offered the opportunity to bring the work of the SPARC-DAWG to the attention of a wider audience, competition from parallel sessions was a significant distraction. The 2010 SPARC-DAWG dedicated workshop will be hosted by the Met Office in Exeter, UK.

### *Proposal for a SPARC Data Initiative*

**S. Tegtmeier** and **M. Hegglin** presented a proposal for an initiative to address a number of outstanding issues highlighted by the CCMVal activity in regard to the availability and use of chemical observational data sets. While a variety of such data sets are available, it is not necessarily known which data set is most reliable for a particular application. Conflicting results may be obtained when comparing models to different data sets. In the context of CCMVal, scores for a specific diagnostic are dependent on

the data set used, making comparisons less meaningful and increasing uncertainties in assessments. Similar difficulties were manifest in regard to comparing and evaluating middle atmosphere model climatologies in the context of the GRIPS project and led to the production of the SPARC Intercomparison of Middle Atmosphere Climatologies (SPARC Report No. 3). There is a need for a similar assessment of the available data sets for chemical trace gases. The proposed report and associated climatologies will offer guidance for the use of chemical trace gas observations from space based instruments. It will involve the following steps: (a) establishing a data portal for chemical observations in collaboration with the space agencies and assessing the state of data availability; (b) compiling climatologies of chemical trace gases (*e.g.* zonal means, variability, seasonal evolution, annual means) in collaboration with the instrument PIs; (c) creating a detailed inter-comparison of these climatologies, summarising useful information and highlighting differences between the data sets.

The proposal was endorsed by the SSG. The initial action will be to hold a workshop in early 2010 to assemble the author team, define the report structure, and address issues involved in coordination of the data initiative. The target completion date for the report is May 2012.

## **Connections with WCRP Projects and Panels**

### *CLIVAR*

**H. Cattle** (director of the CLIVAR IPO) gave an overview of the CLIVAR Project and highlighted activities which have common interests and links to SPARC. The overall mission of CLIVAR is to observe, simulate and predict changes in the Earth's climate system with a focus on ocean-atmosphere interactions, enabling better understanding of climate variability, predictability and change, to the benefit of society and the environment in which we live. CLIVAR has a number of working groups and panels, some of which address issues that are related to SPARC activities and themes, for example the JSC/CLIVAR WG on Coupled Modelling (WGCM) and the WG on Seasonal to Interannual Prediction (WSGSIP), both of which have been noted above.

There are a number of CLIVAR-SPARC

links that are well established and others that are being established (*e.g.* through WGSIP as discussed by A. Scaife). There are also potential SPARC links to CLIVAR/GEWEX monsoon studies. A SPARC/CLIVAR Workshop on 'The role of the stratosphere in seasonal, decadal and longer-term climate predictability' may be worthwhile in the near future. There are also potential SPARC links to CLIVAR/GEWEX monsoon studies.

#### WOAP

The last WOAP meeting (WOAP-3) was held in Boulder in September, 2008 and reported upon at the 2008 SPARC SSG meeting. WOAP-4 will be held in March, 2010. Key issues of concern to SPARC that may be addressed include (a) possible WOAP actions to address gaps in satellite ozone and trace gas profile measurements, (b) Essential Climate Variables, (c) SPARC input and requirements for reanalysis, (d) reprocessing of stratospheric data sets/SPARC data initiative, and (e) SPARC data management issues that may need to be addressed by the WOAP Task Group on Data Management (TGDM).

### Coordination with Other Agencies and Programmes

#### Space Agencies

#### JAXA Earth Observation Satellite Programs associated with SPARC

**T. Igarashi** presented an overview of the long-term plan of JAXA Earth Observation, SPARC related observations, sensors, space platforms and data products. JAXA has been developing, operating, and providing data for the atmospheric research and climate change science communities and user organisations. GOSAT L1 products will be released on 30 October 2009, and L2 and upper level products will be released at the end of January 2010. SMILES first data obtained on 12 October 2009 were released on 19 October 2009. For the future programmes, considering scientific significance and societal needs, JAXA is conducting R&D of geostationary atmospheric and meteorological observation sensors for the monitoring of air pollution, air quality and weather (vertical profile of temperature, water vapour), sounders and lidars expected for 3D profiling as well as radars. Climate change challenges JAXA to tackle the integration of multi-satellite data, weather and climate models. There are many pos-

sibilities of international collaboration such as NPOESS/GCOM, OCO/GOSAT, GPM, EarthCARE, *etc.*

#### Canadian Missions, Activities, and Mission Concepts relevant to SPARC and IGAC

**T. Piekutowski** presented an overview of Canadian Space Agency activities, currently operational and planned instruments and missions. The Canadian atmospheric science community has a long-standing interest and expertise in atmospheric composition and dynamics. The CSA invests in space-borne atmospheric remote sensing, in production and validation of high quality data, and in interactive chemistry-climate modelling. The CSA is likely to continue investing in atmospheric science missions that help to understand ozone recovery, air quality and the processes linking these with climate. The CSA places great value in partnerships with Canadian scientists, government departments and industries, international organisations and with other space agencies. The CSA supports the science operations of ACE-FTS, MAESTRO, OSIRIS and MOPITT through contracts to the Universities of Waterloo, Toronto and Saskatchewan. The CSA also supports a range of validation, modelling, and international research activities including intensive ACE validation campaigns at the Polar Environmental Research Laboratory (PEARL), the Canadian Middle Atmosphere Model and its Data Assimilation System (CMAM-DAS) through the C-SPARC Network, and the SPARC International Project Office.

#### NASA Space-Based Research Activities, NDACC activities

M. Kurylo gave an update on current and planned NASA activities and missions of relevance to SPARC. NASA's Earth Science Division recently completed its biennial senior review to determine those missions that will continue to be funded for operation beyond their primary design life. Nearly all of NASA's Earth Science satellites fell under this review, including Aura, CALIPSO, and Aqua (*i.e.*, missions with some sensitivity in the UTLS). All of these missions were extended for 2 years with a provisional additional 2 years (pending the next senior review). M. Kurylo also summarised the status of several existing and planned atmospheric chemistry missions and summarised developments and some features for the proposed NASA-CSA Chemical and Aerosol Sounding Satellite

(CASS). M. Kurylo also gave an overview of NDACC activities pertinent to SPARC. Examples include observation campaigns, the Working Group on Water Vapor, and NDACC/GAW/IGACO Ozone Theme Meetings.

#### ESA PREMIER Mission

M. Hegglin presented an overview of the ESA PProcess Exploration through Measurements of Infrared and millimetre-wave Emitted Radiation (PREMIER). PREMIER is a candidate mission for implementation by ESA competing for selection in early 2011 (after a user consultation meeting in late 2010). The mission objectives are (a) to investigate processes controlling global atmospheric composition in the UTLS by resolving 3-D structures of trace gases, thin cirrus and temperature in this region on finer scales than has previously been possible from space, and (b) to study links with surface emissions and pollution by exploiting synergies with nadir-sounders on EPS-Metop. For the first time, 3D-distributions of various atmospheric variables will be observed from space in the height range most important to climate. The high-resolution observations will allow a better quantification and characterisation of the complex dynamical and chemical processes in the UTLS. The development schedule is compatible with launch during 2016 as Earth Explorer 7 (PREMIER assessment report).

#### WMO-GAW

**L. Jalkanen** gave an overview of the WMO Global Atmosphere Watch Programme (GAW). GAW is the atmospheric chemistry component of the Global Climate Observing System (GCOS). GAW focuses on global long-term networks for greenhouse gases, ozone, UV, aerosols, selected reactive gases, and precipitation chemistry. GAW is a partnership involving contributors from 80 countries and collaboration with other networks, projects and initiatives. GAW is coordinated by the Atmospheric Environment Research Division (AER) of WMO Research Department. Currently, GAW coordinates activities and data from 26 Global, 410 fully operational Regional, and 81 fully operational Contributing stations. The GAW Strategic Plan (GSP) for years 2008-2015 has overarching themes of long term systematic monitoring of atmospheric chemical and physical parameters globally, analysis and

assessment, and development of a predictive capability. GAW publications include annual WMO Greenhouse Gas Bulletins and WMO Arctic and Antarctic Ozone Bulletins. These are available through its web site ([http://www.wmo.int/pages/prog/arep/gaw/gaw\\_home\\_en.html](http://www.wmo.int/pages/prog/arep/gaw/gaw_home_en.html)), which also provides a comprehensive summary of its programme and products.

### SPARC Programmatic Issues

#### *WCRP Science Conference/SPARC General Assembly*

After considerable discussion the SSG decided to defer the next GA to 2014. See the short article by the SPARC co-chairs below explaining this decision.

#### *The SPARC Data Center*

**P. Love**, the new SPARC Data Center Scientist, gave a brief update on the status of the Data Center. Support for the SPARC Data Center is provided by NASA and is currently committed through August, 2010. System and memory upgrades in the last 2 years substantially increased the system capacity, which now substantially exceeds the current usage. An online plotting facility is under development.

#### *Update on SPARC Office Activities and Funding Status*

During the past year the SPARC-IPY activity has wrapped up. The SPARC Office operational activities in the last year have included publication of newsletters (#32 and #33), providing local organisational assistance for the WAVAS-2 and CCMVal workshops, and coordinating travel funding for SPARC workshops (WAVAS-2, CCMVal, Volcano, ExT UTLS, Limb) and for the SPARC SSG meeting. In addition, the normal operational activities include ongoing interaction and cooperation with the WCRP JPS and other WCRP projects and working groups on a range of issues and actions.

The mandate of the Canadian Foundation for Climate and Atmospheric Sciences (CFCAS) has recently been extended for one year but there is no indication that there will be a further extension and its operation is expected to wrap up in early 2012. The largest portion of the cash support for the SPARC IPO is provided by CFCAS. An application to CFCAS for extension of support for the SPARC IPO through December 31, 2011 has been approved. There are no prospective Canadian funding sources to replace the CFCAS support beyond the

end of its mandate. In the absence of this support it will not be possible to maintain the SPARC IPO in its current location after 2011. Alternative locations and sources of support are being considered.

### The 18<sup>th</sup> Session of the SPARC Scientific Steering Group

The 18<sup>th</sup> meeting of the SPARC SSG will be held in the period January 5-8, 2011 at the Indian Institute of Tropical Meteorology (IITM) in Pune, India at the invitation of SSG member Panuganti C. S. Devara. Following the examples of the Bremen and Kyoto meetings, a 1-2 day local workshop at IITM preceding the SSG meeting is planned.

### Closure of the 17<sup>th</sup> Session of the SSG

The SPARC SSG meeting closed at noon, October 31. All present joined the Co-Chairs in thanking Masato Shiotani and many of his Japanese colleagues including former SPARC SSG members Sachiko Hayashida and Shigeo Yoden for hosting the meeting, arranging the excellent facilities and local support for the SSG meeting and for organising the very successful regional workshop that preceded it.

## The Next SPARC General Assembly

Dear SPARC community — Many of you have told us that you find it very unfortunate that the quadrennial SPARC General Assemblies (GAs) are held in the same year as the Quadrennial Ozone Symposia (QOS), as it means two major international conferences with a stratospheric focus in the same year. We have considered this situation and decided that the optimal arrangement would be to have the SPARC GAs two years out of phase with the QOS. (Moving the GAs one year forward or backward would bring them into conflict with the IAMAS/IUGG Assemblies, which also have strong stratospheric components.) This configuration would also allow for the possibility of holding the SPARC GAs jointly with IGAC Science Conferences (SC), which are held every two years.

Accordingly, we will be delaying our next SPARC GA until 2014. The intervening period will provide an opportunity for the SPARC community to interact more strongly with its many partners. In 2011, the WCRP will hold an Open Science Conference (date and venue are still TBD). This will be a great opportunity for us to present SPARC science and build new scientific connections with the rest of the WCRP, as SPARC transitions into a project with a stronger link to the troposphere. In 2012, there will be an IGAC SC and a QOS, both of which will feature strong SPARC components.

The WCRP Open Conference in particular will be a unique opportunity, and should be seen as an 'interim GA' half way between our regular GAs. The WCRP is our mother organisation, and the last such meeting was held 10 years ago. It's fair to say that at that time SPARC was quite separate from the rest of the WCRP, but that is no longer the case as there are new connections emerging all the time. The WCRP Open Conference is thus a tremendous opportunity for students and post-docs in particular to see the broader context of their work. We strongly encourage the SPARC community to get involved in all of these meetings, as well as the IUGG and IAMAS Assemblies in 2011 and 2013, and look forward to our next GA in 2014.

*Tom Peter and Ted Shepherd, SPARC co-Chairs*