WCRP
World Climate Research Programme

25th Meeting of the SPARC Scientific Steering Group & Local Workshop

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Disclaimer

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Parts of it are also available in the **SPARC-newsletter** no. 50, Feb. 2018, pp 2-9; online:
http://www.sparc-climate.org/publications/newsletter/sparc-newsletter-no-50

Content

The 25th SPARC Scientific Steering Group (SSG) meeting was jointly hosted by colleagues affiliated at the Seoul National University (SNU) and the Korean Polar Research Institute (KOPRI). It took place at the Orakai Songdo Park Hotel in Incheon, Republic of Korea, from 16 - 18 October 2017. The Korean SSG member (Seok-Woo Son) provided most valuable assistance with the technical arrangements. The meeting was followed by an Early Career Researchers (ECR) symposium during the afternoon of 18 October and a WCRP/SPARC local workshop on 19-20 October, both at the conference facilities of the nearby KOPRI. Representatives of the National Institute of Meteorological Sciences (NIMS), which hosts the International Coordination Office of the WWRP Sub-seasonal to Seasonal (S2S) prediction project (**Yu-Kyung Kim**), and of the Korean Polar Research Institute (**Baek-Min Kim**) briefly introduced their institutions and underscored the high relevance of SPARC activities for their research tasks.

1. WCRP update

As already indicated in the previous SSG24-report, the World Climate Research Programme (WCRP) currently undergoes a review, organized by its co-sponsors WMO, IOC and ICSU, of which the report would be submitted to the executive bodies of co-sponsors before the end of 2017 (**Boram Lee**, WCRP Joint Planning Staff [JPS]/ SPARC liaison). The review would include assessments and recommendations on not only the scientific achievement of WCRP groups and activities, but also of the adequacy and effectiveness of WCRP operational structures. In addition, the WCRP Joint Steering Committee (JSC) has been leading the process of refreshing strategic planning for WCRP, and all Core Projects including SPARC and main WCRP activities have been actively participating. In both major processes, it has been reaffirmed that WCRP should not be diluted by moving away from underpinning, fundamental climate science into the applied science required for climate services. Meanwhile WCRP needs to be cognizant of what the users and stakeholders require from climate science, and should therefore maintain an active dialogue with them, either directly or through its co-sponsors. Further integrated community efforts have emerged as the main direction of WCRP's scientific strategy, such as integrated atmosphere-chemistry-climate research and seamless prediction by bringing together the expertise and experience of the weather prediction community and that of the climate modelling groups.

The SSG noted with concern on the still tight financial climate and reduced staffing at the JPS, which necessitates rationalization of overall administrative support and coordination across JPS and the international project offices. At the same time efforts are undertaken to restore support from the co-sponsoring organizations, especially for the core projects and to main WCRP activities.

2. SPARC activity reports

The Long-term Ozone Trends and Uncertainties in the Stratosphere (LOTUS) activity formed two working groups addressing "Multi-Instrument Data Integration" (MIDI) and "Regressions of Ozone Analyzed for Stratospheric Trends" (ROAST), respectively (**Irina Petropavloskikh**). Thirty participants attended the first LOTUS workshop on 13-15 March 2017, hosted by Laboratoire ATmosphères, Milieux, Observations Spatiales

(LATMOS) at the Université Pierre et Marie Curie in Paris, France (see https://events.oma.be/indico/event/23/overview for more information). The bulk of information about LOTUS is being collected and presented on the dedicated website http://igaco-o3.fmi.fi/LOTUS. A collaborative effort was initiated to prepare a Final Report that will be reviewed by SPARC and which will contain critical results to support the 2018 WMO/UNEP Scientific Assessment of Ozone Depletion.

Within the Polar Stratospheric Cloud initiative (PSCi) a focus was put on comprehensive PSC-climatology papers based on long-term satellite data records obtained by the MIPAS and CALIOP instruments (**Larry Thomason** for **Michael Pitts**). These efforts are considered as a foundation for an intended broad review publication on topics as the spatial/temporal distribution, composition, and microphysical properties of PSCs as well as their improved representation in satellite retrievals and transport modelling studies.

The Stratospheric Sulfur and its Role in Climate activity (SSiRC) organized a three-day workshop with the aim of bringing together in-situ and spacebased measurement teams, attended by 35 scientists from the US, Germany, Belgium and the UK (**Stefanie Kremser**). A proposal to the American Geophysical Union regarding a “Chapman Conference on Stratospheric Aerosol in the Post-Pinatubo Era: Processes, Interactions, and Importance” was accepted. The event is scheduled for 18-23 March 2018 in Santa Cruz de Tenerife, Spain. Under the umbrella of SSiRC, ETH Zurich and NASA compiled a new stratospheric aerosol forcing dataset for CMIP6-simulations. Field activities included contributions to a Balloon campaign of the Asian Tropopause Aerosol Layer (BATAL) during August and the StratoClim aircraft campaign out of Kathmandu, Nepal, from mid- July to mid-August.

The SPARC Reanalysis Intercomparison Project (S-RIP) constitutes a valuable communication platform between SPARC-related researchers and large reanalysis centres (**Michelle Santee**). Contributions to an inter-journal special issue appeared in Atmospheric Chemistry and Physics and in Earth Systems Science Data or are still under review. The entire collection consists of 18 articles. The revised version of the S-RIP interim report is about to be submitted to the team of external editors. The annual S-RIP workshop was scheduled for 23-27 October at ECMWF, as usual in junction with the SPARC Data Assimilation Working Group (DAWG).

DAWG was presented remotely (**Quentin Errera**), with reference to the joint workshop at ECMWF and previous technical tasks that had evolved into separate SPARC activities, e.g. SNAP and S-RIP. A review of the activity will be prepared until the SPARC General Assembly in 2018. In August, one of the co-chairs took part at the US-CLIVAR summit, where a strengthening of the links to SPARC was advocated.

The Stratospheric Network for Atmospheric Predictability (SNAP) started its second phase with emphasis shifting towards analysis of data from the World Weather Research Programme (WWRP) project “Sub-seasonal to seasonal prediction” (S2S; **Andrew Charlton-Perez**). A review article was initiated about the stratosphere’s impact on predictability within the S2S-models, which will provide a broad overview of S2S-relevant research being done within the SPARC community. Close links were maintained with SPARC activities QBOi and Data Assimilation.

The activity Atmospheric Temperature Changes and their drivers (ATC; **Andrea Steiner**) defined i) the temperature variability throughout the atmosphere including uncertainty in climate data records and ii) the attribution of atmospheric temperature

changes as its two new foci. The co-chairs organized a dedicated session at EGU-2017. In cooperation with the S-RIP activity measured and re-analysed temperature trends were compared. Combined observational and model studies hinted at subtle connections, as e.g. from ozone extremes in the Arctic stratosphere to northern hemisphere surface climate.

The Atmospheric Composition and Asian Monsoon (ACAM) activity, a joint undertaking with the International Global Atmospheric Chemistry (IGAC) project, continued its series of regional workshops and associated training schools with a combined event in June 2017 in Guangzhou, China, which was attended by some 160 scientists and more than 40 students, respectively (**Laura Pan**). Eight missions of the highflying research aircraft Geophysika out of Kathmandu, Nepal, during the EU-funded StratoClim campaign directly addressed core science issues of ACAM and managed to probe in-situ outflow regions of monsoon events up to heights of 20 kilometres.

The Chemistry-Climate Modelling Initiative (CCMI) constitutes another activity jointly undertaken with IGAC. It held its science workshop in June with around 100 participants, hosted by Météo-France in Toulouse (**Seok-Woo Son** for **Michaela Hegglin**). Internal communication was strengthened through the broad distribution of CCMI e-news. External visibility is being enhanced by formal publication endeavours as, e.g., an overview paper regarding the entire suite of global models participating in the first phase of CCMI, a review article about the Aerosol Chemistry Model Intercomparison Project, and an inter-journal special collection of 12 research articles which had been opened at Copernicus Publications (http://www.atmos-chem-phys.net/special_issue812.html).

The SOLARIS-HEPPA activity deals with solar and high energy particle precipitation influences on stratospheric and higher atmospheric levels; it consists of five working groups. These scheduled their annual workshop meeting for November in Paris, France (**Bernd Funke**, presenting remotely via web-interface).Various external forcing datasets were prepared for the global modelling studies in the CMIP6-exercise. A comparative study, juxtaposing output from eight atmospheric models with observations from seven satellite instruments, was undertaken for the perturbed northern-hemisphere winter of 2008/09 and the results were published.

The second Water Vapour Assessment activity (WAVAS-II) further contributed to the inter-journal special collection, which had been opened at Copernicus Publications (www.atmos-chem-phys.net/special_issue830.html; **Gabi Stiller** remotely). These include an intercomparison of satellite and ground-based microwave measurements. Results of coordinated studies were presented at international conferences in South Africa and Canada. A dedicated session was proposed for the EGU Assembly 2018. For the future, it was decided to concentrate on articles in research journals rather than producing a SPARC-report.

Marvin Geller, SPARC-founding co-chair back in 1992 and active contributor over the past 25 years, presented the Fine Scale Atmospheric Processes and Structures (FISAPS) activity. It had an international workshop during the previous week in Kyoto, Japan, jointly organized with activities QBOi and SATIO-TCS. The collection and storage of full resolution datasets, such as high vertical resolution radiosonde data, was addressed. The next workshop is planned to take place in Europe.

The Quasi-Biennial Oscillation initiative (QBOi) produced several publications on experimental QBO simulations for the present day and future climates (**Scott Osprey**). The initiative was integrated in the 19th Middle Atmosphere conference of the American

Meteorological Society in June and co-organized the workshop in Kyoto in October. Follow-on sessions and side meetings will be planned for the General Assembly 2018, where also a closer link is to be established to the Belmont Forum, a grouping of the world's major funders of global environmental change research.

The Gravity Waves activity extended its focus from climate to also weather regimes, underscoring a seamless prediction approach (**Kaoru Sato**). Vertical profiles of momentum fluxes in general circulation models are considered as important diagnostics together with spectra of inertia-gravity waves in global analyses. The SPARC General Assembly 2018 is co-organized by one of the activity leaders and, thus, will be a natural focal point for scientific exchange across the activity.

The Dynamical Variability activity (DynVar) is having an internal discussion on how to redirect its focus after a decade of successful initiatives, e.g. Dyn-VarMIP endorsed by the modelling intercomparison under CMIP6 (**Alexey Karpechko** for **Elisa Manzini**). "Variability and predictability of surface impacts and extremes" has been suggested as a new focus with close links to the WWRP projects "Sub-seasonal to seasonal prediction" (S2S) and "High Impact Weather" (HIWeather). A second focus could be to promote research based on the huge amount of model data available through CMIP-6 (cf. Eyring and Carlson 2017, SPARC-newsletter no. 48, pp. 11-17). The scope, membership, and leaders will be decided upon during the coming year.

3. SPARC emerging activities

Reports were also presented on the four emerging activities of SPARC. A structure for numerical experiments equivalent to the double CO_2 scenarios within CMIP, but for ozone and aerosols was sketched within Climate Response to Short-Lived Climate Forcers (SLCFs; **Neil Harris** for **William Collins**). Systematic scenario calculation at various modelling groups will only be possible onwards after completion of CMIP6. The possibility of a joint activity on SLCFs with the WMO Global Atmospheric Watch and with IGAC will be investigated.

The activity Towards Unified Error Reporting (TUNER) for space-borne temperature and composition sounders had its first workshop in Saskatoon, Canada, in June (**Nathaniel Livesey**). The International Space Science Institute in Berne, Switzerland, approved a proposal for a TUNER International Team, which scheduled its first meeting for December 2017. In August, the activity was presented at the IAMAS assembly in Cape Town, South Africa.

In July 2017, the activity Observed Composition Trends And Variability in the Upper Troposphere and Lower Stratosphere (OCTAV-UTLS) held its first workshop in Boulder, USA (**Irina Petropavloskikh**), where expert groups were formed for categories of observing platforms and datasets got identified that are suited to determine the composition in the UTLS and its long-term changes. The years 2011 to 2013 were declared as initial test period. In June, the activity was presented at the Middle Atmosphere Conference of the American Meteorological Society.

During the week preceding the SSG meeting, the dynamics oriented activity Stratospheric And Tropospheric Influences On Tropical Convective Systems (SATIO-TCS) participated in the joint workshop with FISAPS and QBOi in Kyoto, Japan (**Shigeo Yoden**), where its scientific objectives were refined. An overview paper is planned for publication in the Bulletin of American Meteorological Society. Possible

links with the Year of the Maritime Continent initiative (2017-2019) are being investigated.

4. General Assembly 2018

The state of preparation for the next quadrennial General Assembly of SPARC, scheduled for 1-5 October2018 in Kyoto, Japan, was presented in some detail regarding venue, intended timetable, the desire to give poster presentations a prominent position, and the links to the IGAC conference (**Kaoru Sato**). The Scientific Organizing Committee has two co-chairs (Harry Hendon and Amanda Maycock) and seven members. Contributions from the Belmont Forum of funding agencies combined with the EU joint initiative on Climate Knowledge (JPI Climate) will be an integral part of the programme. A large number of poster presentations is expected. Each poster will be on display for 2.5 days with the potential to attract numerous poster viewers and to ignite vivid discussions during several sessions accompanied with refreshments.

5. Partner projects

A report on the International Global Atmospheric Chemistry project (IGAC) was presented by **Hiroshi Tanimoto**. IGAC is a close partner of SPARC on chemistry-oriented activities, e.g. ACAM and CCMI. During the previous year the IGAC community sharpened its profile within the new Future Earth framework with strong foci on basic research, fostering the science community, providing leadership and building new capacity through early career support. IGAC will hold its 15th science conference in Takamatsu, Japan, in 2018 in the week prior to the SPARC General Assembly. The local organizing committees are in close communication in order to facilitate visits of both events, only 250 km apart, around the intermediate weekend at reasonable costs.

The Climate and Ocean: variability, predictability and change project (CLIVAR; **Jose Santos**), also a WCRP core project, concentrates on the marine component of the coupled ocean-atmosphere system, in particular with regard of systematic and multi-national observations. Its open science conference 2016 in Qingdao, China, attracted more than 600 participants from 47 countries. Training of the next generation of researchers is regarded as essential for the continuing success of WCRP as the maintenance of a strong grounding in fundamental research. Recently a new Northern Oceans Region Panel (NORP) was approved jointly with the cryospheric core project CliC.

The Korean National Institute of Meteorological Sciences (NIMS) hosts the international coordination office of WWRP's Subseasonal to Seasonal prediction project (S2S; **Yu-Kyung Hyun**), a legacy project of the THORPEX initiative (2005-2015). With the aim of "bridging the gap between weather and climate" about a dozen of global modelling centres undertake coordinated ensemble forecasts up to two months ahead. The efforts of S2S prediction programme in the United States supported by NOAA were reported (**Judith Perlwitz**). It addresses a number of key questions in areas "processes and physics", "prediction approaches", and "prediction evaluation".

6. Space observations

Representatives from four space agencies provided updates of current activities and plans, which are of relevance for SPARC research. **Kenneth Jucks** (NASA; remotely) provided an overview of Earth science missions in categories “extended operations”, “primary operations”, “under implementation”, and “being formulated”, with a special focus on ozone research. The SAGE instrument has reached its third generation. A version is being commissioned for use aboard the International Space Station (ISS). The multi-decal SAGE ozone and aerosol datasets from 1979 onwards are regarded as an international standard for accuracy and stability. The Tropospheric Emissions: Monitoring Pollution (TEMPO) mission is scheduled for launch to a geostationary orbit in 2019. The release of the current decadal survey document is due by the end of 2017.

Lin Chen (Chinese Meteorological Administration [CMA], National Meteorological Satellite Center) gave a detailed summary regarding the current status and future programme of the Chinese meteorological satellite series FengYun, (FY) with currently eight platforms in orbit, six of them operational, partly in low earth and partly in geostationary orbits. The FY satellite data and application service provides near real time access and has more than 45 direct broadcasting users. Monitoring capacities for greenhouse gases are scheduled for mission FY-3D.

Hyo-Suk Lim (Korean Aerospace Research Institute) described the satellite application activities of the Republic of Korea with currently five platforms operational in low earth and one in geostationary orbit. Four launches are scheduled within the coming four years. Besides land and ocean surface observations as well as monitoring during disaster episodes global environmental monitoring is to begin after the launch start of KOMPSAT-2B to a geostationary orbit (scheduled for 2018).

Makoto Suzuki (Japan Aerospace Exploration Agency [JAXA], Earth Observation Research Center) presented the status of the Japanese meteorological satellite programme, highlighting monitoring missions such as GOSAT (since 2009), GCOM-C (launch early 2018), GOSAT-2 (launch 2018) and EarthCARE (launch ~2019). Experiences from the exploratory, limb sounding SMILES project are being fed into a new joint proposal for chemistry and dynamics of stratospheric and mesospheric levels. The need for scientific support from the SPARC, IGAC or SCOSTEP communities was emphasized.

7. Other SPARC news

Fiona Tummon (outgoing SPARC-office director) remotely reported about the SPARC capacity development. The office continued to actively support the Young Earth System Scientists (YESS) community, which has representatives in numerous countries around the planet. Specific workshops and training schools were held on Atmospheric composition and dynamics (in Réunion Island; 28 Nov. - 3 Dec. 2016), on Monsoon variability in a changing climate (in Jeju, Korea; 16 – 21 Jan. 2017), as 2nd ACAM training school (in Guangzhou, China; 5-9 June 2017), as 3rd South-East Asian school on tropical atmospheric science (SEASTAS; in Singapore; 24-27 July 2017), and as Stratosphere-troposphere interactions training school (at university of Cape Town, South Africa; 2-5 September. 2017).

During the afternoon of the 18 October a dedicated Early Career Researcher symposium took place in parallel to the SSG meeting with keynote lectures given by SSG-members (Harry Hendon, Laura Pan) and selected presentations by some of the SPARC-supported participants from Asian countries. Everybody joined the regional (Korea-China-Japan) scientific workshop during the next two days, when 32 oral presentations and 33 poster presentations served as crystallization points for vivid scientific exchange between some 80 scientists from 12 countries on four continents.

8. SPARC local workshop on "WCRP grand challenges and regional climate change"

The SPARC local workshop was held on 18-20 October 2017 at the Korea Polar Research Institute in Incheon, Republic of Korea. Organized back-to-back with the annual meeting of the SPARC scientific steering group, this workshop brought local scientists working on the WCRP grand challenges and regional climate changes together with scientists outside of Asia leading the SPARC research activities. A total of 79 participants from 10 countries made this workshop very lively. Various topics including stratosphere-troposphere dynamic coupling, Arctic climate change, climate prediction and attribution, and regional climate change were presented with the goal of exploring synergies and fostering scientific exchange.

8.1. ECR workshop

To promote capacity development in Asia, an Early Career Researcher (ECR) workshop was held in the afternoon of 18th October. This half-day-long pre-workshop consisted of three invited lectures and ECR's poster presentations. About 50 ECRs from 8 countries participated in this symposium. Ten of them were fully or partly supported by the SPARC and local organizing committee (LOC).

The three lectures provided unique perspectives of stratospheric dynamics, tropical meteorology, and observations. **Marvin Geller** introduced the history of middle atmosphere dynamics and reviewed recent developments. The spatiotemporal characteristics of the Madden-Julian Oscillation (MJO) and their modulation by Quasi-Biennial Oscillation (QBO) was explained by **Harry Hendon**, highlighting stratosphere-troposphere coupling in the deep tropics. **Laura Pan** introduced the CONTRAST (CONvective Transport of Active Species in the Tropics) project and provided observational aspects on the stratospheric dynamics and tropical meteorology. Followed by the invited lectures, **Shipra Jain** introduced the Young Earth System Scientists (YESS) community and its activities. She emphasized that YESS community can provide a voice and leverage for a better future to serve society, and encouraged all participants to join YESS. Lastly, ECRs, who submitted an abstract to the SPARC local workshop, briefly introduced their poster(s) in a minute or two. All posters were lively discussed during the poster session on the next day.

8.2. Subseasonal, seasonal, and interannual climate prediction

In-Sik Kang, a WCRP JSC member, opened the workshop with a keynote speech on the role of the stratosphere in the boreal-winter seasonal prediction. He emphasized the role of both the SST and stratospheric memory that could substantially improve the seasonal prediction in the tropics and the Pacific-North American region during the late

winter. This presentation was followed by three talks on subseasonal predictions. The processes of stratosphere-troposphere coupling and their impacts on predictability in the Southern Hemisphere were reviewed by **Harry Hendon**. He showed that a more skilful prediction by vertical coupling is available in the Australian seasonal prediction models during austral winter. **Yuna Lim** presented the QBO-MJO link in boreal winter and its impact on subseasonal-to-seasonal (S2S) prediction. By analysing the S2S prediction models, she showed that the MJO is better predicted during the easterly phase of the QBO than during the westerly phase. One of the emerging SPARC activities, Stratospheric And Tropospheric Influences On Tropical Convective Systems (SATIO-TCS) was overviewed by **Shigeo Yoden**. He also briefly discussed stratospheric influence on multi-scale interactions of moist convection in the tropics.

8.3. Stratospheric polar vortex and vertical coupling

Opening the session on the stratosphere-troposphere coupling, **Andrew Charlton-Perez** provided a regime view on the coupling and proposed a minimal Markov model to better quantify the tropospheric response to stratospheric anomalies in the North Atlantic. This was followed by re-evaluation on the ENSO-SSW relationship by **Kanghyun Song** using seven SSW definitions in the literature. He showed that the ENSO-SSW relationship is highly dependent on the details of the SSW definition. Although more frequent SSWs during El Niño winters are common, SSWs during La Niña winters substantially differ across the definition. **Patrick Martineau** introduced his recent work on the lower-stratospheric control of SSW frequency in idealized model simulations. The highlight of his study was that stratospheric variability, including SSW frequency, is very sensitive to the temperature distribution in the lower stratosphere. The Holton-Tan relationship, linking the QBO with the polar vortex, was examined by **Judith Perlwitz** using 10 AMIP historical simulations. She showed that the Holton-Tan relationship is not robust when the QBO is in its westerly phase.

8.4. Gravity waves

A series of studies on middle-atmosphere gravity waves were presented. **Hye-Yeong Chun** presented spatiotemporal characteristics of convective gravity waves, their sources, and the associated cloud-top momentum fluxes. She also quantified contribution of small-scale convective gravity waves to the large-scale circulation in the middle atmosphere with an emphasis on their impacts on annual cycle in the mesosphere, Brewer-Dobson circulation, and QBO. Her presentation was further extended by **Min-Jee Kang**, who showed the results of reanalysis datasets. **Byeong-Gwon Song** reported gravity wave activities in the upper mesosphere at King Sejong Station, Antarctica (62.22°S, 58.78°W), operated by the Korea Polar Research Institute. Its close link to the jet stream was particularly highlighted.

8.5. UTLS and Ozone

Joowan Kim presented the thermal characteristics of the tropical tropopause layer in CMIP5 models and discussed their implications on the cross-tropopause water vapour transport and global climate changes. **Yan Xia** also evaluated CMIP5 models, but targeting on UTLS ozone biases, showing that UTLS ozone can radiatively warm the UTLS region and influence high cloud distribution by modulating humidity and static stability in the UTLS. Switching the subject to measurements, **Larry Thomason** intro-

duced some features of the third Stratospheric Aerosol and Gas Experiment (SAGE III) on the International Space Station. This was followed by a presentation on the mesosphere temperature trend and the ozone recovery, which was given by **Gufran Beig**.

8.6. Polar climate

Jinro Ukita reviewed the Arctic-midlatitude climate linkage and presented modelling evidence of a stratospheric pathway. By analysing a set of AGCM experiments and reanalysis datasets, he showed that Arctic sea ice loss results in an increased poleward eddy heat flux and strengthening of upward wave propagation from the upper troposphere to the stratosphere in early winter, which can lead to a more frequent breakdown of the polar vortex. The Arctic sea-midlatitude connection was further described by **Jiankai Zhang**, who showed that the sea-ice-induced planetary-scale waves have likely pushed the stratospheric polar vortex in February towards Eurasia in the last three decades. Consistent with these findings, **Hye-Jin Kim** demonstrated strong correlation between sea ice anomalies over the Barents-Kara seas and Eurasian winter surface air temperature. The influence of atmospheric circulations on Arctic sea ice and surface air temperature change was explored by **Ha-Rim**, who emphasized that Arctic surface air temperature is very sensitive to the moisture intrusion caused by the Barents Oscillation. **Seungmok Paik** identified possible causes of Arctic sea ice loss. He reported that the 2015 record minimum sea-ice extent in the Sea of Okhotsk was caused by both external forcings (56%) and internal variability associated with the North Pacific Oscillation (25%), highlighting the importance of external forcings. **Mee-Hyun Cho** and **Joo-Hong Kim** presented other aspects of Arctic climate change. By conducting AGCM experiments, Mee-Hyun Cho suggested that black carbons, emitted from highlatitude gas petroleum, have likely accelerated Arctic warming in the recent decade. Joo-Hong Kim analysed thermal evolution of late-summer melt ponds on sea ice. The importance of better constraining and understanding the internal heat transfer dynamics and the salinity of melt ponds was highlighted.

8.7. Regional climate

Various subjects in regional climate change and variability were also discussed. **Wen Chen** reviewed the stratosphere-troposphere interaction in boreal winter and its impact on cold extremes in East Asia. He showed that the time-scale of downward coupled stratospheric events is typically longer than that of nondownward events, emphasizing the importance of the formers for regional climate variability. This was followed by a presentation on the low-frequency nature of the Northern Annular Mode (NAM) in the context of mass circulation, which was given by **Yueyue Yu**. **Jinwon Kim** presented the impact of atmospheric river landfalls on the precipitation characteristics in the western US. The monsoon circulation and related variabilities in rainfall and chemical composition was presented by **Anu Xavier** and **Laura Pan**. Anu Xavier discussed the role of monsoon low-level jet in modulating extreme rainfall events across the southwestern coast of India. Laura Pan emphasized the needs for research collaborations on the interactions and couplings between the regional pollutant emissions and the monsoon dynamics to better understand their impacts on regional air quality and climate relevant stratospheric composition changes. As an example, it was shown by **Mijeong Park** that the carbon monoxide emitted from the recorded fire

events in Indonesia was transported into the UTLS. This chemistry transport was evident only in satellite measurements but also in chemistry-climate model simulation. Continuing the theme of chemistry-climate interaction, **Fahim Khokhar** presented a long-term change and variability of short-lived climate pollutants in Pakistan and an anomalous shift in seasonal cycle of methane. On the Arctic carbon cycle, the study by **Su-Jong Jeong** concluded that Arctic carbon release in cold seasons could exceed the carbon update in a growing season under continuous warming condition. Focusing on hydrology, **Chang-Eui Park** discussed an emerging aridification in warm climate. He argued that limiting global warming below 1.5°C above pre-industrial level can notably reduce an emergent aridification compared to the 2°C warming.

Annex 1: SSG Meeting Agenda

Monday 16 October 2017

9:00 to 10:30	**Welcome and WCRP update**	
9:00 – 9.10	Welcome & meeting goals	Co-Chairs
9:10 – 9:20	Korean national Institute of Meteorological Sciences	Yu-Kyung Hyun
9:20 - 9:30	Korean Polar Research Institute	Baekmin Kim
9:30 - 10:00	WCRP update	Boram Lee
10:00-10:30	Discussion - WCRP review/strategic plan	All
10:30-11:00	**Coffee break**	
11:00-12:30	**Partner Projects**	
11:00-11:30	CLIVAR	Jose Santos
11:30-12:00	S2S	Yu-Kyung Hyun
12:00-12:10	S2S – US initiatives	Judith Perlwitz
12:10-12:30	Discussion	All
12:30-13:30	**Lunch**	
13:30-15:00	**SPARC Activities + SPARC-office Report**	
13:30-14:00	LOTUS	Irina Petropavlovskikh
14:00-14:20	PSCi	Larry Thomason
14:20-14:40	SSiRC	Stefanie Kremser
14:40-15:00	SPARC Office Report	Hans Volkert
15:00-15:30	**Coffee break**	
15:30-17:30	**Partner Projects + General Assembly**	
15:30-16:00	IGAC	Hiroshi Tanimoto
16:00-16:30	GA 2018 + Science Programme	Kaoru Sato + Harry Hendon
16:30-17:00	Discussion	All
17:00-18:00	**Closed SSG Session**	
17:00-18:00	Closed SSG Session	SSG members

Tuesday, 17 October 2017

9:00 to 10:30	**Space Agency Reports**	
9:00 – 9:20	NASA	Ken Jucks (remote)
9:20 – 9:40	Chinese Nat. Met. Satellite Centre	Lin Chen
9:40 – 10:00	Korean Aerospace Research Initiative	Hyo-Suk Lim
10:00-10:20	JAXA	Makoto Suzuki
10:20-10:30	Discussion	All
10:30-11:00	**Coffee break**	
11:00-12:30	**SPARC Activities**	
11:00-11:30	SLCFs	Neil Harris (for Bill Collins)
11:30-11:50	S-RIP	Michelle Santee
11:50-12:10	Atmospheric Temperature Changes	Andrea Steiner
12:10-12:30	ACAM	Laura Pan
13:00-14:00	**Lunch**	

14:00-15:30	**SPARC Activities**	
14:00-14:30	TUNER	Nathaniel Livesey
14:30-15:00	OCTAV-UTLS	Irina Petropavlovskikh
15:00-15:20	CCMI	Seok-Woo Son
15:20-15:30	Discussion	All
15:30-16:00	**Coffee break**	
16:00-17:30	**Partner Programmes + SPARC Activities**	
16:00-16:30	Global Atmosphere Watch	Oksana Tarasova (remote)
16:30-16:50	SOLARIS-HEPPA	Bernd Funke (remote)
16:50-17:10	Data Assimilation	Quentin Errera (remote)
17:10-17:30	WAVAS-II	Gabi Stiller (remote)

Wednesday 18 October

9:00 to 10:30	**SPARC Activities**	
9:00 – 9.30	SATIO-TCS	Shigeo-Yoden
9:30 – 9:50	FISAPS	Marvin Geller
9:50 -10:10	SNAP	Andrew Charlton-Perez
10:10 10:30	Gravity Waves	Kaoru Sato
10:30-11:00	**Coffee break**	
11:00-12:30	**SPARC Activities**	
11:00-11:30	QBOi	Scott Osprey
11:30-11:50	DynVar	Alexey Karpechko
11:50-12:30	Discussion	All
12:30-13:30	**Lunch**	
13:30-15:00	**SPARC Activities**	
13:30-14:00	LOTUS	Irina Petropavlovskikh
14:00-14:20	PSCi	Larry Thomason
14:20-14:40	SSiRC	Stefanie Kremser
14:40-15:00	SPARC Office Report	Hans Volkert
15:00-15:30	**Coffee break**	
15:30-17:30	**Capacity Development + New Directions for SPARC**	
15:30-16:00	Discussion	All
16:00-16:30	Capacity Development	Fiona Tummon (remote)
16:30-17:00	**Coffee break**	
17:00-18:00	**Closed SSG Session**	
17:00-18:00	Closed SSG Session	SSG members

Annex 2: SSG Meeting Participants

Group photograph of the majority of participants at the 25th SPARC Scientific Steering Group meeting: ***identification number***, given name, FAMILY NAME, *role at meeting, country* (of work, not necessarily nationality).

Alphabetical list of participants

Surname	**Given name**	**Role, *country* (of work)**
Beig	Gufram	SSG, *India*
Charlton-Perez	Andrew	SNAP, *United Kingdom*
Geller	Marvin	FISAPS, *United States*
Harris	Neil	SSG, co-chair, *United Kingdom*
Hendon	Harry	SSG, *Australia*
Hyun	Yu-Kyung	S2S Intern. Coord. Office, *Rep. of Korea*
Karpechko	Alexey	SSG, *Finland*
Kenntner	Mareike	SPARC Int. Project Office, *Germany*
Kim	Baekmin	Local organising committee, *Rep. of Korea*
Kremser	Stefanie	SSiRC, *New Zealand*
Lee	Boram	WCRP, Joint Planning Staff, *Switzerland*
Lee	Sang-Mim	Local representative, *Rep. of Korea*
Lim	So-Min	Local representative, *Rep. of Korea*
Lin	Chen	Satellite expert, CMA, *China*
Livesey	Nathaniel	SSG (from 2018), *United States*
Osprey	Scott	QBOi, *United Kingdom*
Pan	Laura	ACAM, *United States*
Perlwitz	Judith	SSG, co-chair, *United States*
Petropavloskikh	Irina	LOTUS, *United States*
Santee	Michelle	SSG, *United States*
Santos	Jose	CLIVAR Intern. Project Office director, *China*
Sato	Kaoru	SSG, *Japan*
Schmidt	Hauke	SSG, *Germany*
Son	Seok-Woo	SSG & local organ. committee, *Rep. of Korea*
Steiner	Andrea	ATC, *Austria*
Suzuki	Makoto	Satellite expert, JAXA, *Japan*
Tanimoto	Hiroshi	IGAC, *Japan*
Thomason	Larry	SSiRC, *United States*
Volkert	Hans	SPARC Int. Project Office director, *Germany*
Wuebbles	Don	SSG, *United States*

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