WCRP REPORT

World Climate Research Programme

Report of the 33rd Session of WCRP Joint Scientific Committee

Friendship Hotel, Beijing, China, 17-20 July 2012

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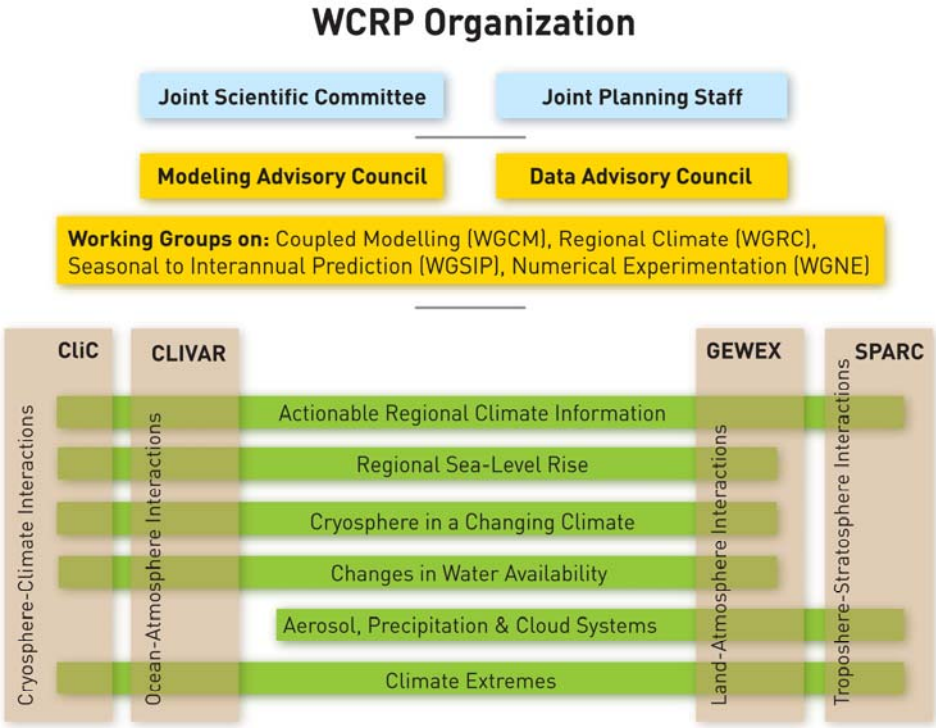
1. Opening of the Session

Prof Busalacchi opened the session by thanking the Chinese National Committee for the WCRP and the China Association for Science and Technology, for their generous support and for all the practical arrangements and social occasions. He thanked all those present (see Appendix A) for their time and interest. Prof Busalacchi then introduced Prof Wang Hui-Jun, Director General of the Chinese Academy of Sciences (CAS) Institute of Atmospheric Physics (IAP), who in turn thanked Prof Liao Hong and her students for their efforts in support of the meeting. Prof Wang gave a brief overview of CAS, which consists of 120 institutes throughout country. Each institute has a Masters and PhD programme and organizes training with other institutions worldwide. The Institute of Atmospheric Physics, in Beijing, contributes significantly to the objectives of WCRP, with many researchers dedicated to research on climate, chemistry and boundary layer physics, mesoscale dynamics and synoptic weather. IAP's success has been reflected in an impressive growth in the number of scientific and technical staff and 20% budget increase each year for the last 20 years.

2. Report on WCRP Developments Post OSC- Prof A. Busalacchi

Presentation by Prof A. Busalacchi.pdf

Prof Busalacchi began his report by observing that the Projects and Working Groups were the heart and soul of WCRP and he took the opportunity to thank all the Project and WG leaders and singled out those who were rotating off at the end of the year and welcomed the new Chairs. He recalled that the JSC, at its extraordinary session directly following the Open Science Conference in October 2011, had finalized the new structure for WCRP with the four pillars focussed on key climate interactions and the Grand Challenges serving as integrating themes.



White papers had been prepared for each of the Grand Challenges and would be presented at this meeting. The JSC had also developed terms of reference for the Modelling and Data Advisory Councils that had met for the first time the day before, and for a Working Group on Regional Climate (WGRC) that would serve to coordinate across the whole programme. He noted that the JSC has asked the Projects to take a fresh look at their regional activities in Africa and in Latin America and the Caribbean, starting with stakeholder needs in the region, to develop research priorities that were in line with the new WCRP priorities.

He reviewed the agenda (see Appendix B) and highlighted some of the major aims of the meeting, including a roll out of the Grand Challenges and review of the Core Projects' future directions. Prof Busalacchi announced that there had been an offer from Brazil to host next year's meeting in Brasilia and that discussion was underway with the WMO Commission on Climatology (CCl) to hold a joint meeting with CCl and the JSC in 2014 in Heidelberg, Germany.

3. Report on JPS Developments, Program, Personnel, Budget – Dr G. Asrar

Presentation by Dr Asrar.pdf

Dr Asrar began by thanking all for their engagement and participation in the meeting. He reviewed major WCRP activities since JSC 32 including the Open Science Conference in Denver in October, the CMIP5 Analysis Workshop in Honolulu in March, the CORDEX South Asia Planning Meeting Workshop in Pune in February, the Workshop on Stratospheric Sudden Warmings in February in Kyoto, the Planet Under Pressure Conference in London in March, the Polar Climate Predictability Initiative Workshop in Toronto in April, and the 4th International Reanalysis Conference in Silver Spring, MD, in May. Dr Asrar noted that as part of its capacity development strategy, WCRP, and in particular the Projects were making every effort to involve students and early career scientists in its activities and he was pleased to report that almost 200 students and early career scientists had been supported by WCRP to attend meetings in 2011 and 2012.

The WCRP secretariat in Geneva was now fully staffed. There had been several changes in the Project offices but these were also now up and running and their budgets were secured at least for the near future. Dr Asrar presented an overview of income and expenditures for the WCRP Joint Climate Research Fund for the past two years and estimates for 2012, noting that the budget situation for WCRP was on solid ground despite recent constraints on funding from UNESCO's Intergovernmental Oceanographic Commission. He thanked the sponsors for their continuing support. Dr Asrar observed that diversification of funding was the key to sustainability and noted that now the secretariat and the projects were writing proposals for targeted events, for instance for training workshops.

Dr Asrar summed up by remarking on the tremendous interest and support for WCRP. He observed that support for regional climate science information was gaining momentum and that the core projects were doing an excellent job at engaging and supporting their respective networks of scientists.

Prof Busalacchi, on behalf of JSC, thanked Dr Asrar for his leadership and strong support from the secretariat staff.

4. Summary of Joint China-WCRP Symposium – Prof Hong Liao

Prof Liao thanked all for coming to Beijing and participating in the Joint China-WCRP Symposium that had taken place the day before. She noted that even though there were over 200 participants, including 80 students, speakers could not give an exhaustive overview of the many WCRP activities in China. Prof Liao observed that climate variability and change in China had unique features because China is located in a large monsoon domain and is flanked by the Tibet plateau to the west. She reviewed the major findings presented by Chinese speakers that included important contributions to all four WCRP core projects and modelling activities. She expressed her positive impression that the symposium will help build greater support and involvement by Chinese scientists in WCRP related activities in the future.

5. Summary of Council Meetings

5.1 WCRP Modelling Advisory Council (WMAC) - Prof C. Jakob and Dr J. Mitchell

Dr Mitchell reviewed the JSC motivation for forming the WMAC, namely that there was neither enough expertise in JSC, nor time during the annual meetings, to discuss modelling issues in depth; the WMAC was to serve as extension of JSC. WMAC had sent a questionnaire to the WCRP modelling community asking what their expectations from the Panel were. Reactions had been mixed; some noted that there was already a lot of coordination in the existing modelling working groups. WMAC discussed this at some length during this first meeting and concluded that there was a role for this group in addition to existing groups. They proposed a shorter and revised terms of reference, as follows:

In partnership with WCRP projects and working groups act as a focal point for WCRP modelling and advise the JSC and WCRP community on issues pertaining to modelling.

1. Regularly assess modelling capabilities within WCRP and identify gaps, overlaps and opportunities for synergy.
2. Provide advice on priorities for modelling across WCRP including the Grand Challenges.
3. Facilitate effective communication on modelling issues within the WCRP and with the broader community.
4. Promote capacity development in model development, evaluation, and applications.

Main responsibility for working level coordination should remain with the individual modelling groups and hence the WMAC membership should be at the level of Chair of the various groups. A request was made to invite a representative from the WMO Weather Research Programme (WWRP) in the interest of increasing interaction between the weather and climate communities. WMAC would act as a forum for discussion and should identify and promote priority areas. The Council proposed to facilitate coordination amongst the groups and Projects through the use of online communication tools. The Council would prefer to meet for one day after the project and working group reports at the annual session of JSC.

Discussion:

The need for a joint activity with IGBP to advance prediction of the Earth system (in addition to the biannual joint meetings of WGCM and IGBP AIMS) was highlighted. The issue of the relationship between the WMAC and the joint WMO CAS/WCRP Working Group on Numerical Experimentation (WGNE) was raised. It was concluded that the two groups were complementary – WGNE addressed mainly atmospheric modelling whereas WMAC was about the earth system as a whole. A question was raised as to where interactions with the end users would be considered. In general, these would be dealt with in the existing modelling groups, but if WMAC saw a gap, it would advise the JSC on appropriate action. It was emphasized that the Councils were primarily advisory and were not to take on activities themselves.

ACTION: *Adopt revised WMAC Terms of Reference;*

ACTION: *WMAC to form task team with IGBP on prediction of Earth system.*

5.2 WCRP Data Advisory Council (WDAC) – Dr O. Brown and Prof T. Koike

Dr Brown briefed the JSC on the outcomes of the first WDAC meeting. The Council was seeking only minor adjustments to their terms of reference (see Appendix C). The first meeting had been very busy with many issues to address, as reflected in the action items below. Dr Brown highlighted the SCOPE-CM collaboration between research and operational groups on the transition of data sets and remarked that these initiatives were worthy of wider participation by WCRP projects, and that significant scientific support from WCRP was needed to make the operational processing tasks successful. The Council had also considered the inventory of Essential Climate Variables (ECVs) proposed at the recent meeting co-sponsored by WCRP and GCOS in Frascati (see recommendation below). The WDAC would take responsibility for organizing the next reanalysis conference that would most likely be held at ECMWF in 2014. The WDAC was also already planning for its next meeting that would include on the agenda a discussion of the Earth System Grid and possible need for further governance.

Discussion:

A question was raised as to what would be WDAC's advising role vis a vis the core Projects, for instance for CLIVAR that worked closely with OOPC on data issues. Dr Brown reaffirmed that the WDAC did not wish to supplant anything that was ongoing, but rather wanted to ensure that all core projects had representatives on WDAC so they could raise issues of broader concern. It was noted that the GEWEX Data Assessment Panel had expressed concern that some of the data sets being considered by Obs4mips might not have been sufficiently quality controlled. Dr Brown remarked that the WDAC was aware of this issue and wanted to develop a more uniform quality assessment approach; this would be an opportunity for WCRP to make expert assessments of these data sets. The need for coordination between the WDAC and WMAC on issues such as Obs4mips and model data was highlighted; Dr Brown said discussion would take place between the two groups to coordinate on common topics. It was suggested that the WDAC should consider strategic issues such as scheduling and funding of reanalyses in addition to technical matters.

ACTION: *Adopt revised WDAC Terms of Reference.*

ACTION: *DAC to help facilitate harmonization between the GOSIC and CEOS/CGMS initiatives that would provide a composite inventory of in situ and satellite observations.*

***ACTION**: WDAC to encourage contributions from WCRP core projects, CEOS, CGMS, IGBP, SOLAS and the reanalysis community to the obs4MIP activity so as to populate the ESG and further facilitate model-data comparisons.*

***ACTION:** WDAC to initiate planning activities for a 5th WCRP reanalysis workshop addressing issues raised at the 4th conference; focus on coordination of observations that are input into reanalysis.*

***ACTION:** WDAC to work with GCOS, GEOS and CEOS to encourage existing networks to place higher priority on measuring non-physical variables such as partial pressure of carbon dioxide (pCO2) (an Essential Climate Variable (ECV)).*

***ACTION:** WDAC to liaise with the WMO Global Cryosphere Watch (GCW) and CliC on Arctic data issues and to help GCW integrate efforts within the wider climate data community activities.*

***ACTION:** WDAC to encourage development of climate data stewardship and efforts towards data set publication and traceability of data set versions (citations, peer-reviewed articles, DOIs).*

6. Planet Under Pressure Conference – Prof J. Syvitski, IGBP Chair

Presentation: Planet Under Pressure.pdf

Prof Syvitski, Chair of the International Geosphere-Biosphere Programme, introduced the Planet Under Pressure Conference (PUP) as the first conference of its kind to be sponsored by all four Global Environmental Change (GEC) programmes. The recurring theme was the dawning of the anthropocene, an epoch where humans were influencing the state of the planet on a scale akin to the forces of nature. Three thousand delegates attended talks and panels focused on drivers of GEC, planetary stewardship and youth engagement. One of the aims of the Conference had been to establish longer-term collaboration with industry. Prof Syvitski observed that the Conference had considerable participation from industries, but that there were significant challenges and that more resources were needed to engage GEC science and scientists with industry. Important outcomes of the Conference included the State of the Planet Declaration and 9 policy briefs that were presented at the RIO+20 Conference. PUP was also the first public voice for the Future Earth initiative that Prof Syvitski described as a new contract between science and society.

The PUP had received good international press coverage and had reached a much wider audience through PUP events at science museums around the world. To date there had been over 800,000 views of "Welcome to the Anthropocene" movie posted on http://www.anthropocene.info and that had also been shown at the opening of Rio+20.

Discussion:

Prof Busalacchi thanked IGBP for their leadership of the PUP on behalf of the other GEC programmes. One JSC member observed that very little interdisciplinary research had been presented at the PUP and that this represented a real challenge for the Future Earth initiative.

7. WCRP Grand Challenge White Papers

7.1 Provision of Skilful Future Climate Information on Regional Scales (includes decadal and polar predictability) – Dr F. Giorgi

Prof Giorgi introduced the white paper noting that the essential objective of this GC is to provide relevant information about proximity to sector thresholds in a risk management framework for a given spatial and temporal scale, variable, metric and application.

He outlined the five Scientific Frontiers that the authors had identified:

F1. Intra-seasonal and seasonal predictability and prediction
- Identify and understand phenomena that offer some degree of intra-seasonal to inter-annual predictability, skilfully predict these climate fluctuations and trends and increase interactions between scientists, operational forecasters and decision makers.

F2. Decadal variability, predictability and prediction
- Identify and understand phenomena that offer some degree of decadal predictability and provide probabilistic regional forecasts to users.

F3. Reliability and value of long-term regional climate projections
- How to assess the reliability of multi-model long-term projections through multiple lines of evidence. Can we go beyond the simple inter-model agreement approach?

F4. Interactions across multiplicity of drivers and feedbacks at the regional scale
- Provide increased understanding of the interplay across the different drivers, processes and feedbacks that characterize regional climate at different spatial and temporal scales. Consider interactions across ghg forcings, natural modes of variability, land use changes and feedbacks, aerosols, tropospheric constituents.

F5. Definition of usefulness: informing the risk management and decision making space
- Provide information that constitutes a solid and targeted basis for decision- making concerning risk management and response options in specific sectors and contexts. Lots of what we produce may be skilful, but not useful;

and the Imperatives:

I1. Develop observational datasets at regional and local scales
I2. Extract predictable signal vs. noise at different spatial and temporal scales
I3. Assess the importance of global vs. regional/local forcings (e.g. land use, aerosols) in climate predictions/projections.
I4. Combine multi-model, multi-method information to assess reliability and characterize uncertainty (probabilistic framework).
I5. Translate climate data into information relevant to societal sectors
I6. Deliver, communicate, co-explore data with stake-holders
I7. Build capacity.

The white paper also included four examples of focused science topics:

- Polar climate predictability
- Monsoon systems

- Development of techniques for producing regional information from large multi-model ensembles
- Extremes.

Discussion:

The JSC observed that this Grand Challenge was very broad and would better lend itself to a subset of more focused initiatives that would aim to improve prediction systems in support of climate services. Four such initiatives were identified, namely:

- Intra seasonal to seasonal to interannual prediction
- Decadal prediction
- Long-term regional climate information
- Polar climate predictability.

Emphasis should be placed on the interdisciplinary nature of these topics, involving stakeholder interests as well as the physical science and aiming to provide useful, not just skilful, information. The polar climate predictability initiative would move to the Cryosphere GC.

The authors should reconsider the title of this Grand Challenge; one suggestion might be "Skilful regional climate information". It was agreed that CLIVAR would take the lead for the first two initiatives and that the WGRC would initially support the initiative on long-term regional climate information. SPARC would lead on development of polar climate predictability and CliC would support its implementation in concert with the cryosphere Grand Challenge and in collaboration with SPARC, GEWEX and CLIVAR.

RECOMMENDATION: *Regional GC to consist of three initiatives, namely: Intraseasonal to seasonal to interannual prediction (CLIVAR lead), Decadal prediction (CLIVAR lead), and Long-term regional climate information (WGRC will support initial planning phase). SPARC lead on development of polar climate predictability initiative and CliC to support its implementation as part of the Cryosphere GC and in collaboration with SPARC, GEWEX and CLIVAR. Authors to reconsider the title of this GC.*

7.2 Regional Sea-Level Rise – Prof K. Steffen

Prof Steffen began by noting that this paper was based largely on the outcomes of the WCRP/IOC Regional Sea-Level Workshop that took place in Paris in February 2011 and that further community input was desirable. He went on to note that the motivation for this Grand Challenge was clear since recent projections of global sea-level rise by 2100 range from 20 cm to as much as 2 m, and sea level is projected to rise in the coming centuries even further. Additionally, good observational data sets are now available. Satellite altimetry data indicate that, since 1993, globally-averaged sea level has been rising at a rate of more than 2.5 mm yr^{-1}.

Accurate predictions of regional sea level change on decadal to centennial time scales are therefore required for impact, adaptation and vulnerability assessments, especially for the coastal communities and ecosystems. Observations are key to our understanding of sea-level changes in the past and present, but models are essential to obtain best projections of change in the future. However, the majority of existing climate models largely disagree about patterns and magnitudes of sea level variability and change on regional scales, and it is unclear whether they have sufficient skill in projecting regional sea level.

Prof Steffen summarized some causes of current regional sea-level rise:

- Most of the observed regional changes are steric in nature, to a large degree being caused by redistribution of temperature and salinity in response to changing winds.
- Local effects (e.g., shelf dynamics, tectonics) may complicate or obscure the relationship between coastal and offshore sea level change.
- Newly available data sets (e.g. Argo) show that salt changes do matter for regional sea level changes (steric changes in thermosteric and halosteric sea levels).
- Atlantic meridional overturning and gyre circulations are also regionally important
- Cryospheric contribution to Global -SLR could be masked by the local effects, and gravitational "fingerprint" are important for regional SLR. 1m sl contribution in Antarctica could lead to 1.6 m rise in northern hemisphere.

He noted that there is need for an extended data base including deep ocean temperature, salinity and pressure information. Such observations are required to determine:

(i) where bottom pressure changes are important to sea level variability and change, as a function of time; and
(ii) where regions of heat and freshwater uptake (through surface fluxes) are located, which cannot be determined from the current datasets.

While it is obvious that wind stress impacts regional sea level on all time scales (decadal to longer time scales), it is not obvious why the wind has been changing during the recent past decades. Additional in situ observing systems in vulnerable coastal areas is needed, in particular, tide gauges co-located with GNSS stations for measuring ground motions.

The following research, observations and modeling imperatives were identified for WCRP in the next decade:

- **Uncertainties** in solid-Earth and gravity models used for predictions/projections
- Estimates of **relative contribution** of climate modes to sea level variability
- **Intercomparison** of climate modes in climate models and observations
- Change of climate modes as function of **CO_2 forcing**
- **Separation** of climate modes and long-term trends
- Encourage further **analysis of proxy and tide gauge data**
- Understand the degree of **decadal variability** in sea surface height observations and in forecasts
- We need to allow for **deep ocean-only sampling** from GRACE thereby omitting the shallow water mass contributions to large-scale bottom pressure variations
- Investigation of **contributions of wind forcing** changes relative to other forcing components on regional sea level variability and secular changes
- Impact of **changes in the wave field** on sea level need to be investigated.
- Encourage **deep ocean observations**; better data sets are fundamental.
- Improve studies of **fingerprinting ice melting**, also by using paleo-data.

Discussion:

Discussion arose as to what extent the global component of sea-level rise could be separated from regional; the JSC concluded that this Grand Challenge would necessarily include global aspects as well. The title would remain as is, the global being implicit. CLIVAR offered to take the lead and support this Grand Challenge, but in close collaboration with CliC and GEWEX. The workshop on Sea Level Rise, Ocean/Ice-Shelf Interaction, and Ice Sheets being organized by the CLIVAR Working Group on Ocean Modelling and scheduled for February

2013 in Hobart, Australia, would serve to provide community input and further direction for this activity.

JSC recommended that the activities of the WCRP-IOC sea-level crosscut be integrated into this Grand Challenge.

RECOMMENDATION/ACTION: *Authors to rewrite white paper to include global SLR; title to remain same; Projects to provide additional feedback, especially on regional aspect; CLIVAR to support this GC in close collaboration with CliC and GEWEX; activities of the WCRP-IOC sea-level crosscut should be integrated into this GC.*

7.3 Cryosphere Response to Climate Change (including Ice Sheets, Water Resources, Permafrost and Carbon) – Dr V. Kattsov

Dr Kattsov began by thanking his co-authors and discussing the strong motivation for this Grand Challenge that included:

- the prospect of an ***ice-free Arctic Ocean***;
- the fate of mountain glaciers providing ***fresh water*** to hundreds of millions of people worldwide;
- the strength of positive feedbacks between the warming climate and ***natural emissions of GHGs*** from the thawing permafrost (both terrestrial and sub-sea);
- the role of ice-sheet dynamics in amplification of ***global SLR***.

He noted that these issues were getting increasing attention in the international scientific research community and related directly to societal needs for information about climate change and its impacts. Several important papers on this topic have been published recently including "Arctic sea-ice change: a grand challenge of climate science" (Vladimir M. Kattsov, Vladimir E. Ryabinin, James E. Overland, Mark C. Serreze, Martin Visbeck, John E. Walsh, Walt Meier, Xiangdong Zhang, J. of Glaciology, Volume 56(200), 2010, 1115–1121).

The overarching objective of this Grand Challenge would be to actively promote targeted research activities aimed at substantially improving our understanding of cryospheric processes and feedbacks and our ability to make quantitative initialized predictions and long-term projections of cryospheric quantities and their interactions with the global climate system.

Expected results include:

- Increased confidence in climate models and their predictions/projections of cryosphere changes including those on regional scale;
- Improved information regarding future changes in the cryosphere, with a specific focus on information relevant for impact assessment and adaptation decision-making, such as the timing of the Arctic multiyear sea ice disappearance, the fate of mountain glaciers, etc.;
- More comprehensive, quality-controlled observational, observationally-based, and proxy datasets of cryospheric variables suitable for a range of research and model evaluation activities;
- Better quantitative understanding of processes involved in cryosphere/climate interactions and better representation of these processes in global and regional climate predictions from months to decades ahead, as well as longer-term projections,

particularly with respect to the effect of the carbon sequestered in the terrestrial and sub-sea permafrost on the atmospheric, the role of ice sheet dynamics in SLR, etc.

Dr Kattsov illustrated ways in which the WCRP could contribute to progress towards these outcomes which included providing fora for improved communication between those involved in cryospheric observations and process studies and those involved in development and application of global and regional climate models and predictions, as well as those providing climate services. WCRP could also facilitate targeted analysis of the CMIP5 and CORDEX results, and of the seasonal hindcasts in the CHFP database, focusing on the cryosphere and polar regions. He also mentioned the need for detection and attribution studies of the cryosphere change, evaluation and perhaps consolidation of cryospheric data sets and the development of more robust and revealing metrics to quantitatively evaluate model performance using these data sets.

Some focused science topics under this Grand Challenge could include:

- coordinated focus on seasonal, interannual and longer-term predictions and projections of polar climate and the role of cryosphere in climate predictability
- analysis of model intercomparison results aimed specifically at understanding and attributing model biases and shortcomings related to cryosphere
- improving the representation of permafrost and high-latitude land surface, including wetlands, in climate models, with specific emphasis on their role in the global carbon cycle;
- developing ice sheet models, with specific emphasis on the role of ice sheet dynamics on the rate of the SLR.

Discussion:

The JSC noted that this Grand Challenge covered a very large spectrum of topics and encouraged the writing team to identify some focused initiatives that could progress significantly in a five-year timeframe. One of these would be polar climate predictability that would now reside in the Cryosphere Grand Challenge and initially be led by SPARC. Overall responsibility for this Grand Challenge, now entitled "Cryosphere in a Changing Climate", would be with CliC in close coordination with other projects and partner programmes (e.g. IASC,…).

RECOMMENDATION/ACTION: *Authors to identify focused initiatives that could progress significantly in a five-year timeframe. One of these will be polar climate predictability (initially led by SPARC). Overall responsibility for this Grand Challenge, now entitled "Cryosphere in a Changing Climate", will be with CliC in close coordination with other projects and partner programmes (e.g. IASC…).*

7.4 Improved Understanding of the Interactions of Clouds, Aerosols, Precipitation, and Radiation and their Contributions to Climate Sensitivity – Prof T. Nakajima

Prof Nakajima began his presentation by recalling that the recent Planet Under Pressure conference had concluded that we were entering the anthropocene – an era of mega-cities and global air pollution. He observed that there was now a pressing need to understand the effect of aerosols on climate. He highlighted the large uncertainties associated with the role of aerosols in radiative forcing and presented the following scientific frontiers for this Grand Challenge:

Aerosol and hydrometeors (cloud droplets, rain drops, snow and other ice particles) play an important role in the earth's climate system

- Direct and indirect interaction to the radiative budget to drive the general circulation
- Complex interactions to affect hydrological cycle and water resources

Large uncertainties in particulate matter and radiation

- Interactions between aerosols and clouds
- Significant progress but still a large uncertainty in the assessed forcing
- Large differences in the climate sensitivity parameter

Modeled cloud processes depend on parameterizations

- Nucleation, wet removal, entrainment/detrainment, ...
- More complexity added by aerosols (composition, chemical transformations, cloud process, re-emission etc)
- Knowledge in the mid- to upper-troposphere and ice phase processes is quite limited.

Increase in measurement platforms from space, but still remains a challenge

- Limited validation studies from surface measurements
- New active instrumentation to provide information on the vertical distribution of aerosols, clouds, and precipitation

Climate sensitivity needs the accurate estimates of the Earth's radiation budget

- Evaluation of the aerosol and cloud forcings
- New definition of radiative forcing: Various feedbacks in the fast response climate system have been revealed

The following imperatives were identified:

Observational and modeling studies of climate-relevant aerosols properties

- Size distribution, hygroscopicity, composition, CCN and IN activity) and their atmospheric distribution
- Organics, black carbon (absorption), particle formation and aerosol mixing and their influence on radiative transfer, and cloud and precipitation throughout the entire region and vertical levels of the atmosphere

Improved understanding (thru process studies) of clouds

- Microphysical processes for water, ice, and mixed phase clouds in climate models
- Modeling of nucleation, scavenging, washout and re-emission of aerosols
- Improving resolution both in climate models and ultra-high resolution regional models

Extending the global monitoring system from space and surface

- Combined passive and active instruments: 3D information for developing better metrics regarding energy and water budget

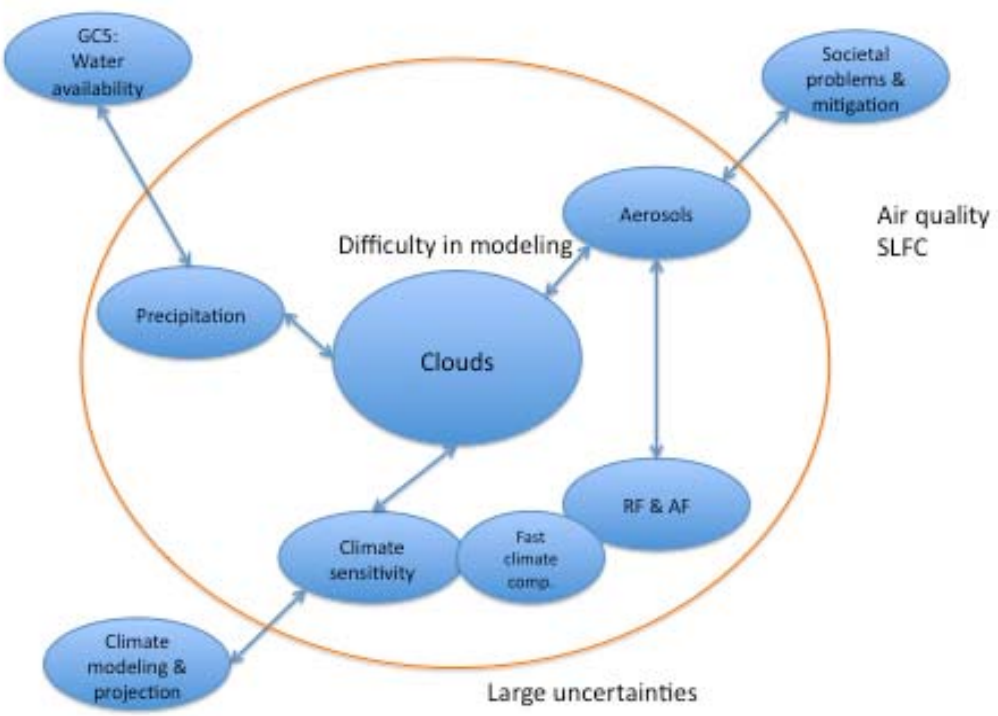
Integrated understanding of the roles of aerosols and clouds

- Interactions with radiation in the process of precipitation, ice/snow, polar climate, atmospheric interaction of land and ocean surface, glacier melting, stratospheric chemistry and dynamics.

Discussion:

JSC welcomed this contribution from Prof Nakajima, but not all members agreed on the relative importance of aerosols as presented in the white paper and they agreed that clouds

were not sufficiently addressed. They suggested that Dr Nakajima consult with WGCM and others key groups present at the JSC meeting to produce a revised outline of the white paper. During the meeting Dr Nakajima consulted with representatives from WGCM and others and presented the following revised scope for this Grand Challenge that identified clouds as the major driver to interlink climate sensitivity, precipitation and aerosol problems:



Professor Syvitski noted that IGBP was also very interested in this topic and urged close interaction with the IGAC project. Dr Trenberth remarked that there was a lot of relevant work on this topic in GEWEX. Dr Beland observed that several CAS groups were also working on aspects of this problem, especially the Global Atmosphere Watch (GAW) program. It was agreed that Dr Bony, with input from GEWEX, WGCM, WGNE, GEWEX/GASS and other key groups, would revise the white paper. WGCM would "host" this Grand Challenge, now entitled "Clouds and Climate Sensitivity", with the role of aerosols to be included in the subtitle, with assistance from GEWEX for its management. SPARC would lead on the aerosol aspects in close coordination with GEWEX and IGAC.

RECOMMENDATION/ACTION: *Dr Bony, with input from GEWEX, WGCM, WGNE, GEWEX/GASS and other key groups, will revise the white paper to include greater and leading emphasis on role of clouds and large-scale distribution of precipitation. Role of aerosols to be included in the subtitle. WGCM will "host" this Grand Challenge, now entitled "Cloud and Climate Sensitivity", with assistance from GEWEX for its management. SPARC will lead on the aerosol aspects in close coordination with GEWEX and IGAC.*

7.5 Past and Future Changes in Water Availability (with Connections to Water Security and Hydrological Cycle) – Dr K. Trenberth

Dr Trenberth began by stating that water is life and that it represents the biggest pressure point for future populations. Science questions for the Grand Challenge could include:

- How well can precipitation be described by various observing systems, and what basic measurement deficiencies and model assumptions determine the uncertainty estimates at various space and time scales?
- How do changes in climate affect the characteristics (distribution, amount, intensity, frequency, duration, type) of precipitation – with particular emphasis on extremes of droughts and floods?
- How do models become better and how much confidence do we have in global and regional climate predictions and projections of precipitation?
- How do changes in the land surface and hydrology influence past and future changes in water availability and security?
- How do changes in climate affect terrestrial ecosystems, hydrological processes, water resources and water quality, especially water temperature?
- How can new observations lead to improvements in water management?
- How can better climate models lead to improvements in water management?

Dr Trenberth stated that prospects for advancement were excellent because new observing systems were already underway or planned and there was growing interest in climate predictions on all timescales. He explained that GEWEX was prepared to tackle science questions related to this Grand Challenge, namely,

How can we better understand and predict variations and changes in precipitation?

- use and development of expected improved datasets on: precipitation and soil moisture from ongoing and planned satellite missions, as well from in-situ observations;
- evaluation and analysis into various products;
- document the mean, variability, patterns, extremes and full probability density functions,
- confront models in new ways;
- improve understanding of atmospheric and land surface processes and their modeling that improve simulations of precipitation;
- employ new techniques of data assimilation and forecasts that improve predictions of the hydrological cycle.

How do changes in the land surface and hydrology influence past and future changes in water availability and security?

- Address terrestrial water storage changes
- Close the water budget over land
- Exploit new datasets, data assimilation, improved physical understanding and modeling skill across scales,
- Catchments to regional to global to the entire hydrological cycle including hydrogeological aspects of ground water recharge.
- Use of realistic land surface complexity with all anthropogenic effects included instead of a fictitious natural environment.

- Includes all aspects of global change: water management, land use change and urbanization; water quality and especially water temperature (affected by industrial and power plants use); later nutrients.
- The ecosystem response to climate variability and responsive vegetation must be included.
- Cryospheric changes such as permafrost thawing and changes in mountain glaciers must be included.
- Feedbacks, tipping points, and extremes are of particular concern.

The results should enhance the evaluation of the vulnerability of water systems, especially to extremes, which are vital for considerations of water security and can be used to increase resilience through good management and governance.

How well are models able to handle extremes and how can we improve their capability?

- Datasets at high frequency (e.g., hourly)
- Characterize precipitation etc and allow for assessment against comparable model datasets.
- Promote analyses and how to improve prediction.
- Confront models with new observationally-based products
- New metrics of performance;
- Highlight shortcomings and developmental needs: focus field programs, process studies, numerical experimentation, and model development.
- Applications will be developed for improved tracking and warning systems, and assessing changes in risk of drought, floods, river flow, storms, coastal sea level surges, and ocean waves. In most cases, such applications will be done by GEWEX with CLIVAR and CliC.

A recent paper (Trenberth, K. E. and G. R. Asrar 2012: Challenges and Opportunities in Water Cycle Research: WCRP Contributions. *Surveys in Geophysics*, submitted) elaborated further on the theme of this Grand Challenge.

Dr Trenberth briefly reviewed the activities of the WCRP Drought Interest Group (DIG) whose objectives were to:

- Identify and leverage current drought research activities already underway within WCRP
- Assess the missing links in drought research and coordinate drought research at an international level.

The DIG had produced a white paper on Drought Predictability and Prediction in a Changing Climate: Assessing Current Predictive Knowledge and Capabilities, User Requirements and Research Priorities and a recent workshop had produced plans for a Global Drought Information System. Dr Trenberth noted that there were multiple benefits to this drought activity, including improved models and better interaction between research and users, and that it could also contribute to the extremes Grand Challenge.

Discussion:

Professor Busalacchi thanked Dr Trenberth and the other authors and expressed his view that this white paper was ideal in style and length and should be used as a model for revision of the other papers.

It was noted that this topic, and especially precipitation, was central to WCRP's portfolio, but that there were many other, much bigger, groups working on water availability. The challenge lay in how to bridge the gap and provide information in a way that they can use and trust it. It was suggested that a more WCRP-specific title might be desirable to manage expectations outside WCRP. However, JSC decided to adopt a similar but slightly shorter title for this Grand Challenge "Changes in Water Availability" because this would resonate with sponsors and stakeholders such as the GFCS.

A question was raised as to whether it was realistic to hope that the model errors would be resolved within a short timeframe. Dr Trenberth pointed out that some of the fundamental errors are that it rains too soon, or the diurnal cycle is incorrect. His sense was that not enough had been done to date to confront models with observations and that by exploiting this metric to analyze and improve the models progress could be made. Professor Jakob observed that the number of people trying to fix models is very small compared to those running the models. He reiterated the need to reinvigorate model development and urged the JSC to stress this in the Grand Challenges.

RECOMMENDATION/ACTION: *White paper endorsed but regional emphasis should be strengthened; GEWEX to lead this GC, now entitled "Changes in Water Availability".*

7.6 Science Underpinning the Prediction and Attribution of Extreme Events – Prof D. Karoly

Dr Karoly began his presentation by remarking on the large amount of material has been written on extremes and noted in particular the two community papers on extremes prepared for the WCRP Open Science Conference (http://conference2011.wcrp-climate.org/documents/Stott.pdf and http://conference2011.wcrp-climate.org/documents/Extremes.pdf) and the recently released IPCC special report (http://ipcc-wg2.gov/SREX/report/).

He introduced the topic by noting that weather and climate-related extreme events have major impacts on human and natural systems. They span a very wide range of temporal scales, from minutes to years, and spatial scales, from a few to thousands of kilometers, yet are rare in any one location. Climate variations (e.g. ENSO, NAO) affect the frequency and intensity of extremes on seasonal to interannual time scales and there is clear evidence that anthropogenic climate change is already changing the frequency and intensity of some extremes and will have a greater influence in the future.

Dr Karoly observed that everything that had been presented for the previous Grand Challenges was relevant to this Grand Challenge. The following Scientific frontiers had been identified in the white paper:

F1. Observations
- Limited availability and quality of observational data
- Improved integration of satellite, reanalysis and conventional data sources

F2. Modelling
- Many phenomena are not well simulated in models (covered in all the GCs so this GC linked to all the others)
- Model resolution and parameterizations are insufficient for accurate simulation of many extreme events
- Conceptual difficulties in comparing model results with observations

F3. Attribution of climate-related events

- Development of physically-based assessments of observed extreme events, to identify any changed risk of such events attributable to particular factors
- Strong links between operational attribution systems and those used to make monthly to decadal predictions

F4: Informing decision makers (how to make this information relevant to users)
- Many different potential users for information on weather and climate-related extreme events
- Development of readily understandable language for describing extremes, based on user needs, is key to better informing stakeholders

Imperatives and science topics included:

I1: Improved observational data (with WDAC)
- Access to historical data from data-sparse regions (with GC Regional Climate Information)
- Guidelines for archiving higher temporal and spatial resolution data
- Synthesis of satellite, analysis and conventional weather observations to produce high-resolution data for extremes

I2: Improved understanding of process interactions (connection with all other GCs)
- Better representation of key processes in prediction models
- Connections with the processes studies planned in the other Grand Challenges

I3: Operational seasonal predictions (with WMAC)
- Skilful predictions of the frequency or intensity of extreme events at regional scales on monthly to decadal time scales
- To be coordinated by WGSIP

I4: Improved longer-term predictions (with WMAC)
- Improved representation of key processes in models
- Higher resolution simulations, including regional modelling
- Initialization of coupled modelling systems used for decadal and longer term prediction
- Archiving of higher temporal and spatial resolution output
- To be coordinated by WGCM

I5: Operational attribution of climate events
- Production of timely and scientifically robust attribution assessments of extreme weather and climate events
- Coordinated by international Attribution of Climate-related Events (ACE) project (UK-US sponsored with participation by other countries); no WCRP parent, but linked to CLIVAR, WGCM, WGSIP and ETCCDI.

I6: Translation of extremes data into information for stakeholders
- Development of "actionable science" on extremes, in collaboration with GC Regional Climate Information
- Research on effective communication of information on extremes, including on uncertainties, across a wide range of stakeholder cultures and communities

Discussion:

Discussion centered on the initiatives part of the white paper. There was a sense that some of the proposed activities were already covered in other Grand Challenges. JSC asked the authors to invite more feedback from the Projects and to reduce the number of initiatives. GEWEX would take the overall lead and closely coordinate with other core WCRP Projects on this Grand Challenge, to be entitled "Prediction and Attribution of Extreme Events". The Expert Team on Climate Change Detection and Indices would remain within CLIVAR and would possibly lead some of the initiatives.

RECOMMENDATION/ACTION: *Authors to invite more feedback from the Projects and to reduce the number of initiatives. GEWEX will take the overall lead on this Grand Challenge, now entitled "Prediction and Attribution of Extreme Events".*

7.7 Discussion of Grand Challenges and Next Steps

There was considerable discussion about what exactly would be the role of the "Grand Challenges" in the overall WCRP framework. It was noted that the white papers had gone somewhat further than the original guidelines set out by the JSC at the extraordinary session in Boulder in October 2011, which were:

- A Grand Challenge is both **highly specific and highly focused** identifying a specific barrier preventing progress in a critical area of climate science.
- This focus enables the development of **targeted research efforts** with the likelihood of significant progress over 5-10 years, even if its ultimate success is uncertain.
- It should thus enable the implementation of effective and **measurable performance metrics.**
- By being transformative, a Grand Challenge should bring the **best minds** to the table (voluntarily), **building and strengthening communities of innovators that are collaborative**, perhaps also extending beyond "in-house expertise".
- It can **capture the public's imagination**: teams of world-leading scientists working to solve pressing challenges can offer compelling storylines to capture the interest of media and the public.

The JSC agreed that the Grand Challenges should be comprised of research efforts that were likely to demonstrate significant progress in the next five years. In some cases, sub-"initiatives" would be identified as efforts that would be doable in the five- year timeframe. The Grand Challenges should be seen as targeted activities that the Projects would organize, and they would depend/benefit from the solid scientific foundation and network of researchers supporting them through the WCRP Core Projects.

By a deadline of 10th September, the rewritten white papers (5/6 pages) should be completed, incorporating:

1. Why is this a grand challenge?
2. Why is this area prime for progress?
3. Initiatives.

In addition, the white paper lead authors and project leads were requested to write a short appendix to each paper that would outline an implementation strategy. Consultation across the full breadth of WCRP, as well as with other relevant research projects and groups, in form of workshops, was encouraged. The targeted date for completion of these papers was 10 September. A one page summary and appealing graphic(s) was also requested from the

authors. The summary and full-length papers would be compiled in document(s) aimed at sponsors, funders, researchers, etc.

Recognizing that community "buy-in" was essential for the success of the Grand Challenges, the JSC charged the lead projects to organize focused workshops for the Grand Challenges within the next year that would identify specific activities to be promoted and coordinated by the WCRP and its core Projects. Draft implementation plans for each workshop should be sent to the JSC by 1 November of this year.

RECOMMENDATION: *Grand Challenges will be comprised of research efforts that are likely to demonstrate significant progress in the next five years. In some cases sub-"initiatives" will be identified. The Grand Challenges will be organized by the Projects as a supplement to their core activities.*

ACTION: *White paper authors and project leads to finish rewrites (5/6 pages) and attach a short appendix to each paper that outlines an implementation strategy by first week of September. Consultation across the full breadth of WCRP is encouraged as well as with other relevant research projects and groups.*

ACTION: *White paper authors to produce a one page summary and graphic for each GC; JPS to compile the summary and full-length papers in documents aimed at sponsors, funders, researchers, etc.*

ACTION: *Lead Projects for each GC to organize focused workshops for each of the GCs or "initiatives" within the next year to gather community input and identify specific activities to be promoted and coordinated by the WCRP and its core Projects. Draft implementation plan for each workshop to be reported to JSC by 1 November 2012.*

8. Agency Updates

8.1 NOAA – Dr R. Rosen

Dr Rosen, Senior Advisor for Climate Research, Climate Program Office, described the steps being taken within NOAA to better coordinate its climate activities across the agency given that NOAA was not granted permission to create a new Climate Service line office. NOAA has instead formed a cross-line office Climate Board, consisting of the directors of the National Weather Service, National Ocean Service, National Marine Fisheries Service, and National Environmental Satellite and Data Information Service and chaired by the director of the Office of Oceanic and Atmospheric Research. The Climate Board will oversee the agency's climate efforts and, as a first step, has identified three focus areas to receive high priority for implementation: climate and water resources, coastal inundation and sea level rise, and extreme events in a changing climate. Dr Rosen noted with satisfaction the alignment between these focus areas and the grand challenges being discussed by the JSC.

Dr Rosen also briefly described the new strategic plan (http://www.globalchange.gov/what-we-do/strategic-planning) of the US Global Change Research Program (USGCRP) of which NOAA is one of 13 federal agency members. The Plan is built around four strategic goals: Advance Science, Inform Decisions, Conduct Sustained Assessments, and Communicate and Educate. In addition to these four goals, the Plan emphasizes the importance of national and international partnerships that leverage federal investments and provide for the widest possible use of the Program's results. Dr Rosen reported the US National Academy of Sciences had reviewed progress against the previous USGCRP plan and found there had been good progress on science, but less on societal issues. The new plan responds to this

assessment and hence has placed considerably more emphasis on delivering the science and educating.

Dr Rosen reviewed some of the recent and upcoming changes in NOAA personnel, including the impending retirement of Dr Koblinsky, Director of the Climate Program Office. Dr Rosen will serve as the acting director of the Office until a national search for a permanent replacement is completed.

8.2 CEOS – Ms K. Sawyer

Presentation: CEOS.pdf

Ms Sawyer, Deputy Executive Officer for the Committee on Earth Observation Satellites (CEOS), gave a brief overview of CEOS, which has 30 members and 22 associate members, including WCRP and GCOS. She presented the primary objectives of CEOS that are to:

- optimize benefits of space-borne Earth observations through:
  - Cooperation of its Members in mission planning
  - Development of compatible data products, formats, services, applications, and policies;
- serve as a focal point for international coordination of space-related Earth observation activities;
- exchange policy and technical information to encourage complementarity and compatibility of observation and data exchange systems.

CEOS has a Working Group Climate (WGClimate) whose mission is to facilitate the implementation and exploitation of Essential Climate Variable (ECV) time-series through coordination of the existing and substantial activities undertaken by CEOS Agencies. This includes the numerous iterative steps involved in the creation of ECVs and ensuring ECV life-cycle information is gathered, organized, and preserved for future generations. The WG, in collaboration with CGMS (Coordination Group for Meteorological Satellites) and WMO, had recently issued a questionnaire to members asking them to describes their current and planned monitoring capability on an ECV basis. The information gathered should help identify gaps and shortfalls and trigger medium-term activities that need to be undertaken to sustain the long-term implementation of the earth-observing architecture.

8.3 EUMETSAT – Dr J. Schultz

Presentation: EUMETSAT.pdf

Dr Schulz described EUMETSAT's activities towards sustained generation of climate data records from satellite data. The overarching conceptual view contains the Global Observing System and two major climate-related initiatives in which EUMETSAT is playing a major role. The EUMETSAT space component comprises of the geostationary Meteosat series and the polar orbiting Metop satellites. He reviewed the current status of the earth environment observing satellites and showed a film of the recent launch of MSG-3 satellite that took place on 5 July 2012. In 2011, EUMETSAT member states committed to the Third Generation of Meteosat that will extend the time series for some observations to more than 50 years around 2040 making it an invaluable resource for climate research.

Two WMO initiatives, the Global Space-based Inter-Calibration System (GSICS) and Sustained, Co-Ordinated Processing of Environmental Satellite Data for Climate Monitoring (SCOPE-CM), mostly supported by the members of the Coordination Group for Meteorological Satellites (CGMS), are essential to generate climate quality data records from

the raw satellite data. GSICS develops and provides methodology to monitor and correct instrument biases. SCOPE- CM facilitates international coordination for a sustained production of high-quality ECV products among space agencies supported by scientific institutions. EUMETSAT is concentrating on data from the current operational satellite instruments for which it is responsible (the geostationary Meteosat series and polar-orbiting Metop). Initial efforts on satellite intercalibration have been concentrated on the infrared channels of the MVIRI, SEVIRI, IASI and HIRS instruments. Developments are underway to reprocess the full archive of Meteosat data using IASI and HIRS as a reference in support of EUMETSAT's Climate Monitoring activities. GSICS is also working on extensions of inter-satellite calibration to channels in the solar-reflected band employing many instruments on satellites operated by GSICS members.

Dr Schulz presented examples of recent reprocessing activities at EUMETSAT including surface albedo derived from geostationary satellites and a reprocessing of GOME-2 data important for many atmospheric trace gas retrievals. The geostationary surface albedo is a SCOPE-CM pilot project that involved a successful export of the retrieval system to NOAA and JMA. He also reported that climate data records for the oceanic domain are produced, in particular, in the EUMETSAT Satellite Application Facility (SAF) network. A good example for this are sea-ice concentration provided by the Ocean and Sea Ice SAF and over ocean turbulent energy fluxes and precipitation products provided by the Climate Monitoring SAF derived from SSM/I observations. The CM SAF activity also incorporated a successful transition of a Climate Data Record production capability from a research institution into an operational environment.

9. Project Reports

9.1 SPARC – Dr G. Bodeker and Prof T. Shepherd

Presentation: SPARC.pdf

Dr Bodeker made the presentation, and began by introducing the SPARC Project Office staff and thanking WCRP for its support. He reviewed the project's objects and overall approach, noting that the scientific goals of SPARC are currently encapsulated within three main themes:

- Detection, attribution, and prediction of stratospheric change
- Chemistry–climate interactions
- Stratosphere–troposphere dynamical coupling.

SPARC imperatives had been and would continue to be:

- Improve the models: through model-measurement comparison
- Improve the use of (imperfect) model information: through model assessment and diagnostic analysis
- Improve the reanalyses: through assessment of the products
- Improve the observational record: through assessment of the products and development of climate data records
- Serving user needs (feed into assessments; for climate services, mainly work through the various WCRP working groups)

He observed that SPARC had always had a strong focus on deliverables (e.g. peer-reviewed SPARC Reports) and user needs, noting that the WMO/UNEP ozone assessment was a key

user of SPARC results, as well as the IPCC and space agencies. SPARC has developed metrics of success that included citations for the SPARC newsletter, of which, he was pleased to report, there were many. Other metrics included:

- The response of the scientific community to any particular activity, judged by its level of commitment to and engagement in the activity
- The response of national agencies to SPARC activities
- Clear outcomes or deliverables, the existence of a well-defined timeline for each activity, and the ability to meet that timeline
- Production of new data sets, and the extent of their use
- Production of peer-reviewed scientific reports or journal publications, and the extent of their use
- Quality of the SPARC Newsletter, judged both informally and through citations to it in the peer-reviewed literature
- Impact of SPARC activities on scientific assessments, the WMO/UNEP Ozone Assessment being of particular importance for SPARC
- Contribution to capacity development, involvement of developing nations in SPARC activities
- SPARC being approached to deliver research
- Engagement of end-users.

Dr Bodeker gave a brief update on main activities and accomplishments over the past year that included: the SPARC Data Initiative, an evaluation of stratospheric trace gas and aerosol climatologies from satellites; the temperature trends activity; an initiative on changes in the vertical distribution of ozone; the DynVar (Dynamical Variability) project that includes activities on stratospheric modelling and Arctic wintertime response to CO2 increases; and the gravity-wave activity.

Dr Bodeker then outlined some new and emerging SPARC activities:

- SPARC reanalysis/analysis intercomparison project (S-RIP)
- Stratospheric network on assessment of predictability (SNAP)
- SSiRC- stratospheric sulfur and its role in climate – what processes maintain the stratospheric aerosol layer during volcanically quiescent periods and what role does this aerosol layer play in climate?
- ESA SPARC initiative (SPIN)- to improve quality of existing measurements and make new climate data records
- SPARC data requirements initiative

SPARC activities were evolving naturally to develop a greater emphasis on stratosphere-troposphere coupling, as this was where the science was headed ("one atmosphere"). SPARC with the IGBP IGAC project had sponsored a joint workshop on chemistry climate modelling which resulted in a recommendation for the establishment of a joint IGAC-SPARC chemistry climate modelling initiative (CCMI) that would no longer make a distinction between stratosphere and troposphere modelling.

SPARC was taking the lead in planning for the WCRP Polar Climate Predictability Initiative. An implementation plan was in preparation. Frontier questions had been identified as:

- Why are the climates at the two poles changing so differently to each other (with the Arctic changing rapidly, and the Antarctic unevenly), and to global climate?
- Why is the rate of Arctic change at the edge of (or beyond) the distribution of model estimates, with observations on average exceeding the model rate of change? And why is the situation essentially the opposite in the Antarctic?

- What does high latitude climate change mean for lower latitudes?
- Do the ongoing amplified changes in the Arctic have an influence on extremes in the Arctic?
- How predictable is Arctic climate?
- Is the stability of ice sheets changing? What is the probability of catastrophic ice sheet breakdown in the next few decades?

Imperatives for this initiative included:

- Reconstruct past climate variations (100+ years)
- Improve reanalysis products for the high latitudes
  - Ocean as well as atmosphere, work towards coupled
- Design optimised sustained observational networks
  - Need for public sharing of data
- Improve the climate models that are used for simulating past and future polar climate
  - Improve process parameterizations
- Assess model performance and inform new model development
  - Assess how much confidence we can place in models
- Define proper use of models to answer frontier questions
- Improve prediction

Suggested implementation mechanisms included:

- A sequence of actions to form a community on Antarctic climate processes, centred on the question of how the jets and non-zonal circulation couple to the rest of the system in the SH
- Synthesis workshop focused on Antarctic climate and its change, as represented in data records, reanalyses and CMIP models
- Workshop to determine the best estimate and uncertainty of old Arctic data
- Workshop to construct metrics that can be used to assess models
- Workshop (with special collection or single consensus paper) to synthesize the polar performance in CMIP5 analysis
- Workshop to assess, understand, and improve predictability experiments (involve WGSIP and YOPP)
- Special session or paper collection to debate Arctic-mid-latitude connectivity (linkage with IASC and WWRP)

The plan was to form a limited-lifetime steering committee for the initiative, which SPARC saw as an 'incubator' to generate community research efforts that could be adopted, in the longer term, by more permanent components of the WCRP or partner organizations.

SPARC anticipated making significant contributions to several other WCRP Grand Challenges. Progress in understanding atmospheric circulation would contribute to the regional, sea-level rise and water availability GCs. SPARC work on atmospheric chemistry, upper tropospheric water vapour, and sulfate aerosols would be important for the understanding of interactions of clouds, aerosols, precipitation, and radiation and their contributions to climate sensitivity, and DynVar could contribute to the science underpinning the prediction and attribution of extreme events.

SPARC recognized that if it was to provide regionally-tailored climate services, then engagement of regional research community was essential and where there was no such regional capacity, SPARC needed to build capacity. Dr Bodeker presented an outline of a capacity development plan and asked the JSC for their comment.

Dr Bodeker reported that the SPARC community discussion on a potential name change had resulted in the recommendation to keep the SPARC acronym, but change what it stood for: Stratosphere-troposphere Processes And their Role in Climate. The logo would be redesigned to highlight that SPARC's focus now extended to include those tropospheric processes that are relevant to stratosphere-troposphere interactions.

The IPO was building a database to identify new participants in SPARC activities and the SSG. The 2014 SPARC General Assembly would be held in New Zealand; see www.sparc2014.org for more details.

Discussion:

There was considerable discussion on the polar climate predictability initiative. It was noted that in the paper, and at the WCRP workshop in Toronto in April, the discussion was much broader than just predictability. However, the JSC felt in general that the main WCRP contribution to this problem would and should be on predictability of climate over the Polar Regions. It was noted that the distinction between the proposed WCRP activity and the polar weather prediction improvements by WWRP was along significantly different timescales, but there were common processes and phenomena whose lack of understanding and representation have been an impediment to progress on improvement of predictability across both time scales. These research challenges could benefit significantly from joint efforts by both communities, and some further consideration should be given to the name of the WCRP effort since the difference between prediction and predictability might be too subtle. JSC also felt that it might be premature to put into place a scientific steering group for this effort until the relationship with the WWRP polar activity was more clearly defined upon completion of the strategy for the climate component by the WCRP sponsored task team.

The question was raised as to whether SPARC involvement in research on geoengineering should be greater. It was noted that none of the CCMVal models were coupled with the ocean and hence only certain aspects of this problem could be investigated, but that as these models became coupled, SPARC could expand its activity in this arena.

A query was posed concerning what was envisaged with respect to troposphere studies. The response was that SPARC would need to collaborate more with IGAC and AEROCOM but that the SPARC contribution would be mainly in areas that are not currently being covered, for instance dynamical aspects and where the troposphere–stratosphere exchange was important for climate.

ACTION: *Invite SPARC SPIN to present to WDAC*

RECOMMENDATION: *JSC concurs with the SPARC proposal for regional capacity development activity, but advises coordination with WGRC.*

RECOMMENDATION: *Predictability should be enhanced and made more prominent in the polar climate initiative; SPARC to coordinate with WGSIP and CLIVAR in this regard.*

9.2 CLIVAR – Prof M. Visbeck and Dr J. Hurrell

Presentation: CLIVAR.pdf

Prof Visbeck began his presentation by noting that CLIVAR was a very large project with a well-staffed Project Office. He remarked that the CLIVAR mission statement was still compelling and emphasized that regional aspects of climate had been a focus of CLIVAR since the earliest days even if the official project objectives do not specify the spatial scales of

interest. Prof Visbeck explained that the current CLIVAR imperatives and research challenges had been identified as the top priorities by the various CLIVAR panels and working groups. Criteria included:

- scientific importance;
- opportunity to make considerable progress;
- benefit from international coordination.

He noted that the research challenges and imperatives map across CLIVAR panels and working groups and across WCRP and other international research programmes. He went on to give an overview of some recent CLIVAR activities/results for each.

- Anthropogenic climate change
  - Prediction of Atlantic meridional circulation
  - Analysis of CMIP 3/5 outputs in regions through regional panels
  - (US) Hurricane working group – how hurricanes might change in the future

- Intra-seasonal to seasonal climate variability and predictability
  - Climate-system Historical Forecast Project (CHFP) – investigating the best possible observationally based initialization of all components of climate system
  - CINDY2011/Dynamo – multi-national field experiment in Indian Ocean to improve understanding of Madden-Julian Oscillation (MJO)
  - AAMP monsoon diagnostics/metrics task team – eg boreal summer Asian monsoon model uncertainty

- Decadal variability and predictability
  - Pan-CLIVAR effort – clear evidence of decadal variability – what is predictability and what are sources of predictability?

- Improved atmosphere and ocean components of climate models
  - Coordinated ocean-ice reference experiments (CORE)
  - Workshop on coupled processes in tropical Atlantic – focus on model biases
  - US CLIVAR climate process teams

- Data synthesis and analysis
  - GSOP ocean syntheses
  - VAMOS Atlas of Extremes over the Americas

- Ocean observing system
  - AMOC observing system
  - South Atlantic meridional overturning circulation observations being planned
  - RAMA observation network in Indian Ocean
  - Coordination of multiple observing programmes in the Pacific
  - Southern Ocean Observing System

- Education and capacity development
  - ETCCDI workshops and large number of other workshops across the globe

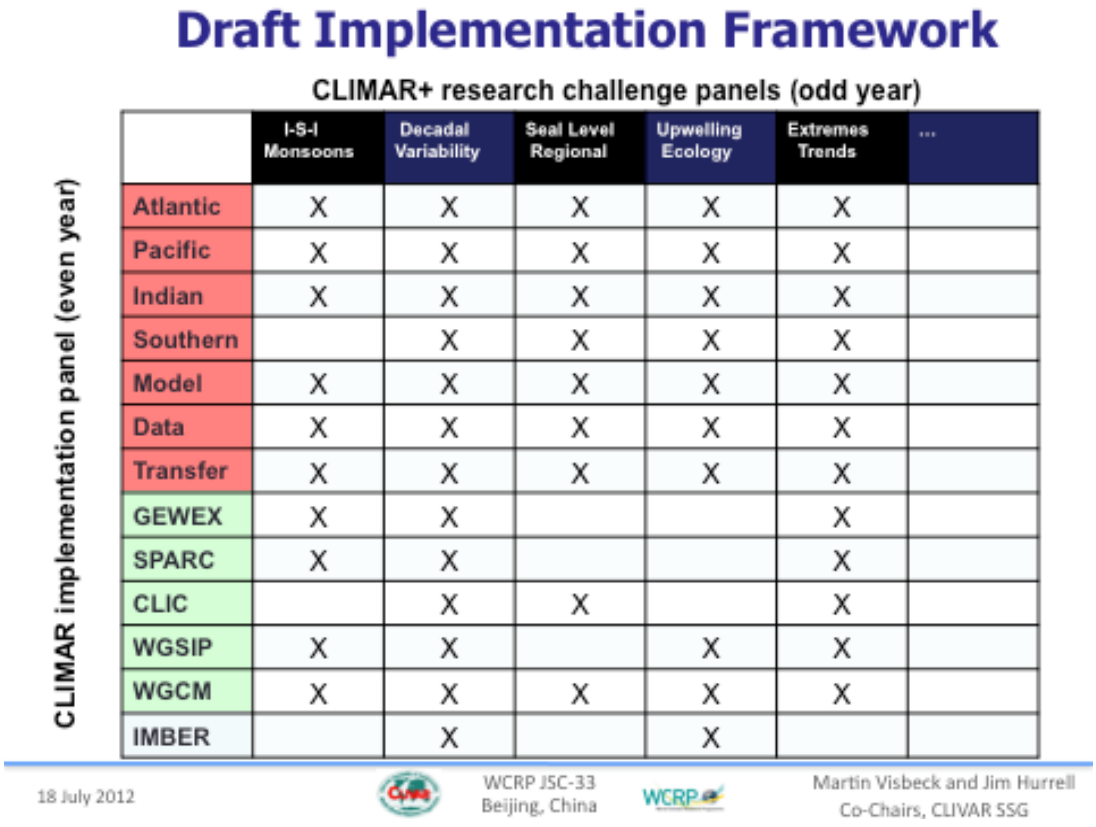
Prof Visbeck recalled that JSC had encouraged CLIVAR to take a fresh look at its research agenda and structure in light of the WCRP Grand Challenges, new research results and stakeholder interests. The CLIVAR SSG, at its recent meeting in Mexico, had focussed its planning process around the following guiding questions:

- What research challenges and capabilities should be the focus of an ocean-atmosphere project?
- If it is time to "downsize" CLIVAR where do broader activities fit into the restructured WCRP?
- Is it time to change the name of CLIVAR?

The SSG had begun to construct the "new" CLIVAR around ocean-atmosphere research challenges/capabilities and had identified the following as key topics:

- Intraseasonal, seasonal and interannual variability and predictability of monsoon systems
- Decadal variability and predictability of ocean and climate variability
- Trends, nonlinearities and extreme events
- Marine biophysical interactions and dynamics of upwelling systems
- Dynamics of regional sea level variability

Consultations would now take place within the CLIVAR panels and working groups, based on the SSG discussions and outcomes of the JSC meeting. Position papers would be developed for each of these research areas to be discussed at the next SSG meeting that would be held in June 2013 in Kiel, Germany. A draft implementation framework had been put forward at the SSG meeting in Mexico. The proposed structure, based on a matrix of core capabilities on one axis and research themes on the other, was presented to the JSC and met with a positive response; the participants of the meeting recognised the benefits that would be gained from this more integrative approach. CLIVAR would now finalise and flesh out these core capabilities and research themes, in consultation with the wider community with the aim to fully transition the project in 2014.



Prof Visbeck observed that there were many ongoing and potential areas of collaboration with GEWEX, including surface fluxes, drought, extremes, monsoons and regional efforts in the

Americas and Africa, but experience suggested that a assigning a primary lead project office was desirable.

Prof Visbeck recalled that the JSC had asked VACS and VAMOS panels to work with their constituencies to develop a list of research priorities and activities for their respective regions for post 2013. He reported on the progress in this arena. In particular VACS was working to strengthen its network of African scientists through a newsletter and database development and was planning a Conference entitled "State of the African Climate System Conference" that would be held in September 2013 in conjunction with an African climate policy meeting, with the aim to narrow the gap between African decision-makers and climate science researchers and to identify priorities for actionable climate research for the region. VAMOS was also planning a scoping workshop in the first part of 2013 that would bring together researchers and stakeholders. Both the VACS and VAMOS activities would involve the wider WCRP communities. Indeed, VACS had suggested that it should be renamed the African Climate Panel to emphasise the pan-WCRP nature of its scope.

There had been discussion at the recent CLIVAR SSG meeting regarding a name change for the Project. Prof Visbeck noted that it was a big undertaking to change brand name and that none of traditional marketing reasons seemed to apply in this case. Some new names had been put forward, but there was a sense that if one core project were to change its name, then the others should as well.

Prof Visbeck reported that CLIVAR openly solicits nominations to the SSG through its newsletter and webpage and 15 nominations had been received in 2012. He concluded with a status report on ICPO, noting that a new Director would soon be appointed and that several offers had been made to host the ICPO after March 2014, but that no decision had yet been taken.

Discussion:

Concern was raised that the proposed matrix structure would create more meetings; this was deemed not to be the case if the alternate year meeting schedule was respected. The capacity building/outreach efforts were welcomed, but JSC urged considerable development of the plan and questioned the advisability of the proposed 5-year terms for panel members.

A question was raised as to what was CLIVAR's interaction with IGBP and in particular IMBER and PAGES. Prof Visbeck reported that the CLIVAR SSG had met jointly with the IMBER SSC for a full day at its recent meeting to identify research topics of common interest and that there were already some joint efforts in the Indian Ocean. A CLIVAR –PAGES intersection group had been formed many years before to enhance collaboration between climate modelers and the paleo community; now that there was a great deal of interaction between these communities as reflected in the CMIP5 activities, Prof Visbeck suggested that it may be time to close CLIVAR intersection group and that joint activities could be managed at the WCRP level.

RECOMMENDATION: *JSC concurs with proposed CLIVAR matrix structure; welcomes capacity building/outreach efforts, but advises considerable development; JSC questioned need for proposed 5-year terms.*

ACTION: *CLIVAR to revisit project name; acronym to remain same.*

RECOMMENDATION: *The Expert Team on Climate Change Detection and Indices (ETCCDI) to remain within CLIVAR.*

9.3 CliC – Prof K. Steffen

Presentation: CliC.pdf

Prof Steffen began by acknowledging the co-authors of his presentation that included the SSG Vice-Chair, Dr Casassa, Dr Baeseman, the International CliC Project Office Director and her assistant, Ms Heidi Isaksen, as well as Dr Vladimir Ryabinin from the JPS. He reviewed CliC's mission statement and the four main Project theme areas that were:

- Ice Masses and Sea Level (IMSL)
  - contribution of glaciers, ice caps and ice sheets to sea level rise
  - how will ice shelves respond to changes in ocean and atmosphere

- The Marine Cryosphere and Climate (MarC)
  - impacts and feedbacks of a reduction in sea ice cover
  - nature of hemispheric differences between the two polar regions

- Terrestrial Cryosphere and Hydroclimatology of Cold Regions (TCHM)
  - role of terrestrial processes in water, energy, carbon cycles of cold regions
  - interactions and feedbacks between terrestrial and other elements of cryosphere/climate

- Global Predictions and the Cryosphere (GPC)
  - impacts of changes on ocean and atmosphere circulation
  - likelihood of abrupt climate changes

Each theme represented a community of researchers. CliC had developed initiatives that integrate across the themes:

- Improved understanding of ice sheet and shelf dynamics, and impacts on sea-level rise (maps into WCRP GC)
- Cryospheric Inputs to Arctic and Southern Ocean Fresh Water Balance
- Regional climate modeling
- Carbon and Permafrost – includes CAPER which is joint with IGBP AIMES – (also contributes to WCRP GC)
- Climate feedbacks from changes in Arctic and Antarctic sea ice

CliC regional groups in Asia and South America were very active and had sponsored several workshops.

The future of CliC was the major topic of discussion at the most recent SSG meeting. It was decided that the long-term objective for CliC revolved around studies of the cryosphere in a changing climate which fits very well with the WCRP Cryosphere GC. The main priorities and challenges for future CliC were determined to be:

- Global sea level: Response of ice sheets and glaciers to climate variability, including ice sheet processes and dynamic modeling
- Polar Climate Predictability (as part of a WCRP initiative based on the outcomes of the Toronto Workshop, WCRP: SPARC+CliC)
- Cryospheric inputs to the Arctic and Southern Ocean freshwater budgets
- The role of carbon and permafrost in the climate system (CAPER, WCRP/CliC & IGBP/AIMES)
- Sea-ice: observations, modelling and data products, endorsements of a community sea-ice concentration and ice extent product

- Changes in mountain cryosphere and water resources, via regional activities (Asia-CliC, South America)
- Global snow cover, past observed changes and variability, prediction for the future

Potential gaps included:

- Sea level rise of ice sheets triggered by ocean interaction (50% of ice loss in Greenland, larger in Antarctica)
  - Need better collaboration with ocean community in polar regions, both hemispheres → Ice/Ocean Initiative
  - Regional sea level rise emerging issue

- Dynamic response of ice sheets in a warming climate
  - SCAR-IASC-WCRP/CliC collaboration on ISMASS
  - Proposal for WS-support to ICSU, submitted in December 2011

- Global Snow Cover – combine observations and modeling
  - Albedo feedback
  - Water resources
  - Regional trends and variability

The SSG found that CliC described well what the programme was about so no change of name was proposed, however a new simpler logo had been adopted. Prof Steffen mentioned that the large turnover in SSG membership was viewed as an opportunity to bring in modeling capability.

Discussion:

The question was raised as to whether CliC saw model development as part of its remit. Prof Steffen felt that this would not happen given the current community and that a new approach was needed. The JSC urged the CliC SSG to look beyond its own membership when seeking expertise in modeling and to nurture this activity.

The ESSP Global Carbon Project was identified as a major player in the carbon field and CliC was urged to work with them on the role of permafrost in the carbon cycle.

Antarctic ice sheet-ocean interaction was mentioned as a key question for future investigations and it was noted that the joint CLIVAR-CliC Southern Ocean Panel was addressing this.

RECOMMENDATION: JSC proposes that the role of the CliC SSG should be primarily advisory; working groups should be formed to carry out activities.

RECOMMENDATION: JSC recommends CliC engagement with the Global Carbon Project vis-à-vis the role of permafrost in the carbon cycle.

9.4 GEWEX – Dr K.Trenberth

Presentation: GEWEX.pdf

Dr Trenberth began by introducing leaders of the major GEWEX panels. He noted that amongst these only the SSG had met since the Open Science Conference. He reviewed the GEWEX post-2013 vision statement that was:

Water and energy are fundamental for life on Earth. Fresh water is a major pressure point for society owing to increasing demand and vagaries of climate.
Extremes of droughts, heat waves and wild fires as well as floods, heavy rains and intense storms increasingly threaten to cause havoc as the climate changes. Other challenges exist on how clouds and aerosols affect energy and climate. Better observations and analysis of these phenomena, and improving our ability to model and predict them, will contribute to increasing information needed by society and decision makers for future planning.

This had led to a new mission statement:

To measure and predict global and regional energy and water variations, trends, and extremes (such as heat waves, floods and droughts), through improved observations and modeling of land, atmosphere and their interactions; thereby providing the scientific underpinnings of climate services.

The SSG with input from the GEWEX communities had identified the following imperatives that dealt with the basics of what GEWEX needed to do:

- Datasets: Foster development of climate data records of atmosphere, water, land, and energy-related quantities, including metadata and uncertainty estimates.
- Analysis: Describe and analyze observed variations, trends and extremes (such as heat waves, floods and droughts) in water and energy-related quantities.
- Processes: Develop approaches to improve process-level understanding of energy and water cycles in support of improved land and atmosphere models.
- Modeling: Improve global and regional simulations and predictions of precipitation, clouds, and land hydrology, and thus the entire climate system, through accelerated development of models of the land and atmosphere.
- Applications: Attribute causes of variability, trends and extremes, and bases in collaboration with the wider WCRP community.
- Technology transfer: Develop diagnostic tools and methods, new observations, models, data management, and other research products for multiple uses and transition to operational applications in partnership with climate and hydro-meteorological service providers.
- Capacity building: Promote and foster capacity building through training of scientists and outreach to the user community.

Dr Trenberth was pleased to be able to report that GEWEX had received very positive recognition as a program that coordinates Earth observations successfully in a recent US Office of Science and Technology Policy report that addressed US Earth observation capabilities. The report is available at:
http://www.whitehouse.gov/sites/default/files/microsites/ostp/ostp-usgeo-report-earth-obs.pdf.

Dr Trenberth gave an overview of current activities in the main GEWEX panels:

The GEWEX Data and Assessments Panel (GDAP) dealt with radiative processes and understanding, global data sets (aerosols, clouds, radiation, water vapour, precipitation, surface fluxes), global *in-situ* observational networks, development and standardization, reprocessing of datasets and assessment and intercomparison studies (www.gewex.org/GDAP.html).

The GEWEX Hydroclimatology Panel dealt with globally distributed regional data sets of water and energy observations as well as hydrological modelling and processes at relatively small scales, including monsoons and extremes. The Panel was in transition; some regional hydroclimate projects (RHP) were sunsetting and new ones were under development; some of

the data activities had been transitioned to other groups. Hydrological applications and forecasting was also in the remit of this panel. www.gewex.org/projects-ghp.html GEWEX would like to see more coordination of regional studies, particularly in Africa, and would recommend just one RHP for the continent.

GEWEX modelling activities had two major components: the GASS Global Atmosphere System Study and the Global Land Atmosphere System Study (GLASS)
GASS dealt with atmospheric process, parameterization, data set and tools and the atmospheric boundary layer www.gewex.org/gass_panel.html. GLASS dealt with surface modelling, parameterizations, data sets and tools; land-atmosphere coupling, model data fusion, strong cooperation with NWP via WGNE. www.gewex.org/glass_panel.html Both groups had strong cooperation with numerical weather prediction via WGNE.

At last SSG and in response to JSC request, GEWEX had identified four GEWEX grand science questions:

- How can we better understand and predict precipitation variability and changes?
- How do changes in the land surface and hydrology influence past and future changes in water availability and security?
- How does a warming world affect climate extremes, and especially droughts, floods and heat waves, and how do land area processes, in particular, contribute?
- How can understanding of the effects and uncertainties of water and energy exchanges in the current and changing climate be improved and conveyed?

Dr Trenberth described in some detail what GEWEX saw as the major challenges and opportunities for addressing these questions and how GEWEX planned to address them. He emphasized that new data sets and synthesis activities presented great opportunities to refine understanding of water and energy cycles.

GEWEX had conducted a community poll concerning the Project name. The first preference had been to keep GEWEX but change the meaning to Global Energy and Water Exchanges. There had been general agreement that GEWEX should change name only if the other Projects changed their names.

Dr Trenberth mentioned that there were many ongoing and potential collaborations with CLIVAR as raised in the CLIVAR presentation. He had attended the recent CLIVAR SSG meeting where these were discussed. He commented that a lot more attention was warranted on a global synthesis activity that integrated CLIVAR and GEWEX (and CliC and SPARC) activities along with the observations and modelling efforts in WCRP. In his view, there should be a single WCRP monsoon and extremes activity. Dr Trenberth observed that aging panels often had mission creep, gaps, and overlaps developed, so it was good to revamp from time to time. The following recommendations were made from the GEWEX perspective:

GASS should continue to take lead on global atmosphere processes (moist, troposphere). Must be global, not just land.

AAMP could take the lead on global monsoons with activities on Africa, Asia and the Americas. Some AAMP activities could come under GASS (e.g., MJO). CLIVAR could take the lead on overseeing this monsoon activity that would have emphasis on variability and predictability (versus precipitation and hydrology). The latter would remain in GEWEX. A single WCRP monsoon website should be developed.

ETCCDI could take the lead on extremes with distributed activities in GEWEX and CLIVAR. Whether ETCCDI was the right body would depend on the views of the other sponsors of that panel. Otherwise ETCCDI would be a key part of this activity.
The extremes activities should be guided by the new WCRP extremes Grand Challenge and this would necessarily involve a great expansion over what currently existed in ETCCDI.
The extremes activity could be centered anywhere but probably belonged with land (GEWEX) since it included drought, ETCCDI, and activities in the RHPs. It must, however, engage with CLIVAR and CliC, and perhaps SPARC.

Discussion:

Some concern was expressed that atmospheric circulation was not being sufficiently addressed; GASS focussed on processes, not circulation although there were some circulation studies by the MJO group. The view was expressed that a new community should be introduced into GASS to address this shortfall.

ACTION: *GEWEX to confer with SPARC on the need for a panel on global atmosphere synthesis.*

9.5 General Discussion of Projects

Some concern was expressed that the proposals for establishing monsoons and regional studies would result in "business as usual". It was observed that South America funding agencies were looking for more integrative studies based on socio-economic issues. Hence, one should wait for the regional conferences to see what the scientists want to address in the near future before establishing a structure.

It was remarked that AMMA was shifting to biogeochemical and human dimensions studies – how would this be integrated into the new panels. Dr Trenberth expressed the view that the focus of the WCRP global monsoon activity should be on improving simulation of monsoons in climate models. Other aspects would seem to relate more to regional issues, i.e., GC 1.

There was some unease that by not changing the Project names, WCRP might send a signal that it was going about "business as usual". However, it was agreed that the distinction between capabilities and initiatives was useful: capabilities were things done over the long term and hence new names are not needed for these. The Core Projects should be seen as the fundamental capabilities of WCRP, quasi-permanent fixtures, and so should not invent new names. However, the way we will apply these capabilities must undergo a very serious change to meet societal needs, e.g., as evidenced by the GCs. WCRP should be focussing on internal reorganization of projects.

RECOMMENDATION: *CLIVAR and GEWEX to join forces to coordinate monsoon activities with CLIVAR taking the lead in managing this under new pan-monsoon panel. Monsoon panel to explore greater collaboration with MAIRS.*

RECOMMENDATION: *VACS and VAMOS, with full support and engagement of CLIVAR, GEWEX and the JSC, to take lead in forming scientific organizing committees for conferences that will identify future directions for WCRP in climate research for Africa and for Latin America and the Caribbean, respectfully. JPS to assist in fund raising. VACS and VAMOS to be jointly administered by CLIVAR and GEWEX, at least until the conferences.*

RECOMMENDATION: *JSC agrees to proposed name changes for SPARC and GEWEX; acronyms for all four core projects remain the same.*

10. Modelling Working Group Reports

10.1 WGCM – Dr S. Bony

Presentation: WGCM.pdf

Dr Bony, WGCM co-chair, reviewed the main objectives of WGCM, noting that the Group tried to promote a balance between prediction, evaluation and understanding. The major focus of the Group was now CMIP5 in which 26 modelling groups were participating. CMIP5 was organized around two major sets of experiment, the near term (decadal) up to 2035 and long term (century and longer). CMIP5 model output was served by federated centres around the world that appear to be a single archive, the Earth System Grid Federation (ESGF). This distributed archival and storage capability was widely viewed as the future of accessing both model and observed data for a wide variety of applications in climate science. Experience was showing that there was a need for greater governance of the ESGF to create a decision-making framework or procedure that was accepted by the various ESGF institutions, and to help interface with both the CMIP5 and other communities.

Dr Bony outlined first impressions from the CMIP5 model analysis workshop held in Hawaii in March of this year with 175 participants. In spite of some delays in model availability and challenges in downloading model data, analyses so far usually could include between 15 and 22 AOGCMs, 4 to 8 decadal prediction simulation sets, about 6 high-top models, and 3 to 8 Earth System Models (ESMs). The concern that the spread of future projections from the new generation of AOGCMs with more complexity, or from ESMs with coupled carbon cycle would be much greater than from the AOGCMs of CMIP3 appears to have been unfounded. The spread of projections in CMIP5 AOGCMs seems comparable to CMIP3, and most first generation ESMs are well-behaved and produce comparable first order results to AOGCMs.

Dr Bony observed, however, that CMIP5 offers the opportunity to study climate change with many additional capabilities (carbon and chemistry, short-term climate change, comparison paleo/future, forcings and feedbacks diagnostics, high-resolution, high-frequency outputs, etc) and hence to better understand the spread and better assess the robustness of model results. She went on to note that in terms of model performance, some quantities show considerable improvement (e.g. rate of sea ice loss in Arctic) or a decrease in model spread (e.g. AMOC, Nino3 standard deviation), but others have not significantly improved (e.g. double ITCZ, Arctic clouds and atmospheric circulation, Antarctic sea ice loss, southern ocean too warm, SPCZ too zonal, humidity in subtropical descent regimes too high).

Hundreds (or perhaps thousands) of papers would be based on CMIP5 model output analysis and Dr Bony saw a growing need for community reviews and syntheses of CMIP5 analysis results. WCRP could solicit a series of synthesis papers from its core panels, WG, expert communities that would make its activities highly visible and more useful to other communities and facilitate IPCC assessments.

Dr Bony felt that the community was poised to make significant progress in predicting the distribution of clouds and precipitation, and the large-scale circulation closely coupled to them that had been identified as one of the most important problems in climate. CMIP5, new observations, Global Cloud Resolving Models, and a growing and motivated community were likely to accelerate progress and WCRP was in a position to lead and nurture this effort through the GC.

RECOMMENDATION: *Request to all WCRP-affiliated projects to consider advocating and supporting CMIP5 synthesis papers.*

10.2 WGSIP – Dr F. J. Doblas-Reyes

Presentation: WGSIP.pdf

Dr Doblas-Reyes began his presentation with a slide illustrating the progression from initial-value problems with weather forecasting at one end and multi-decadal to century projections as a forced boundary condition problem at the other, with climate prediction (sub-seasonal, seasonal and decadal) in the middle. He described how WGSIP was making use of knowledge on all these timescales in a "seamless" approach to climate prediction. A joint activity of IRI with the Red Cross demonstrated the practical application of this multi-scale approach, for instance, in preparations for humanitarian assistance in cases of natural disasters: seasonal forecasts were used to get "Ready", mid-range forecasts helped the assistance teams to get "Set" and short-term forecasts told them when to "Go".

The WGSIP terms of reference had been updated since the Group was reporting directly to the JSC and no longer to CLIVAR:

- Develop a programme of numerical experimentation for seasonal-to-interannual variability and predictability, paying special attention to assessing and improving predictions;
- Develop appropriate data assimilation, model initialization and forecasting procedures for seasonal-to-interannual predictions, considering such factors as observing system evaluation, use of ensemble and probabilistic methods and statistical and empirical enhancements, and measures of forecast skill;
- Foster synergies with the joint WCRP-WWRP project on Subseasonal to Seasonal Predictions to capitalize on both weather and climate scientific knowledge;
- Advise the WCRP core projects and the JSC on the status of seasonal-to-interannual forecasting;
- Liaise with WGCM, WGRM, WGNE and other relevant groups through WMAC and other channels as appropriate;
- Liaise with the WDAC on the adequacy of the observing systems for model assessment and validation;

Dr Doblas-Reyes reviewed the actions to WGSIP from JSC-32 and reported that WGSIP had been engaged in planning for the WWRP Polar Prediction Project and the WCRP Polar Predictability Initiative and that IceHFP experiment was making progress. The issue of engaging core Projects in analyzing the nonstationarity of modes of climate variability based on CMIP5 results would be discussed at the upcoming joint WGCM/WGSIP meeting in September.

WGSIP had participated in many meetings over the past year especially with regard to the IPCC. A workshop was being planned jointly by WGCM and WGSIP for early 2013 with objectives to:

- illuminate the state of climate prediction in general including, especially, the results of the Climate Historical Forecast Project (CHFP) and the Decadal Prediction component of CMIP5;
- bring the seasonal forecasting and climate modelling communities together to discuss model formulation, initialization, forecast assessment, forecast post-processing, etc.

Dr Doblas-Reyes reviewed progress on the flagship WGSIP project, the CHFP and reported that a CHFP synthesis paper was in preparation. He recalled that areas of untapped skill were identified at the WCRP 2007 workshop on seasonal prediction. This lead to three additional experiments:

- Land Surface, the GLACE2 experiment
- Stratosphere, Stratospheric Historical Forecast Project
- Sea Ice, Ice Historical Forecast Project

These would be revised and updated in European FP7 SPECS project (2012-2017), which will send invitations to participate to all interested groups outside Europe.

Dr Doblas-Reyes noted that many groups were now developing decadal prediction systems, many based on the CMIP5 experience. The joint WGCM/WGSIP Decadal Climate Prediction Panel (DCPP) was preparing methodological material to inform the rapidly growing decadal prediction community. The vision for post-CMIP5 was to try to organize the community to produce near-real-time decadal predictions and informally exchange a small part of the output to ensure mutual ownership. A very simple exchange was now underway under auspices of the WMO Commission on Climatology and sponsored by WGSIP.

WGSIP used current ocean observations and climate models to produce regional climate predictions from intraseasonal, seasonal, and decadal time scales and hence it expected to make a major contribution to the regional GC, but also to provide input to the cryosphere (sea ice initialization), water availability and extremes GCs.

Discussion:

It was noted that winds were key for the sea-level GC and therefore WGSIP would have a big role. Data storage and use were discussed; there was concern that the data being stored at the central site at CIMA in Buenos Aires was not being used enough; this should be addressed by the regional GC. The question was raised as to whether the models could go beyond 60 degrees N/S; Dr Doblas-Reyes said that it was standard practice to include the polar regions in forecast systems assessments and that WGSIP was already engaged with the WWRP Polar Prediction Project and the WCRP Polar Climate Prediction Initiative.

10.3 WGNE – Prof C. Jakob

Presentation: WGNE.pdf

Prof Jakob reviewed the WGNE terms of reference and presented a "distilled" version around which most of the Group's activities revolved:

- Advice, liaison
- Co-ordinated experiments
- Workshops, publications, meetings

He noted that the groups with which WGNE liaised were numerous and included the operational NWP centres, WCRP, WWRP and other WMO groups.

Several coordinated experiments and projects were ongoing or being planned:

- Transpose-AMIP with WGCM
- SURFA
- Grey-zone (with GASS)
- Verification
- NWP performance (with JWGV) (e.g. TCs, precipitation)
- Polar (CBS-style; ConcordIASI intercomparsion)
- Climate metrics (with WGCM
- Issues with verification against own analysis (with JWGV)

Transpose-AMIP was testing climate models in NWP mode. The CMIP5 protocol was being used to accommodate that community; Prof Jacob was pleased to report that the data was being used and publications were expected in time for use in the IPCC 5th assessment. The Grey zone project was studying the model range where features are not resolved but also not parameterized. The case study was on a cold air outbreak and sought to determine how well do models represent convection and the evolution of the boundary layer in a cold air outbreak and to explore the use of high resolution 'truth' to investigate parameterization issues for coarser resolution models.

The recent systematic error workshop had demonstrated that errors in weather models were not that different from those in climate models. The workshop on representing model uncertainty and errors in both NWP and climate models had made progress on finding common language between the two communities. Key recommendations from Pasadena workshop on model physics included:

- Improve funding around model physics development, in particular increase length and target key issues;
- Focus on addressing long-standing issues, in particular some of the old model biases
- Grow the model developer species
  - Links to academia - use complementary strengths of both operational and academic communities
  - Improve recognition including prizes
    Targeted programs including summer schools and scholarships
- Communicate better, especially, be more positive about the field

Prof Jakob closed with some reflections on his career with WGNE. He concluded that "climate is the PDF of weather" and hence WGNE had never been more important than today in bringing research in the two areas closer together. He looked forward to WGNE's important contribution to the WMAC.

11. CORDEX Update – Prof F. Giorgi

Presentation: CORDEX.pdf

Prof Giorgi recalled that CORDEX was a modelling framework designed to:

- Evaluate and improve RCD models and techniques;
- Provide a coordinated set of RCD-based projections/predictions for regions worldwide;
- Facilitate the communication with the IAV community and the involvement of the research community from developing countries.

He noted that there had been a recent change in scientific oversight of CORDEX; the original task force was terminated after having successfully completed its mandate and a Science Advisory Team (SAT) was being formed with regional representation. CORDEX would now be a project within the new WGRC.

Prof Giorgi was pleased to report that there had been a great deal of progress in the last year. He reported that the regional modelling session at this years' EGU meeting was the largest in climate area. There had been a number of regional workshops and papers were now starting to appear in research journals. There were proposals for two new regions, one covering the Middle East and North Africa and another for Southeast Asia. The Earth System Grid was now being used for the data management of CORDEX.

There had been considerable activities in Africa. Ten groups have completed the first ERA interim-driven runs, 14 groups were completing different scenario runs, a diagnostic team had been formed and journal papers were in preparation. Twenty-two modelling groups were participating in Euro-CORDEX, which was making high resolution runs as well as the standard 50km runs. MED CORDEX had 11 participating and had strong connections with HYMEX and MEDCLIVAR. Plans were underway for runs covering the East Asia and South Asia domains. CORDEX activities in South America have recently gotten underway. Regional modelling activities were ongoing in North America but with no formal connection to CORDEX. There was an important capacity building aspect to CORDEX and many training workshops had been held or were planned for the near future in Asia and Africa.

For the future, CORDEX will continue to consolidate regional teams and activities, in particular in central and North America and Australia. It is expected that a set of publications will be ready for publication in the open literature in time to support IPCC assessment. CORDEX was looking for greater involvement of statistical downscaling community and to extend its activities to include seasonal to decadal prediction experiments. A major pan-CORDEX conference was being planned for Northern Hemisphere Fall 2013, and about 250-300 participants are expected to participate. The potential venue is Brussels, Belgium, or another European city.

Prof Giorgi observed that CORDEX was growing very fast and that better mechanisms were needed to coordinate the activities in the different domains and more generally across the wider CORDEX community. Enhanced website management was needed and also a mechanism for approving new domains and activities. The project is exploring new sources of core funding to address some of these requirements.

Discussion:

The JSC congratulated the CORDEX team on tremendous progress and observed that this was a perfect example of what WCRP can and should do. It was noted that CORDEX communicated to the global community through scientific journal articles, but the question was raised as to whether WCRP should try to accelerate this communication. It was noted that there was not yet much data at the CORDEX centre in Denmark; Prof Giorgi observed that there was some hesitation to make runs public before the authors had published their results. The general sense was that all runs should be accessible. It was observed that the CORDEX runs were being used for many impact studies and the question was raised as to whether there was a plan on how to manage this; Prof Giorgi said this was an issue for the new SAT group to discuss.

A comment was made that it was very important that regional and global models did not diverge too much and that WCRP should plan activities to assess the relative merits of regional versus global modelling.

RECOMMENDATION: *Provide some guidance on use/limitations of data on CORDEX website*

ACTION: *CORDEX in collaboration with WGCM to plan some activities that compare regional and global modelling approaches.*

RECOMMENDATION: *CORDEX to reconsider name of domain covering Middle East in keeping with all other CORDEX domain names that are geographic.*

12. Status of Working Group on Regional Climate (WGRC)

Prof Semazzi led off this session with an update on WCRP developments with respect to Africa. At the extraordinary session of the JSC in October 2011, Professors Yanda and Semazzi had been charged to form task team and develop a white paper on WCRP priorities for Africa and a strategy for the way forward. Soon thereafter, the CLIVAR VACS panel met in South Africa with Prof Semazzi in attendance. Prof Semazzi reported that VACS had developed a comprehensive list of activities and deliverables and was proposing a pan-Africa climate conference joint with the Africa Climate Policy Center. Professors Yanda and Semazzi felt that the VACS agenda and the proposed conference fully addressed the JSC request and saw no need for a separate action.

The pan-Africa climate conference would focus on user needs and identify "actionable" research. The proposal was for a 2-day meeting that would be held as part of bigger policy workshop in October 2013 in Addis Ababa. Prof Semazzi expressed concern that 2 days was not enough and said he would encourage the organizers to add another day to consolidate the outcomes and develop a climate research agenda for the continent. They were looking to form an agenda that goes beyond CLIVAR, to include other relevant WCRP activities. VACS also planned to carry out an assessment of operational African climate products; essentially the Regional Climate Outlook Fora (RCOF) products that were seen as critical elements of the GFCS.

Dr Trenberth presented a brief overview of regional aspects of GEWEX. The Regional Hydroclimate Projects were located in several regions of the globe and focused on observations, data, hydrological modelling and applications, and user outreach. These could be a home for nascent WCRP regional activities.

Dr Hurrell presented an update on some aspects of CLIVAR regional activities. He recalled that at its recent meeting, the CLIVAR SSG had developed a first draft science agenda and implementation strategy that revolved around a matrix structure of research challenges versus capacities. A single monsoon panel was being proposed that was likely to be lead by members of the current AAMP, but that would include appropriate representation from the VAMOS and VACS communities and also GEWEX, WGSIP, WGCM and other WCRP regional activities. The SSG plan also included a new capability box labelled as "knowledge transfer" which address capacity development issues and would also interface with the regional activities.

The JSC, at its Executive Session immediately following the full JSC meeting, agreed to identify and appoint two Co-Chairs for the WGRC from the names put forward by the Projects. A membership roster would be developed by the WCRP Chairs and Directors based on nominations by the core Projects and partners. The JSC further decided that regional aspects of the Grand Challenges would be managed by the responsible Projects where applicable; WGRC would act as unique interface with the GFCS as per the terms of reference agreed at the extraordinary JSC session in Boulder.

Discussion:

It was noted that there had been previous attempts to map climate research activities in Africa and that networks of university researchers had met to discuss research priorities and capacity development needs. There was also a very successful ongoing capacity development activity in Africa sponsored by START. Documentation of all these activities existing and should be tabled for discussion at the pan-Africa conference.

ACTION: *JSC to identify and appoint two Co-Chairs of the WGRC from the names put forward by the Projects. The membership roster to be developed by the WCRP Chairs and Directors based on nominations by the core Projects and partners.*

RECOMMENDATION: *Regional aspects of the Grand Challenges to be managed by the responsible Projects where applicable; WGRC to act as unique interface with GFCS as per TOR agreed at Boulder JSC.*

13. START

Presentation: START.pdf

13.1 Introduction – Dr M. Manton

Dr Manton reviewed the overall mission of START, which was to promote capacity building through supporting regional research and assessment, promoting innovation in education and enhancing knowledge sharing for action. He reviewed the history of START and outlined the regional structure that included nodes in Africa, South East Asia, Temperate East Asia, South Asia and Oceania. START was now helping with capacity building for CORDEX and looked forward to playing an increasingly important role in institutional capacity development.

13.2 START East Asia Regional Center – Prof Jia Gensuo

Prof Jia gave an overview of the START Temperate East Asia Regional Centre (TEA) located at the CAS Institute for Atmospheric Physics in Beijing. He noted that the region had a very dense population, rapidly increasing industry and expansion of urban life that created major environmental issues. The TEA missions were:

- To understand the processes and mechanisms of the monsoon environment system in East Asia;
- To develop the theories and tools for the predicting regional environmental changes in next 10-30 years;
- To provide science support on orderly human activities for sustainable development in East Asia, especially in China.

Research foci included:

- Integrated studies on the monsoon environmental system of East Asia under global change;
- Comprehensive field experiments and synthesis on the effects of orderly human activities to life support environment;
- Investigate abrupt changes and extremes of the regional Earth system and climate.

TEA research facilities include observation sites and networks, a regional data system and data assimilation and modelling activities. Dr Jia gave an overview of the many ongoing TEA research projects (see http: tea.ac.cn).

13.3 MAIRS – Dr M. Manton

Presentation: MAIRS.pdf

Dr Manton reviewed the history of the Monsoon Asia Integrated Regional Study (MAIRS) noting that the project carried out studies that integrated across different disciplines, national boundaries and stakeholder interests. The studies were organized around four geographic themes:

- Multiple stresses in high mountain zones
- Vulnerable systems in dryland zones
- Rapid transformation in coastal zones
- Rapid development of urban zones

and cross cutting themes of modeling and observations. Each theme addressed key questions:

- What are the major drivers for change and variability?
- What are the vulnerabilities of communities and ecosystems?
- What are the options for responding to those vulnerabilities

Dr Manton gave illustrative examples of MAIRS projects. He described an investigation of drought impacts in Inner Mongolia that demonstrated the value of including social science to understand the overall situation. He highlighted the importance of international collaboration by observing that papers with multiple authors from different countries are more often cited than those with authors from just one country. This was a motivation in particular for students and young researchers to encourage them to pursue international collaborations.

Dr Manton concluded by observing that MAIRS had developed links between research groups across the region and between the regional and global research. MAIRS aims to provide a regional connection for the Future Earth initiative.

RECOMMENDATION: *JSC encourages MAIRS to provide feedback to CORDEX by evaluating products using regional knowledge and data sets, as well as continue to interact with the new Monsoon Panel*.

14. Opportunities and Challenges in Monsoon Prediction in a Changing Climate (OCHAMP-2012) – Prof B. Goswami

Presentation: OCHAMP-2012.pdf

As a part of celebration of Golden Jubilee Year (1962-2012) of the Indian Institute for Tropical Meteorology (IITM) a conference on Opportunities and Challenges of Monsoon Prediction in a Changing Climate (OCHAMP-2012) was held at the IITM in February of this year with support from WCRP/WWRP. Support from the Ministry of Earth Sciences (MoES), Government of India and ICTP, Trieste, made possible a training component for Ph.D students and early career scientists. There were 340 participants in all.

Prof Goswami gave an overview of the history of IITM. He highlighted the recent creation of a Centre for Advanced Training in Earth System Science and Climate (CAT-ESSC) that will entrain 20-30 students every year who will participate in a work/study programme. New

initiatives include a project to improve operational modelling systems by linking operational and academic modelling efforts.

Prof Goswami summarised recent progress in understanding of monsoon prediction and predictability and observed that there are major opportunities for advancement since current prediction skill is still below the potential limit of predictability. He reviewed some of the most salient results presented at the OCHAMP conference, which covered a broad range of topics including the role of aerosols, monsoon season changes over time, the intersection of weather and climate, convection, the role of orography and future projections of monsoons.

He presented recommendations from the Conference that included:

- Coupled Models for Monsoon Prediction: Have shown some measurable progress. Must focus on further improvement to realize the potential predictability;
- Improve the Parameterization schemes: Formulation of clouds is largest source of biases in models. New observations required for better understanding leading to new ideas on parameterization;
- Aerosol's Role: Considerable uncertainty on how it influences monsoon. A model inter-comparison project suggested;

Discussion:

It was suggested that targeted observing system simulation experiments (osse's) would be useful to make the case for more space based observations of upper air winds that appear to be crucial for improving monsoon predictions. It was observed climate predictions were just one piece of the puzzle and that many floods in Asia had strong human dimensions.

15. WCRP Capacity Development and Communications and Outreach Plans – Dr G. Asrar

Presentation: Capacity Development & Communication Strategies.pdf

Dr Asrar began his presentation by observing that JSC had heard reports over the course of the week of many excellent efforts to capture the interest of, and engage, students and early career scientists in the programme. Summer schools and training seminars had been very effective in building the next generation of researchers. The strategy paper provided guidelines on how WCRP could identify next generation of scientists and involve them in all WCRP activities in a sustained way. Two major thrust were proposed:

- Building research capacity in developing regions
- Communicating science to the public

Dr Asrar noted that WCRP has a unique set of partners who could help implement the overall strategy. He gave the example of CORDEX in Africa where the partnership with START had opened doors for NGO support. WCRP would continue to actively seek alternative sources of funding to support the capacity development and communication efforts. In addition, WCRP will forge alliances with professional organizations to develop and implement such activities. For example, WCRP could partner with organizations that sponsor fellowships and scholarships to influence their priorities to match those of WCRP. Dr Asrar reported that

there was a major such effort within WMO. WCRP could also negotiate with publishers to facilitate access to scientific journals in developing countries.

JSC had also urged the secretariat to explore how WCRP could better communicate what we do and attract the best minds in the community. A strategy paper had been prepared that investigated what communication means/themes most appeal and identified which communication means might be the most effective. The overall aim was to help WCRP to:

- Be a reliable source of science-based climate information for the past, present and future state of Earth's climate system
- Attract the best minds from the international scientific community to continue providing global context and integrative framework for regional climate research and information
- Increase public awareness about importance of climate and environment for a sustainable future
- Enhance the profile and the visibility of WCRP projects, activities and products
- Support information exchange and dialogue between the WCRP Secretariat and the projects as well as assist WCRP and its projects in securing the necessary resources to fulfill their objectives

The paper identified some ways to implement these steps within the base budget. The current approach was opportunistic and efforts should be made to do this systematically. Dr Asrar appealed to the JSC members and Projects to assist in these efforts. He also invited them to send in their comments, suggestions and ideas to Dr Roberta Boscolo, the WCRP Communication and Outreach Officer.

Discussion:

JSC passed its appreciation to the JPS and endorsed both documents. The Chair urged the Projects and JSC members to further populate the matrix of strength and weaknesses as presented in the communication and outreach document. It was suggested that the people responsible for outreach in each of the Projects should meet to share ideas and best practices; it was suggested that preparation of input to the WCRP achievements report could be rallying point.

It was observed that many organizations already offer fellowships and scholarships for which people in the WCRP community could apply and that WCRP should bring these to the attention to our community. One could even negotiate to include WCRP in the name on some of these fellowships and scholarships. Projects could share their networks to encourage interdisciplinary research. The Director of the CliC office reported on an ICSU study of relevance that she would share with the JSC and the Projects. Communication tools such as webinars could also serve.

The importance of the link between the operational and research communities was highlighted - the observational community needed input from research to guide how new observing system should develop to meet future requirements and the research community needed long term observations to support research, so the benefits were mutual. This was also an important element of communication.

RECOMMENDATION: *JSC endorsed strategy outlined in white paper on WCRP Education, Training and Capacity Development. Projects and JSC members to alert JPS to regional and national fellowships, scholarships and employment opportunities that could benefit WCRP community.*

RECOMMENDATION: *JSC endorsed strategy outlined in white paper on WCRP Communication and Outreach. JSC members to comment on any potential gaps in outreach matrix.*
ACTION: *Projects and JSC members to bring to the attention of JPS and IPOs recent and upcoming publications and research results that are particularly newsworthy.*

16. Partner Presentations

16.1 GCOS – Dr A. Simmons

Presentation: GCOS.pdf

Dr Simmons gave an overview of the activities of the Global Climate Observing System (GCOS) that included designation of Essential Climate Variables, assessment of observing system adequacy and identification of requirements. He noted that GCOS functioned through operational agencies, in particular the meteorological services and through its panels which were the:

- Atmospheric Observation Panel for Climate (AOPC) - sponsored by GCOS and WCRP, with WCRP participation through SPARC
- Terrestrial Observation Panel for Climate (TOPC) - sponsored by GCOS, WCRP and GTOS, with WCRP link through panel membership of Prof Koni Steffen
- Ocean Observations Panel for Climate (OOPC) - sponsored by GCOS and WCRP, with WCRP participation through ex-officio CLIVAR membership.

Dr Simmons reported that GOOS had been a sponsor of the OOPC, but had temporarily dropped off due to a re-organization. The new GOOS Steering Committee foresaw three panels, each covering both open ocean and coastal waters. These panels will work within the new Framework for Ocean Observing. OOPC was seen as the panel for physical oceanography, with the other panels covering biogeochemistry and ecosystems.

Recent GCOS activities included:

- publishing Satellite Supplement to 2010 Update of Implementation Plan
- liaising with CEOS, coordinator of the space-agency response to the Plan and Supplement
- contributing to the observation and monitoring component of the plan for the Global Framework for Climate Services (GFCS)
- participating in WIGOS Pilot Project Meeting on observing practices and governance of GCOS Reference Upper Air Network
- convening with partners an Implementation Strategy Meeting for S America
- continuing donor-supported revitalization of key stations in networks
- supporting UNFCCC SBSTA's consideration of research and systematic observation, contributing on behalf of WCRP to the research dialogue
- preparing to host a new ocean programme officer in Geneva.

GCOS was formulating a new Implementation Plan (2015-2016) that would emphasize support to the UNFCCC as previously but likely also address more explicitly the needs of sectors other than policy. Future activities will be subject to the outcome of a Sponsors' review to be held over the coming 12 months. It was expected that the views of WCRP would be sought by the review panel.

16.2 IGBP – Prof J. Syvitski

Prof Syvitski, Chair of the IGBP SSC, began his presentation by stating that, if the Future Earth initiative didn't exist, we would be having a different meeting. In his view, WCRP and IGBP were not maximizing their capabilities and that by working more together they could be more effective. He reviewed the strategic vision for IGBP, noting that it was quite similar to that of WCRP.

IGBP was primarily a natural science organization. Research foci centred on the anthropocene concept and IGBP had embarked on a new series of synthesis to be completed in 2013 on the following topics:

- Earth system impacts from changes in the cryosphere
- Impacts from changes in the cryosphere on the biota and societies in the arid Central Asia
- Megacities in the coastal zone
- Global environmental change and sustainable development: needs of least developed countries
- Geoenginerring impacts
- Nitrogen and climate
- Impacts of land-use-induced land-cover changes on the functioning of the Earth System
- Air pollution and climate

Prof Syvitski observed that all of these were also of interest to WCRP.

He described the three pillars of IGBP as research and synthesis, the research-policy interface, and communication and outreach. He estimated that 70 percent of what IGBP did was global and 30 percent regional. He gave an overview of the core projects, noting that each represented large communities, some with thousands of members. The Secretariat delivers policy briefs, produces a newsletter and other outreach; the core projects do similar outreach but also publish peer- reviewed articles. IGBP was also a strong supporter of the IPCC process.

IGBP was shifting its focus more towards providing planetary leadership to policy makers. He gave illustrative examples of why this was needed. He reported that IGBP liked the Future Earth approach, focussing on innovative solutions to societal problems based on research. He emphasized, however, the need to continue the fundamental science that underpins what IGBP and WCRP do, observing that we cannot continue to make progress on quantitative understanding without this. Prof Syvitski agreed that further integration of the Global Environmental Change (GEC) was needed. The human dimension was the most difficult because the social science agenda was not common with the other GEC agendas, but it was needed.

Prof Syvitski raised concern as to how the Future Earth initiative would be supported and pointed to the need for more specificity coming down to fundable science. This would build community support and engagement. He suggested that there should be a world bank for this effort because it is so important.

Discussion:

The view was expressed that the IGBP-WCRP relationship should be stronger and that there should be more dialogue amongst all the GEC programmes, regardless of Future Earth. It was noted that the ESSP could have provided such a forum but suffered from a variety of factors such as a lack of coherent and effective governance.

The strong overlap of the IGBP synthesis activities with WCRP activities was noted and the question rose as to whether some of these should be done jointly. Prof Syvitski elaborated that the IGBP concept of synthesis required new science and discovery, not just review, and that IGBP would welcome WCRP support for these.

There was discussion about at what level should there be collaboration between IGBP and WCRP. There was considerable interaction ongoing at the project level. It was generally agreed that collaboration made sense only when the science was mature enough and there was demand for joint efforts. It was suggested that one such area could be prediction in a broader, but rigorously defined sense, of the Earth system, and that this could provide a framework for cooperation. The JSC agreed and charged the WMAC to establish a task team to investigate this further with IGBP.

16.3 WWRP – Dr G. Brunet

Presentation: WWRP.pdf

Dr Brunet, Chair of the WWRP JSC, gave a brief overview of the WMO World Weather Research Programme (WWRP). WWRP is a WMO programme whose overarching goal is to advance weather prediction. In addition to THORPEX the programme had working groups on mesocale forecasting, nowcasting, forecast verification, sand and dust, tropical meteorology, weather and health, weather modification and weather and society. WWRP interacted with many partners, including WCRP, IGBP, and GCOS.

He gave an overview of the joint WWRP/WCRP Subseasonal to Seasonal Prediction Project (http://www.wcrp-climate.org/documents/CAPABILITIES-IN-SUB-SEASONAL-TO-SEASONAL%20PREDICTION-FINAL.pdf). The main goals were:

- The establishment of collaboration and co-ordination between operational centres undertaking sub-seasonal prediction to ensure when possible consistency between operational approaches to enable the production of data bases of operational sub-seasonal predictions to support the application of standard verification procedures and a wide-ranging program of research.
- Facilitating the wide-spread research use of the data collected for the CHFP (and its associate projects), TIGGE and YOTC for research.
- Sponsorship of a few international research activities
- The establishment of a series of regular workshops on sub-seasonal prediction

A few case studies were under consideration to demonstrate the benefits of sub-seasonal predictions to society. These could include:

- Pakistan floods (2010) concurrent with the Russian heat wave
- Australian floods (2011)
- European Cold spells (2011)
- Monsoon event (with CMA, WWRP Tropical Meteorology Research WG and the WCRP monsoon panel)

At least one of the demonstration projects should be in real-time to best foster collaboration between the research and application communities.

Dr Brunet also gave an overview of the WWRP Polar Prediction Project, which aimed to promote cooperative international research enabling development of improved prediction services for the polar regions, on time scales from hourly to seasonal. A Steering Group had

been formed which included ex officio members from WGSIP and CliC. Research priorities for the project included:

- Understand the specific needs for and evaluate the use of enhanced prediction information and services in polar regions;
- Establish and apply verification methods appropriate for polar regions;
- Determine predictability of the weather and identify key sources of forecast errors in polar regions;
- Improve knowledge of two-way linkages between polar and lower latitudes, and their implications for global prediction;
- Improve representation of key polar processes in (coupled) models of the atmosphere, land, ocean and cryosphere;
- Develop and exploit ensemble prediction systems with appropriate representation of initial conditions and model uncertainty for polar regions;
- Develop data assimilation systems that account for the unique characteristics of polar regions;
- Provide guidance on optimizing polar observing systems, and coordinate additional observations to support modelling and verification.

Plans were being made for a Year of Polar Prediction tentatively scheduled for the period 2017-2018.

17. Sponsor Initiatives

17.1 WMO: Global Framework for Climate Services – Dr J. Lengoasa

Presentation: WMO-GFCS.pdf

Dr Lengoasa, Deputy Secretary General of WMO, presented an overview of the Global Framework for Climate Services (GFCS), noting that there was a critical need to translate what we do into useful information for users. There was already a lot of ongoing activity in this arena, but a coordinated and integrated approach was needed to enable user feedback and so that the community could respond in a systematic way.

The overarching purpose of the GFCS was to enable better management of the risks of climate variability and change and adaptation to climate change, through the development and incorporation of science-based climate information and prediction into planning, policy and practice on the global, regional and national scale.

Pillars of GFCS were the user interface platform; a climate services and information system; observations and monitoring; research, modelling and prediction; and capacity building. There was a key role for WCRP in the research pillar and other partners; the seamless approach across the weather climate interface was an important step. The capacity development pillar was all encompassing and included the need to educate users, but also capacity building for observations and monitoring in terms of institutions as well as people.

An implementation plan was in preparation and the assistance of WCRP was appreciated. Four thematic areas had been identified as initial foci of the plan: food security and agriculture, water resource management, disaster risk reduction and human health. These matched well with the ICSU visioning process themes and provided the impetus for WMO's involvement in Future Earth. Dr Lengoasa saw the WCRP Grand Challenges as key

contributions to the GFCS. The work on extremes in particular highlighted the importance of working with weather research community. He noted that there would clearly be a need for basic and applied research in support of the GFCS and they would look to WCRP to help access the capacities for applied climate research. The user interface was another area where WCRP could assist, in providing access to science-based climate information, but also in making sure that research results were accessible. Capacity development was another key are for WCRP to contribute. There was a need to entrain early career scientists and also to have impact at the institutional level where they are trained. There was also a need to ensure that the emerging group was fully engaged, committed and retained in the science.

17.2 ICSU: Future Earth Initiative– Dr S. Wilson

http://www.wcrp-climate.org/JSC33/presentations/Future_Earth.pdf

Dr Wilson began by briefly introducing himself and recalling that he had joined ICSU as Executive Director in April of this year. He reviewed the ICSU mission that was to strengthen international science for the benefit of society. ICSU carried out its mandate in three ways: coordinating international science, working at the policy-science interface and promoting the universality of science. There would be an independent review of ICSU in 2014.

Dr Wilson noted that he was speaking on behalf of the Alliance for Future Earth that included ICSU, ISSC, funders (Belmont Forum) and UN organizations. WMO played a role as an active observer, recognizing the tremendous synergies of Future Earth with the GFCS. Dr Wilson highlighted some of the challenges the future earth faced including:

- Feeding 9 billion people within sustainable planetary boundaries
- Valuing and protecting nature's services and biodiversity
- Adapting to a warmer and more urban world
- Transitioning to low carbon societies
- Providing income and innovation opportunities through transformations to global sustainability
- Reducing disaster risks
- Aligning governance with stewardship.

These motivated a new global Alliance to launch a ten-year initiative: Future Earth that would provide the knowledge required for societies in the world to face risks posed by global environmental change and to seize opportunities in a transition to global sustainability. The Alliance felt that new approaches were required which were more international, more interdisciplinary and more collaborative. By involving users and funders as well as scientists in the co-design, the initiative would be more responsive to society and grand challenges of sustainability. It was recognized that the initiative would build on the success of current international research programmes and Dr Wilson highlighted the important role being played by WCRP and the other GEC programmes, in particular, by mobilizing a volunteer army of scientists to develop a shared agenda, influencing funders, and doing assessments. The WCRP Grand Challenges would definitely contribute to the success of the initiative.

The Transition Team with representatives from many different disciplines, sectors, regions and organizations was developing a conceptual framework based on a number of integrated research themes:

- **A Changing Planet:** Understanding earth, ecological and societal system trends, drivers, processes, and projections
- **Resources for development and wellbeing:** ensuring the sustainable provision of food, water, health and ecosystem services

- **Low Carbon Societies:** Linking Climate Change, Energy and the Economy
- **Living with the Sea:** Oceans, coasts and blue societies
- **Reducing the risk of catastrophes:** Global thresholds and disaster risk reduction
- **Pivotal places:** Cities, regions, and critical biomes
- **Global Responses:** Managing change and governing the environment

The Transition team was also developing an initial research framework, institutional design and a strategy for outreach, education and stakeholder engagement.

Dr Wilson observed that there were a range of concerns about the initiative that included the top-down nature of the process, community engagement, the need for disciplinary research, the difficulties of interdisciplinary research, funding uncertainties and so on. He recognized that there was a need for both top down and grass roots input and that to date there had not been enough engagement with the community. The plan was to hold a series of consultations with programmes and projects and in regions during the second half of 2012 to allow for further involvement of the community in development of the science plan. Dr Wilson noted that the existence of the Alliance had already generated interest from the World Bank and this should open new avenues for funding.

Discussion:

JSC welcomed the concept of the Future Earth initiative but expressed concern about the scale and pace of the effort. The eight research theme challenges that had been identified were all of great importance, but addressing them could not be done simply by repackaging GEC research. There would have to be an effort at least of the scale of a core project for each theme. This would require a great expansion of the current GEC networks and it was not clear how to marry such a large new effort with the existing effort, and how to obtain the requisite new funding. There was also a sense that more time was needed to do this initiative well, particularly because of the time needed to develop interdisciplinary languages and skills and bringing the existing communities and networks to take the ownership of the process and required research activities. Moreover, as noted in the Belmont Challenge document, those who took the time to develop these skills would see their scientific publication productivity drop, which was a huge obstacle in the academic system that rewarded productivity based on such criteria.

Dr Wilson recognized that all these points were valid but saw evidence that some organizations/institutions were beginning to nurture truly interdisciplinary research. Regarding timing, the plan was to get the initiative up and running in 2014. Funding agencies seemed to want to move quickly and hence the Transition Team was taking an evolutionary approach to see how existing efforts could contribute and at the same time exploring how new initiatives could develop, but taking time to assess what was working and lessons learned before going the next step.

Some participants saw evidence that the uncertainty about how the initiative would actually be implemented was sowing confusion, particularly with the funding agencies, and expressed concern that this could actually set the programmes back.

17.3 IOC: Integrated Framework for Sustained Ocean Observations – Dr W. Watson-Wright

Dr Watson-Wright, Executive Secretary of the Intergovernmental Oceanographic Commission (IOC), made a presentation via Skype. She reviewed the IOC's high level objectives, which were:

- Preventing and reducing the impacts of **natural hazards**
- Mitigating the impacts of and adapting to **climate change and variability**
- Safeguarding the **health of ocean ecosystems**
- Promoting management procedures and policies leading to the **sustainability of coastal and ocean environment and resources**

IOC is the focal point for ocean observations, science, services and data exchange within the UN system and has functional autonomy within UNESCO. However, the admission of Palestine as a Member State at the 2011 UNESCO General Conference had resulted in the United States stopping all assessed and voluntary contributions to UNESCO, including IOC. This has had a severe impact on the IOC's budget and constrained its ability to contribute to the WCRP Joint Climate Research Fund.

Dr Watson-Wright was pleased to report that there is some positive news on IOC and WCRP cooperation. IOC is a lead partner in a Global Environment Facility-funded project, the Transboundary Waters Assessment Project (TWAP). The IOC role is to lead an assessment of the global ocean environment and local impacts, looking at indicators of global ocean change and how they project onto human or ocean ecosystem vulnerabilities. WCRP is involved as a partner with a modest level of funding. The TWAP project provides WCRP with an opportunity to work with "end users" and develop a two-way dialogue about what is needed in the way of climate information.

Dr Watson Wright recalled that the OceanObs'09 Conference had identified tremendous opportunities and significant challenges for ocean observations. The conference had called for a framework for planning and moving forward with an enhanced global sustained ocean observing system over the next decade, integrating new physical, biogeochemical, biological observations while sustaining present observations.

A key idea in the Framework is the definition of Essential Ocean Variables, some of which overlap with other types of essential variables that have been defined. Essential Ocean Variables should respond to high-level drivers related to climate, to understanding and managing ecosystem services, to conserving biodiversity, to managing living marine resources, to safety and protection of life and property at sea and on the coasts. Aligning the coordination processes of the observing system on variables, rather than by platforms or observing techniques, stays truer to the natural system which we are trying to observe, while allowing for innovation of observing techniques over time as technology and capability develop. Characteristics of the Framework include:

- Common language and consistent handling of requirements, observing technologies, and information flow among different, largely autonomous, observing elements
- Seeks to support self-funding and self-managing elements
- Essential Ocean Variables as common focus
- Assessment and promotion of Readiness
- for coastal and open ocean

The aim would be for an "Integrated Observing System" that would be a derivative of an EOV-based approach driven by requirements.

Dr Watson-Wright remarked on the relationship of IOC and WCRP. The WCRP Open Science Conference in 2011 showed the convening power of the WCRP and its strength in engaging the scientific community. WCRP science benefits from sustained ocean observations, and has helped to shape them, and continued strong cooperation with GOOS, particularly through CLIVAR, is very important to both programmes. Dr Watson Wright observed that IOC is trying to address the full range of global and regional ocean science

disciplines that are key for sustainability. In that respect there has been an ongoing discussion on how ocean science and ocean governance as a whole will contribute to the Future Earth initiative for science for sustainability.

Dr Watson-Wright concluded by urging WCRP regional activities to engage more fully with the IOC regional sub-commissions and regional programmes. This would provide an opportunity for WCRP to better connect with users and to improve the dialogue between users and generators of climate science.

18. Nomination Process for Project SSG and WG Membership

The JSC felt that the current strategy of requesting two candidates for each open membership slot on any given WCRP panel or group was not effective and that there was a need for more discussion to come up with a good slate of candidates. The JSC decided to form a membership team chaired by the JSC Vice-chair to facilitate the process. Projects would be asked to identify a slate of potential new members several months in advance of JSC meetings and to iterate with the membership team until agreement was reached. Projects would then approach candidates to inquire whether they were willing to serve. Confirmation of membership would be made at the JSC meeting.

ACTION: *JSC to form a membership team chaired by its Vice-chair; several months in advance of JSC meeting, Projects to identify a slate of potential new members and iterate with the membership team until agreement reached; then Projects to approach candidates to inquire whether they are willing to serve; confirmation of membership to be made at JSC meeting.*

19. Future of Existing Crosscuts

The JSC noted that the Sea-level and Extremes crosscuts had been raised to GCs and Decadal was now an initiative under the regional GC. The Atmospheric Chemistry and Climate (AC&C) crosscut should continue until agreement reached by SPARC with IGAC on how best to proceed. The Monsoons and Anthropogenic Climate Change crosscuts had been sunset at previous meetings.

RECOMMENDATION: *Sea-level and extremes crosscuts raised to GCs; Decadal an initiative under regional GC.*

RECOMMENDATION: *Atmospheric Chemistry and Climate (AC&C) to continue until agreement reached by SPARC with IGAC on how best to proceed.*

20. Closing Comments – Prof A. Busalacchi

Prof Busalacchi thanked all the participants and, in particular, the JSC members who were rotating off at the end of the year. He was pleased that discussions at the meeting had shown that the future directions being developed for WCRP were in step with those of the sponsors. The Councils were off to a good start and the Projects were entraining their communities in discussions about the future. The JSC reviewed a preliminary list of actions and recommendations and then convened to an Executive Session.

ACTION: *JPS to prepare letters of appreciation from JSC to all outgoing project and working group leaders and JSC members and welcoming new project office directors, WDAC and WMAC Co-chairs and new JSC officers.*

ACTION: *JPS to develop a funding strategy for engagement with development community (i.e., World Bank, IADB, ADB, NGOs, etc.)*

ACTION: *JSC 34 to be held 27-31 May, 2013, in Brasilia, Brazil.*

APPENDIX A – List of Participants

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APPENDIX B – JSC-33 Agenda

Monday, 16 July

08h00 - 17h30	Joint China-WCRP Symposium on "WCRP Plans and Priorities for Regional and Global Climate Research" WMAC and WDAC Joint/Parallel Meetings

Tuesday, 17 July

08h30 - 09h00	Welcome Remarks - CAS/IAP Host
09h00 - 09h30	Report on WCRP developments post OSC - A. Busalacchi
09h30 - 10h00	Report on JPS developments, program, personnel, budget - G. Asrar
10h00 - 10h30	Summary Joint China-WCRP Symposium - H. Liao
10h30 – 10h45	Coffee break
10h45 – 11h15	Summary first WMAC & WDAC meeting - Chairs
11h15 – 11h45	Summary Report on Planet Under Pressure Conference - IGBP Chair
11h45 – 12h45	Lunch
	Presentation of WCRP Grand Challenge White Papers (30 min each: 15 min presentation +15 min discussion)
12h45 – 13h15	Provision of skillful future climate information on regional scales (includes decadal and polar predictability) - F. Giorgi
13h15 – 13h45	Regional Sea-Level Rise - K. Steffen
13h45 – 14h15	Cryosphere response to climate change (including ice sheets, water resources, permafrost and carbon) - V. Kattsov
14h15 – 14h45	Improved understanding of the interactions of clouds, aerosols, precipitation, and radiation and their contributions to climate sensitivity - T. Nakajima
14h45 – 15h00	Coffee Break
15h00 – 15h30	Past and future changes in water availability (with connections to water security and hydrological cycle) - K. Trenberth
15h30 – 16h00	Science underpinning the prediction and attribution of extreme events - D. Karoly
16h00 – 16h30	Discussion of Grand Challenges and Next Steps
16h30 - 17h30	Agency Updates- NOAA, EUMETSAT, CEOS, ESA, NASA, …
17h30 – 18h30	Meeting with CAST (by invitation)
19h00	Banquet hosted by CAST

Wednesday, 18 July

	Project Reports (Project response to OSC and actions as a result, evolution of the project and decision on new name, future directions, role in the Grand Challenges) (60 min presentation, 30 min discussion)

08h30 - 10h00	SPARC (including Polar Predictability Initiative)
10h00 - 10h30	Coffee Break
10h30 - 12h00	CLIVAR
12h00 - 13h00	Lunch
13h00 – 14h30	CliC
14h30 - 16h00	GEWEX
16h00 - 16h30	Coffee Break
	Modelling WG Reports
16h30 - 17h00	WGCM
17h00 - 17h30	WGSIP
17h30 - 18h00	WGNE

Thursday, 19 July

08h30 - 09h00	CORDEX Update - F. Giorgi/C. Jones
09h00 - 09h30	Status of Working Group on Regional Climate (WGRC)
09h30 - 10h30	START - Introduction - M. Manton
	START East Asia Regional Center - Prof. Jia Gensuo MAIRS IPO - Dr Ailikun Discussion
10h30 - 11h00	Coffee break
11h00 - 11h30	Opportunities and Challenges in Monsoon Prediction in a Changing Climate (OCHAMP-2012) - B. Goswami
11h30 - 12h00	WCRP Capacity Development Plan and Communications Strategy - G. Asrar
12h00 - 13h00	Lunch (JSC Executive Session)
13h00 - 15h00	Partner Presentations (20 min presentation + 10 min discussion)
	GCOS IGBP WWRP (+ report on joint subseasonal to seasonal prediction project) Other (eg IRDR, SOLAS, CCI, etc.)
15h00 - 15h30	Coffee Break
15h30 – 17h30	Sponsor Initiatives - Present Status, Envisioned Role of WCRP and reaction to WCRP Future Directions (30 min presentation + 10 min discussion)
	WMO Global Framework for Climate Services ICSU Future Earth IOC Integrated Framework for Sustained Ocean Observations
17h30 – 18h00	Summary Discussion of WCRP role in Sponsor Initiatives

Friday, 20 July

08h30 - 09h00	Nomination process for Project and WG Membership
09h00 - 09h30	Discussion Future of existing crosscuts: Sea Level, Decadal, etc.
09h30 - 10h00	Summary of JSC-33 and Closing Comments - A. Busalacchi
10h00 - 10h30	Coffee Break
10h30 - 13h00	Executive Session
	Implementation Issues with respect to new structure How to better engage with sponsor initiatives Membership Action Items Other items

APPENDIX C – WDAC Terms of Reference

WCRP Data Advisory Council

Mandate

A combination of climate observations and models are resulting in significant amount of data and information. Research on and development of Earth observing systems, models and field experiments comprise an intrinsic part of WCRP activities and contribute to continuation and expansion of global environmental monitoring. Every WCRP project develops data and information and has a set of observation activities. The WCRP Data Advisory Council (WDAC) will act as a focal point for all WCRP data, information, and observation activities with its sister programmes, and will coordinate their high-level aspects across the WCRP, ensuring cooperation with main WCRP partners such as GCOS and other observing programmes. WDAC will work with the WCRP Modelling Advisory Council to promote effective use of observations with models and to address issues related to the coordinated development of data assimilation, reanalysis, Observing System Sensitivity Experiments, and paleoclimatic data and their assessments.

Terms of Reference:

- To serve as a focal point for observations and data in WCRP
- To advise JSC and coordinate with WCRP Projects and Working Groups on issues pertaining to observations and climate data
- To promote research using sustained observations and data from process studies across the WCRP
- To promote assessment of the adequacy of sustained observations and derived products to support climate research
- To promote assessment of gaps in the global observing system in cooperation with observation programmes
- To promote coordinated assessment and comparison of climate-data products, including those from reanalyses
- To promote research for continuing improvement in the processing and reprocessing of climate data
- To promote development of mechanisms for archival and preservation of, access to and analysis of data, and associated meta data
- To promote standards for product generation, including global and regional reanalyses
- To promote development of coupled data assimilation and a coordinated approach to reanalysis across all domains

Meeting Schedule:

The Data Council meets annually and reports to the subsequent JSC session and partner programmes. Dates will be chosen by consensus of membership.

Membership:

Members will be appointed by JSC for a three-year term with a possibility of two two-year extensions:

- Chair and vice-chair (both independent)
- Representative from each of the four projects (SSG nominates, JSC confirms)

- Representative from each of the three GCOS panels (chairs or their nominees)
- Representative of the WCRP Modelling Advisory Council
- Representative from the Working Group on Regional Climate
- Representative of IGBP (IGBP SC nominates)
- Representative of SOLAS (SOLAS SSC nominates)
- Representative of CEOS (chair or vice-chair of WG Climate)
- Representative of CGMS (CGMS secretariat nominates)

All representatives are ex-officio appointments representing their respective organizations. Other international agencies and observations coordinating bodies may participate as observer members of the Council.

Mode of Functioning:

The WCRP Data Advisory Council is expected to:

- Communicate regularly by email, teleconference or videoconference
- Meet in person, annually as a minimum
- Encourage joint meetings of working groups and/or panels to promote communication or to launch focused joint initiatives

WDAC should have the flexibility and resources to promote action within existing WCRP projects and panels or by appointing limited duration task teams to accomplish its tasks.

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APPENDIX D - JSC 33 Recommendations and Actions

General

JPS to prepare letters of appreciation from JSC to all outgoing project and working group leaders and JSC members and welcoming new project office directors, WDAC and WMAC Co-chairs and new JSC officers.

WMAC

Adopt revised WMAC Terms of Reference.

WMAC to form task team with IGBP on Prediction of Earth System.

WDAC

Adopt revised WDAC Terms of Reference.

WDAC to help facilitate harmonization between the GOSIC and CEOS/CGMS initiatives that would provide a composite inventory of in situ and satellite observations.

WDAC to encourage contributions from WCRP core projects, CEOS, CGMS, IGBP, SOLAS and the reanalysis community to the obs4MIP activity so as to populate the esgf and further facilitate model-data comparisons.

WDAC to initiate planning activities for a 5th WCRP reanalysis workshop addressing issues raised at the 4th conference; focus on coordination of observations that are input into reanalysis.

WDAC to work with GCOS, GEOS and CEOS to encourage existing networks to place higher priority on measuring non-physical variables such as partial pressure of carbon dioxide (pCO2) (an Essential Climate Variable (ECV).

WDAC to liaise with the WMO Global Cryosphere Watch (GCW) and CliC on Arctic data issues and to help GCW integrate efforts within the wider climate data community activities.

WDAC to encourage development of climate data stewardship and efforts towards data set publication and traceability of data set versions (citations, peer-reviewed articles, DOIs).

Invite SPARC SPIN to present to WDAC

WGRC

JSC to identify and appoint two Co-Chairs of the WGRC from the names put forward by the Projects. The membership roster to be developed by the WCRP Chairs and Directors based on nominations by the core Projects and partners.

Regional aspects of the Grand Challenges to be managed by the responsible Projects where applicable; WGRC to act as unique interface with GFCS as per TOR agreed at Boulder JSC.

Grand Challenges

Grand Challenges will be comprised of research efforts that are likely to demonstrate significant progress in the next five years. In some cases, sub-"initiatives" will be identified. The Grand Challenges will be organized by the Projects as a supplement to their core activities.

White paper authors and project leads to finish rewrites (5/6 pages) and attach a short appendix to each paper that outlines an implementation strategy by first week of September. Consultation across the full breadth of WCRP is encouraged as well as with other relevant research projects and groups.

White paper authors to produce a one page summary and graphic for each GC; JPS to compile the summary and full-length papers in documents aimed at sponsors, funders, researchers, etc.

Lead Projects for each GC to organize focused workshops for each of the GCs or "initiatives" within the next year to gather community input and identify specific activities to be promoted and coordinated by the WCRP and its core Projects. Draft implementation plan for each workshop to be reported to JSC by 1 November 2012.

Regional

Regional GC to consist of three initiatives, namely: Intraseasonal to seasonal to interannual prediction (CLIVAR lead), Decadal prediction (CLIVAR lead), Long-term regional climate information (WGRC will support initial planning phase). SPARC lead on development of polar climate predictability initiative and CliC to support its implementation as part of the Cryosphere GC and in collaboration with SPARC, GEWEX and CLIVAR. Authors to reconsider the title of this GC.

Regional Sea-level Rise

Authors to rewrite white paper to include global SLR; title to remain same; Projects to provide additional feedback, especially on regional aspect; CLIVAR to support this GC in close collaboration with CliC and GEWEX; activities of the WCRP-IOC sea-level crosscut should be integrated into this GC.

Cryosphere in a Changing Climate

Authors to identify focused initiatives that could progress significantly in a five-year timeframe. One of these will be polar climate predictability (initially lead by SPARC). Overall responsibility for this Grand Challenge, now entitled "Cryosphere in a Changing Climate", will be with CliC in close coordination with other projects and partner programmes (e.g. IASC…).

Cloud and Climate Sensitivity

Dr Bony, with input from GEWEX, WGCM, WGNE, GEWEX/GASS and other key groups, will revise the white paper to include greater and leading emphasis on role of clouds and large-scale distribution of precipitation. Role of aerosols to be included in the subtitle. WGCM will "host" this Grand Challenge, now entitled "Cloud and Climate Sensitivity", with assistance from GEWEX for its management. SPARC will lead on the aerosol aspects in close coordination with GEWEX and IGAC.

Changes in Water Availability

White paper endorsed but regional emphasis should be strengthened; GEWEX to lead this GC, now entitled "Changes in Water Availability".

Prediction and Attribution of Extreme Events

Authors to invite more feedback from the Projects and to reduce the number of initiatives. GEWEX will take the overall lead on this Grand Challenge, now entitled "Prediction and Attribution of Extreme Events".

Core Projects

SPARC

JSC concurs with SPARC proposal for regional capacity development activity, but advises coordination with WGRC

Predictability should be enhanced and made more prominent in the polar climate initiative; SPARC to coordinate with WGSIP and CLIVAR in this regard.

CLIVAR

JSC concurs with proposed CLIVAR matrix structure; welcomes capacity building/outreach efforts, but advises considerable development; JSC questioned need for proposed 5-year terms.

CLIVAR to revisit project name; acronym to remain same.

The Expert Team on Climate Change Detection and Indices (ETCCDI) to remain within CLIVAR.

CliC

JSC proposes that CliC SSG be primarily advisory; working groups should be formed to carry out activities.

JSC recommends CliC engagement with the Global Carbon Project vis-à-vis the role of permafrost in carbon cycle..

GEWEX

GEWEX to confer with SPARC on the need for a panel on global atmosphere synthesis.

General-Core Projects

CLIVAR and GEWEX to join forces to coordinate monsoon activities with CLIVAR taking the lead in managing this under new pan-monsoon panel. Monsoon panel to explore greater collaboration with MAIRS.

VACS and VAMOS, with full support and engagement of CLIVAR, GEWEX and the JSC, to take the lead in forming scientific organizing committees for conferences that will identify future directions for WCRP in climate research for Africa and for Latin America and the

Caribbean, respectfully. JPS to assist in fund raising. VACS and VAMOS to be jointly administered by CLIVAR and GEWEX, at least until the conferences.

JSC agrees to proposed name changes for SPARC and GEWEX; acronyms for all four core projects remain the same.

Modelling

WGCM

Request to all WCRP affiliated projects to consider advocating and supporting CMIP5 synthesis papers.

CORDEX

Provide some guidance on use/limitations of data on CORDEX website

CORDEX in collaboration with WGCM to plan some activities that compare regional and global modelling approaches.

CORDEX to reconsider name of domain covering Middle East in keeping with all other CORDEX domain names that are geographic.

JSC encourages MAIRS to provide feedback to CORDEX by evaluating products using regional knowledge and data sets, as well as continue to interact with the new Monsoon Panel.

Capacity Development

JSC endorsed strategy outlined in white paper on WCRP Education, Training and Capacity Development. Projects and JSC members to alert JPS to regional and national fellowships, scholarships and employment opportunities that could benefit WCRP community.

Communication and Outreach

JSC endorsed strategy outlined in white paper on WCRP Communication and Outreach. JSC members to comment on any potential gaps in outreach matrix.

Projects and JSC members to bring to the attention of JPS and IPOs recent and upcoming publications and research results that are particularly newsworthy.

Crosscuts

Sea-level and extremes crosscuts raised to GCs; Decadal an initiative under regional GC.

Atmospheric Chemistry and Climate (AC&C) to continue until agreement reached by SPARC with IGAC on how best to proceed.

Funding

JPS to develop a funding strategy for engagement with development community (i.e., World Bank, IADB, ADB, NGOs, etc.)

Membership

JSC to form membership team chaired by Vice-chair; several months in advance of JSC meeting, Projects to identify a slate of potential new members and iterate with the membership team until agreement reached; then Projects to approach candidates to inquire whether they are willing to serve; confirmation of membership to be made at JSC meeting.

Next meeting

JSC 34 will be held 27-31 May 2013, in Brasilia, Brazil.