



## PROJECT REPORT

Report of the first session of the CORDEX  
Science Advisory Team (SAT)

ICTP, Trieste, Italy  
16-17 May 2014

July 2014

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**CORDEX Science Advisory Team 1<sup>st</sup> Session**

**16-17 May 2014**

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***CORDEX SAT1 attendees: from left to right: Tannecia Stephenson, J. Sanjay, Fredolin Tangang, Michel Rixen, Hyun-Suk Kang, Bill Gutowski, Grigory Nikulin, Bertrand Timbal, Filippo Giorgi, Chris Lennard, Silvana Solman***

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**Present:** Filippo Giorgi, Bill Gutowski, Hyun-Suk Kang, Chris Lennard, Grigory Nikulin, J. Sanjay, Silvina Solman, Tannecia Stephenson, Fredolin Tangang, Bertrand Timbal

**WCRP JPS:** Michel Rixen

**Apologies:** Isabelle Anguelovski, R. Krishnan, Won-Tae Kwon

## 1. Introduction

### a. Welcome address

Filippo Giorgi welcomed all participants and was looking forward to their active participation in the meeting. He briefly presented ICTP and its active role in developing CORDEX from the onset, as illustrated by the ongoing RegCM meeting held 12-23 May in Trieste. He further welcomed Fredolin Tangang and Hyun-Suk Kang as new nominees on the SAT for consideration by the JSC at their 35<sup>th</sup> session.

### b. Introduction

See previous item.

### c. Meeting arrangements

Filippo Giorgi provided some specific meeting arrangements pertaining to schedule and hospitality.

### d. Adoption of agenda

The agenda was adopted without further changes, except a decision to start the meeting at 09:00 on Saturday 17 May.

### e. WCRP Update, CORDEX project office

Michel Rixen presented the new WCRP structure aimed at better tackling climate science in service to society under the Global Framework for Climate Services (GFCS) as well as multidisciplinary science under the new Future Earth initiative. The Research, Modeling and Prediction pillar of the GFCS represents an important initiative in the context of CORDEX, especially regarding the provision of regional climate information in support of vulnerability, impact and adaptation work for the GFCS priorities on water, agriculture and food security, health and disaster risk reduction. The Future Earth Initiative issued the first call for proposals in April 2014 and others are

expected later this year, which may represent opportunities to sustain CORDEX activities in some regions.

The WCRP community has identified 6 Grand Challenges (GC) representing the major science foci of the WCRP for the 3-5 years ahead. The importance of coordinating the work of WGCM, DCP, WGSIP and CORDEX to address the GC on Regional Climate Information was highlighted.

WMAC2 and the JSC34 endorsed the Earth System Grid Federation (ESGF) as the future pan-WCRP model-data dissemination mechanism within the program. Initially adopted by the CMIP community, this archiving system is now being also used by CORDEX. WGSIP is planning to migrate to this infrastructure soon. The sister initiative on observations, aka obs4MIPs, brings satellite data to the same archive and aims at expanding to many observational products. A kick-off meeting was held on 29 April – 1 May 2014 at NASA HQ, Washington, DC, USA with data providers to expand holdings. This will expand and strengthen the fundamental infrastructure of CMIP, to which CORDEX may contribute as one of the CMIP6 experiments.

The new Director, David Carlson, will join WCRP on 13 June. The process to review the offers to host the CORDEX International Project Office is currently being developed. The Team recommended establishing an independent selection board to that effect.

Some important upcoming meetings were briefly reviewed, such as the pan-GEWEX meeting in The Hague, Netherlands, 14-17 July 2014, the WWRP Open Science Conference in Montreal, 16-21 August 2014, the WCRP-IPCC workshop at ISSI in Bern, Switzerland 8-10 Sept and the Climate Symposium in Darmstadt, Germany, 13-17 October 2014.

#### **f. WGRC and CORDEX update, including ICRC – CORDEX 2013**

Filippo Giorgi provided an update of the status of CORDEX and highlighted outstanding issues that need to be addressed in the future. He first reviewed the composition of the Scientific Advisory Team (SAT), in particular the replacement of several members who left for different reasons and the addition of new ones to expand the expertise in the SAT. The upcoming creation of the CORDEX International Project Office (CIPO) was also mentioned as a key development in the CORDEX management. He went on to summarize some of the main outcomes of the International Conference on Regional Climate, ICRC CORDEX-2013, held in Brussels on 4-7 November 2013. This was a highly successful event with ~ 450 abstracts submitted and more than 500 attendees, not only from the climate downscaling community but also from the Vulnerability-Impact-Adaptation (VIA) and stakeholder communities. Plenary and parallel oral sessions, along with large poster sessions, addressed the areas of CORDEX achievements, scientific issues in dynamical and statistical downscaling, applications to VIA work and future developments and directions. Special sessions were held on the day after the conference to discuss specific topics. The outcome of the conference was

pivotal in identifying outstanding issues to be addressed in the next phases of CORDEX. Filippo Giorgi outlined the most important: 1) need for mechanisms to achieve a better coordination and homogenization across different regional CORDEX activities and the CORDEX community at large; 2) improvement of data management and distribution; 3) need of a clear protocol for the approval of official CORDEX domains; 4) better integration of statistical downscaling within the CORDEX framework; 5) increased focus on regionally specific forcings (e.g. land use, aerosols); 6) transition to CORDEX Phase II and development of Flagship Pilot Studies (high resolution studies); 7) strategies for obtaining CORDEX-specific funding. These issues were discussed within the SAT during the session.

*The SAT recommended refining the decision-making protocols among CORDEX and all actors, including the CORDEX International Project Office and regional point of contacts. Following the success of the International Conference on Regional Climate – CORDEX 2013, it was proposed to hold a similar event in 2015 or 2016, maybe in close coordination with the Lund Regional Climate Modeling workshop. The office could play a major role in organizing such event. The SAT suggested considering developing attribution work at regional level in the future, as done within the new structure of CMIP. It was also noted that CORDEX experiments should be aligned as much as possible with CMIP for consistency and to support the Grand Challenge on Regional Climate. The need for resources to support model development was highlighted as a high priority across WCRP, and is currently taken up by the Modeling Advisory Council. The SAT commented that CORDEX and the WGRC are areas within the program that have natural connections with end-users.*

#### **g. CORDEX scope**

Bill Gutowski introduced the topic by highlighting the rapid growth in CORDEX activities, the establishment of the WCRP Working Group on Regional Climate (WGRC) and wide range of suggested directions for extending CORDEX in the wake of the Brussels conference, which have prompted a need to review and affirm the scope of CORDEX. In other words, what is CORDEX?

Some discussions in Brussels, in particular, appeared to view the WGRC and CORDEX as synonymous, whereas CORDEX is one activity under the purview of the WGRC. The WGRC has broader terms of reference that include espousing and coordinating efforts to transform outcomes of climate research into actionable information by society. Such activity is beyond the goals of CORDEX, which are to foster regional climate science and provide climate-change outcomes for use by others. CORDEX provides a key scientific foundation for the WGRC. CORDEX may partner with other scientific or non-scientific programs to achieve some of its goals, but at its core, it is a science program focused on regional climate science.



*The SAT emphasized the useful CORDEX ‘public interface’ as a science program (modeling, ensembles, intercomparison, etc.) inspired by end-users. The CORDEX mandate is closely linked to IPCC WGI, whilst WGRC takes it to the IPCC WGII level. The need to secure the CORDEX added value was highlighted in the context of growing GCM resolution, recognizing the cost of regional simulations with a possible common resolution at 25km and specialized experiments at even higher resolutions. Multiple nests were also suggested as a way forward to address physical/process considerations and to deal with uneven resources across the community.*

## **2. Updates from the CORDEX regions**

Briefers were invited to focus their presentation on the recent activities and scientific developments, data dissemination and funding in their region by liaising with corresponding regional POCs.

### **a. Europe and Mediterranean**

In this segment Filippo Giorgi provided an update of the EURO-CORDEX and MED-CORDEX regional initiatives. In general, these are the most advanced within the CORDEX framework. Twenty-nine groups are participating to EURO-CORDEX, downscaling 12 different GCMs and using 10 different RCMs. Inclusion of statistical downscaling is currently under discussion. Two sets of simulations have been completed as part of EURO-CORDEX, the first at 0.44 degrees (~ 50 km) and the second at 0.11 degrees (~12.5 km) horizontal grid spacing. The simulations include ERA-Interim-driven runs as well as full scenario runs (1950-2100) under the RCP2.6, RCP4.5 and RCP8.5 concentration pathways. Data are already available on the ESGF CORDEX nodes and are being actively analyzed by both the climate and VIA communities. MED-CORDEX is focusing more on the development and use of coupled regional models for the Mediterranean region including atmosphere, ocean, hydrology and biosphere components. MED-CORDEX simulations include atmosphere-only at 12 to 50 km grid spacing (13 models), ocean-only (4 models) and coupled atmosphere-ocean (12 models) at an intermediate resolution (25-30 km). The focus of MED-CORDEX is on the importance of coupled processes and on the strong interaction with the VIA and stakeholder communities.

*The Team noted the need to use metrics more systematically to support added value statements regarding downscaling exercises. It was commented that funding opportunities were mainly available under EU FP7 and the scientific community is looking into possible Horizon2020 calls.*

### **b. North America and Polar regions**

Bill Gutowski updated the SAT on North America and Polar regions.

## Arctic CORDEX

Points of contact are Annette Rinke and John Cassano. Arctic CORDEX has had substantial activity, with over 11 groups running or planning to run simulations. Four models have completed evaluation and historical simulations with ERA-Interim and GCM boundary conditions and two models have completed scenario simulations driven by 4 different GCMs. The first Arctic-CORDEX results are available on the ESGF-CORDEX nodes. Approximately 7 are expecting to complete RCP8.5 scenario runs this calendar year. Analysis of the ERA-Interim runs is proceeding with emphasis on extremes, trends, systematic model errors, data uncertainty and benchmark metrics. The Arctic CORDEX community held a side meeting during the Brussels CORDEX conference to exchange, foster and coordinate further simulations and analysis.

Future steps include fulfilling a better, more complete RCM-GCM matrix for multi-simulation studies, with further steps to improve understanding of key phenomena such as the atmospheric boundary layer, cyclones, clouds, marginal ice zones and polynyas. Extensions from the CORDEX baseline include simulations at 0.2° resolution (some already done) and coupled atmosphere-ice-ocean RCMs (some nearly ready).

Coordination steps include establishing a Polar CORDEX website, an emailing list hosted by CliC and plans for a second program meeting during the Lund RCM conference in June 2014.

## Antarctic CORDEX

Points of contact are John Cassano and Annette Rinke. Activity for this region has fewer participants than the Arctic. Nonetheless, groups at KNMI and New Mexico Tech have run Antarctic CORDEX simulations. Four other groups in France, Denmark, Belgium and the U.S. have plans for simulating this domain.

## North America CORDEX

Points of contact are Linda Mearns, Anne Frigon and William Gutowski. Activity has proceeded on two fronts: trying to establish a major, U.S. program supporting the goals of CORDEX and coordinating existing efforts. An organizing committee in the U.S., consisting of William Gutowski (co-chair), Linda Mearns (co-chair), Lawrence Buja, Dennis Lettenmaier, Ruby Leung, Joe Barsugli and Gregg Garfin, has drafted a short, overview of a possible program, a proposal for an organizing workshop and an extensive outline of the potential program. The committee has interacted with officials from several U.S. federal agencies, the U.S. Global Change Research Program and the U.S. CLIVAR community. There appears to be interest in a workshop for which the U.S. Department of Energy would be the prime sponsor, but specific plans are still in development.

The POCs and committee are also working to coordinate existing efforts, through a web site nearly ready for release. The web site will include a listing of simulations done by others, with points-of-contact for detailed information on the runs, the brief overview of a possible program and a presentation of plans given by L. Mearns at a meeting of the American Geophysical Union. The group is also exploring possible interest by NASA in aspects of North America CORDEX.

The CORDEX SAT acknowledges the value of plans by NASA scientists to assess downscaling using a substantial observational database.

*The SAT noted the lack of sustained resources for CORDEX in those regions and recommended engaging closely with agencies (e.g. DoE, NOAA, NSF, NASA, EPA) in the US to advocate for CORDEX and high-resolution Flagship Pilot Studies possibly in support of future US climate assessments.*

### c. South–America

The CORDEX update by Silvina Solman on South America covered three main topics: the recent activities, scientific developments, and data dissemination and funding in the region.

#### Recent Activities

Conclusions and outcomes from two recent Training Workshops developed under an ICSU Grant in a joint effort between the World Climate Research Programme (WCRP) and CLIVAR/VAMOS and co-sponsored by the Inter-American Institute for Global Change Research (IAI), the Caribbean Community Climate Change Centre (5Cs) and WCRP were presented. The ICSU Grant was focused on “Regional Climate Downscaling over South America, Central America and the Caribbean: A coordinated effort to pursue Vulnerability, Impacts and Adaptation studies in the region”. The Geophysics Institute (IGP) in Lima, Peru, hosted the first Workshop from 11 to 13 September 2013. More than 70 participants from 19 countries (mainly from South America and the Caribbean) discussed the main vulnerabilities the modeling capabilities and on-going studies in the region. During 7-9 April 2014, the National Weather Service from Dominican Republic (ONAMET) held the Second Training Workshop at Santo Domingo, Dominican Republic, built on the activities developed at the first Workshop. Around 40 participants from 18 countries were trained on approaches for developing useful climate-relevant messages for policy development. These two activities allowed gathering the South American and Caribbean communities pursuing them to collaborate and interact between each other. A mailing list was created to maintain the communication among participants.

#### Scientific developments and data dissemination

The availability of CORDEX simulations for the South American region was presented. It was noted that most of the simulations are not available yet at

the ESGF nodes. The scientific developments based on this set of simulations are still on-going and focus mainly on understanding both model biases and the climate change signal for the region.

#### Funding

So far no funding is available for pursuing the development of CORDEX-South America within the region.

*The SAT welcomed the CORDEX progress in the region, building on the VAMOS experience, and the outcome of the two workshops organized jointly with them. It further recommended building on this positive momentum and encouraged people in the region to run their own simulations. The JPS representative noted that WCRP is ready to provide some support to facilitate the migration of simulations into ESGF, as this is a high priority for the program. The SAT also recommended exploring the availability of high-performance computing resources under the EU PRACE project.*

#### d. Middle-East North Africa and Central Asia

Grigory Nikulin provided an overview of current progress in the MENA and Central Asia CORDEX domains. At moment 8 modeling groups are involved in running or preparing regional climate simulations for the MENA domain. 3 of them are from the MENA region and 5 are from Europe. 5 regional models and one high-resolution global model downscale, in different combinations, 8 CMIP5 AOGCMs at about 50km resolution. In addition there are a few simulations at about 25km resolution. The first set of the MENA-CORDEX simulations have been already completed and made openly available on the ESGF while a few more simulations completed are waiting for post-processing. Only one modeling group is running simulations for the Central Asia CORDEX domain. The CA-CORDEX matrix includes one regional model and 3 CMIP5 AOGCMs. Downscaling of one AOGCM has been completed and waiting for post-processing.

A proposal to the ISSI 2014 call (International Team in Space and Earth Science) led by the Cyprus University was submitted in March 2014 and ISSI's decision is expected at the end of May 2014. The proposal aims to establish a MENA-CA CORDEX network for analysis of climate simulations and all modeling groups from the MENA-CORDEX and CA-CORDEX domains are involved in the proposal.

*The SAT noted the issue of groups using different domains. It was suggested to contact people in Russia again about any interest in running CA simulations. The current boundaries of the CA domain could be revisited.*

## e. Australasia

Bertrand Timbal presented a table summarizing the CORDEX simulations already completed and the one planned in the near future as well as the existing projections made with an analogue-based statistical downscaling technique across the Australian continent. In addition, some scientific highlights were presented in the context of the existing programs that are funding this research. A few key points emerged from this presentation.

The research is really Australia centric: only one simulation from a group outside Australia, not a lot of information about uptake of CORDEX data in other countries (NZ, PICs, PNG). Probably the lack of a CORDEX workshop is showing here.

The funding model is problematic to start with: being projects driven it is hard to coordinate into a CORDEX framework; there is only limited core funding to support model development. The project driven funding is in serious trouble in Australia (many large projects are finishing with no perspective on future programs, nationally and also to support collaborations with PICs). The support is in the space of interactions with VIAs and hence is near impossible to channel into model (either dynamical or statistical) development.

The on-going projects offer some interesting insight aligned with the possible Flagship Pilot Studies that CORDEX should be encouraging. The delivery of National projections for Natural Resources Managers has provide a strong platform to develop state-of-the-art methods to convey the complexity of climate change to users as well as comparing statistical and dynamical downscaled projections (on a continental scale) to demonstrate added value. There are also a number of pilot studies pushing high-resolution modeling (into the convection enabling range).

## f. Africa

Chris Lennard provided an update on CORDEX Africa. In 2013 and 2014 six CORDEX Africa papers have been published and two more are in review. Currently 9 post-graduate students at University of Cape Town (3 Ph.D, 5 M.Sc., 1 B.Sc Honors) are using CORDEX data in their dissertations and it would be useful to consolidate an Africa-wide database.

CORDEX Africa activities have also engaged users of climate data in regional contexts in collaboration with START. These activities have been funded by CDKN, START and CSAG and the next workshop will be held in Ghana in July.

Eight modelling groups have completed downscaling of Era-Interim and a number of CMIP5 GCMs. More than half of the completed simulations have been published on ESGF and openly available. To facilitate distribution of CORDEX data in many African institutions that do not have adequate bandwidth or storage facilities, all CORDEX Africa data is currently being

copied to CSAG at UCT. Data will be distributed using external USB drives once this process is completed.

From discussions at the CORDEX Brussels meeting, a CORDEX Central Africa region was formed and Andreas Haensler and Wilfred Pokam will be points of contact for this region. Numerous email discussions have established there is a strong desire to run similar analysis workshops as have been run for the current CORDEX Africa regions.

There is not direct funding available for CORDEX-Africa activities. Indirectly, bursaries fund student activities that have the analysis of CORDEX data in their themes. Most recently, funding from CDKN, START and CSAG has been used to run user-engagement workshops. Funding opportunities to explore would include the Future Climate for Africa call, leveraging activities of SASSCAL (<http://www.sasscal.org/>) and WASCAL ([www.wascal.org](http://www.wascal.org/)). A further possibility is to explore NSF workshop funding through Bill Gutowski, an option that requires US partners. Current partners CSAG work with include Bill Gutowski at ISU, Rob Crane at Penn State and Chris Mattman at NASA JPL (RCMES).

#### **g. South-Asia**

J. Sanjay updated the SAT on CORDEX South-Asia.

The Centre for Climate Change Research (CCCR) at the Indian Institute of Tropical Meteorology (IITM) is leading the WCRP CORDEX South Asia component recognizing the importance of climate information and capacity building in this region. In CORDEX South Asia, regional climate scenarios are developed using multiple high-resolution regional climate models (RCMs) for the historical period and the future. The CORDEX South Asia datasets are based on simulations carried out at IITM, as well as from other partner institutions in Germany, Sweden, Japan, Norway, Australia and Korea. A high-end data server has been set up for data archival and dissemination of the CORDEX South Asia data sets, through the CCCR web-portal (<http://cccr.tropmet.res.in/cordex/files/downloads.jsp>). This climate data portal presently hosts available important meteorological variables such as rainfall, surface air temperature, sea level pressure, surface specific humidity, surface winds and surface radiation from five RCMs. These variables are available on daily and monthly time scales for the historical period (1950-2005) and for the future projection (RCP 4.5 for 2006-2100). The climate data portal is expected be updated by publishing CORDEX specified variables for the historical and future periods by the end of 2014.

With the objective to develop the regional capacity for assessment of regional climate change, two scientific training workshops were held. The 1st WCRP CORDEX South Asia Training Workshop in partnership with CCCR-IITM, START, ICTP, CSAG, SMHI and ICSU-ROAP was held at IITM, Pune, India during 17–20 October 2012. This four day training workshop focused on skill development in analysis and verification results from the CORDEX climate



models. This capacity building effort helped to foster trans-disciplinary collaborations between individuals from the physical sciences and the VIA research community. The 2nd WCRP CORDEX South Asia Science and Training Workshop was organized jointly by the International Centre for Integrated Mountain Development (ICIMOD), WCRP, APN, CCCR-IITM, Chinese Academy of Sciences (CAS) and Monsoon Asia Integrated Regional Study (MAIRS) at ICIMOD, Kathmandu, Nepal during 27-30 August 2013. About 70 experts from 16 countries participated in the workshop. The deliberations of the workshop addressed important issues concerning regional climate change over South Asia and their potential impacts on water, food and energy. The workshop included scientific lectures, training lectures on regional climate downscaling over South Asia and hands-on training on analysis and applications of CORDEX South Asia regional climate data for sectorial assessments. The participation researchers from South Asia in the International Conference on Regional Climate – CORDEX 2013 in Brussels, Belgium during 4 – 7 November, 2013 was coordinated by IITM. This facilitated a great opportunity for Asian-Pacific attendees to meet with their peers and the wider CORDEX network.

*The SAT recommended developing forward planning for meetings in CORDEX Asia, in close consultation with MAIRS and APN and to migrate the IITM database in ESGF. The funding allocation to IITM under the CARIIAA project was unclear.*

#### **h. Southeast-Asia**

Fredolin Tangang presented SEACLID/CORDEX Southeast Asia, which is funded by Asia Pacific Network (APN) and internal funding from individual countries. Currently SEACLID/CORDEX Southeast Asia comprises of 7 countries within the Southeast Asia region (11 institutions) and 4 countries (4 institutions) outside of the region. The resources (both financial and computing facilities) of participating countries within the Southeast Asia region vary. Two countries i.e. Cambodia and Lao PDR have not yet participated in any activity of CORDEX Southeast Asia. However, three representatives from each of these two countries have confirmed their participations in the Second SEACLID/CORDEX Southeast Asia 9-10 June 2014, Bangkok. Overall there will be 14 GCMs that will be downscaled by the institutions / country involved. The domain has not been finalized yet but tentative agreement has been reached among members. The agreed domain is 90E-145E, 15S-27N with resolution of 25km x 25km. The group has also completed the 20-year ERA-Interim run where eighteen experiments were conducted to examine the sensitivity of cumulus and ocean flux parameterizations and of the Tibetan Plateau. Final decision on the domain, resolution and best physics options will be made at the second workshop. Actual runs are expected to begin in July or August 2014.

*The SAT wondered about the potential involvement from Burma/Myanmar in this initiative. It was commented that although Myanmar is not part of APN, it is able to participate in all APN programme activities and is considered to be*

*an APN approved country under the programme membership participation criterion. The discussion noted the difficulty to attract PhD students, whilst resources are available.*

#### **i. East-Asia**

Hyun-Suk Kang reviewed the experiments for CORDEX-EA, which have been successfully completed with 6 regional climate models (RCMs) but driven by only one CMIP5 model (HadGEM2-AO). Korea Meteorological Administration (KMA) is coordinating COREX-EA activities with three RCM groups and one SDM group at universities, of which all outputs from 5 regional climate models have been archived at an East-Asia data center (<http://cordex-ea.climate.go.kr>). One group at AORI/U. of Tokyo from Japan has been involved recently and will submit their output soon. Analysis of CORDEX-EA output is focusing on development of ensemble average methods and investigating monsoon evolution and extreme climate events including tropical cyclones' activities. For preparing the next phase of CORDEX-EA, a new smaller domain with higher-resolution is proposed after deliberations at the ICRC-CORDEX2013 conference. Details on the framework including domain, resolution, GCM/RCM metrics, simulation period, timeline, and etc. are still open for discussion. Every issue will be discussed further with EA groups and will be circulated to the SAT.

*The SAT emphasized the need to ensure a strong engagement of China in CORDEX EA and to seek their contribution in terms of simulations. It also recommended migrating the EA database into ESGF.*

#### **j. Central America/Caribbean**

Tannecia Stephenson presented the two CORDEX workshops that have been hosted since September 2013. They are the WCRP VAMOS/CORDEX Workshop on Latin America and the Caribbean (CORDEX LAC) Phase I – South America at Lima, Perú on September 11-13, 2013 and the WCRP VAMOS/CORDEX Workshop on Latin America and the Caribbean (CORDEX LAC) Phase II – The Caribbean in Santo Domingo, Dominican Republic on April 7-9, 2014. The sponsors included World Climate Research Programme (WCRP); International Council for Science - Regional Office for Latin America and the Caribbean (ICSU-ROLAC); the Inter-American Institute on Global Change Research (IAI); Caribbean Community Climate Change Centre (5Cs). (See CORDEX - South America Update for more details.) Additionally a Working Group on Regional Climate (WGRC) Side Event was hosted at the International Conference on Climate Services 3 on December 3, 2013 in Montego Bay, Jamaica under the theme: Regional climate science and robust foundations for climate services – what does the CORDEX initiative have to offer climate service providers and users? An upcoming event is the First Workshop on Climate Change, Variability and Modeling over Central



America and Mexico, scheduled in Ensenada, Baja California, Mexico on November 10-14, 2014.

Some CORDEX simulations that have been completed for Central America are shown in APPENDIX C.

*The SAT recommended including a reference to CORDEX in the LAC conference report so as to attract support for future events in the region around 2015.*

#### **k. Liaison with regions, web sites**

Michel Rixen presented the current list of Points of Contact (POCs) for the various CORDEX regions as a basis for discussing the two-way liaison mechanisms to put in place between the secretariat, the SAT and the regions. This list was reviewed and resulted in some additional suggestions and specific changes as outlined in APPENDIX A. He also mentioned that soon, the CORDEX International Project Office would have to be added into the equation. In terms of outreach, a number of essential pieces of information should be part of each regional web site, such as the available simulations, application areas, events, and publications, and should be supported by outreach tools such as calendars and mailing lists. Some coordination with the CORDEX main web site, currently supported by Catherine Michaut at the WCRP support unit at IPSL, Paris, France, is also necessary to avoid duplications. Regional POCs should be asked to play a coordinating role in this effort.

### **3. CORDEX II Experimental design**

#### **a. Added value, pilot studies, physical basis for domains**

In this segment Filippo Giorgi led the discussion concerning the development of Flagship Pilot Studies (FPSs) for the next phase of CORDEX. The need to develop such studies emerged as one of the main recommendations of the CORDEX 2013 conference. The main motivation for these case studies is to address in depth key questions on the value of the CORDEX framework, and in particular issues such as: 1) Better identification and illustration of the added value of regional downscaling (both dynamical and statistical) and of very high (up to cloud resolving) resolutions; 2) more process-based analysis, in particular by using high quality observations deriving from special programs; 3) use of multiple downscaling techniques in an ensemble approach and distillation of actionable information; 4) development and use of regional coupled Earth System Models; 5) better analysis of the effects of regional forcings, such as land-use and aerosols; 6) development of end-to-end (climate to end-users) projects. The choice of the FPSs is very important and a transparent protocol should be developed. Among the criteria for choice

of FPSs are 1) physical science key issues/hotspots; 2) VIA key issues/hotspots; 3) availability of high quality data; 4) interaction with other WCRP programs (e.g. GEWEX, CLIVAR); 5) availability of funding. It was indeed pointed out that the development of these FPSs might indeed provide a better avenue for obtaining funding for CORDEX-related activities. It was concluded that a document should be produced and presented to the JSC35 to start the discussion of FPSs within the context of future CORDEX phases.

*The SAT recommended initiating a dialogue with regions via the POCs regarding the domain specifications and pilot studies. An early draft for the rationale, definition and guidelines for domains was produced by Grigory Nikulin and should be finalized, including regular and flagship domains. The SAT also noted the need to revisit overall CORDEX goals. Guidelines for the pilot studies would build on the CORDEX framework with some necessary amendments, recognizing that observations and reanalysis over these new domains are paramount to develop any meaningful scientific effort.*

## **b. Statistical downscaling**

This presentation by Bertrand Timbal and Bill Gutowski provided an overview of the recent development in planning a CORDEX-ESD component in the program and the issues that are likely along the way.

In terms of progress, a series of workshops are underway to produce ESD inter-comparison. The first one in Trieste in September 2013 started the conversation and helped define the objectives of the exercise. The next one in Buenos Aires in August 2014 will help continue develop the framework of ESD Intercomparison while starting the first experiment. Other activities included a topical session on ESD at the CORDEX conference in Brussels in November 2013; a slide was shown summarizing the key summary points from this session.

In terms of planning, key issues surrounding ESD developments were presented as well a draft of a scoping document on ESD contribution to CORDEX. This document is currently a series of bullet points covering the main issues. It is schedule to be completed in July and review by the ESD community as part of the next workshop (August 2014).

Finally the main issues regarding how to integrate ESD in CORDEX were discussed at length focusing on 1) the relevance of the existing CORDEX domain and resolution to ESD, 2) the prospect to have meaningful overlap between SDM and RCM outputs for well-observed subdomains once high resolution RCMs are run and SDMs are producing gridded outputs and 3) how can the ESD community contribute to the CORDEX in the meantime.

*The SAT recognized the need to promote ESD more actively within CORDEX and to finalizing the scoping of this effort in conjunction with dynamical downscaling.*

### c. CMIP6

Michel Rixen updated the SAT on the preparation for phase 6 of the Coupled Model Intercomparison Project (CMIP6). Feedback is currently sought from the community on an initial CMIP6 proposal by September. The WGCM and CMIP panel will then iterate on the proposed design with the intention to finalize it in Oct 2014 at the WGCM18 session.

The backdrop for CMIP6 would be the six Grand Challenges with an additional theme encapsulating questions related to biospheric forcings and feedbacks. The specific experimental design would be focused on three broad scientific questions:

- 1) How does the Earth System respond to forcing?
- 2) What are the origins and consequences of systematic model biases?
- 3) How can we assess future climate changes given climate variability, predictability and uncertainties in scenarios?

CMIP would be comprised of two elements:

- 1) Ongoing CMIP Diagnostic, Evaluation and Characterization of Klima (DECK) experiments
- 2) Standardization, coordination, infrastructure, and documentation functions.

A scientist or group of scientists could send a 'Request for a CMIP6-Endorsed MIP' at any time to the CMIP Panel Chair via a template available from the CMIP page.

#### CMIP6-Endorsed MIPs

- can make full use of the ESGF infrastructure.
- can propose that part or all of their experiments be included in CMIP6.

The main criteria for MIPs to be endorsed for CMIP6 are:

- The MIP addresses at least one of the key science questions of CMIP6;
- The MIP follows CMIP standards in terms of experimental design, data format and documentation;
- A sufficient number of modeling groups have agreed to participate in the MIP;
- The MIP builds on the shared CMIP DECK experiments;
- A commitment to contribute to the creation of the CMIP6 data request.

*The SAT recommended CORDEX to submit a CORDEX CMIP6-endorsed MIP, potentially including statistical downscaling and attribution, with due consideration of potential requirements for high temporal (e.g. 6-hourly) GCM outputs and in close consultation of regional POCs. This proposal could be presented at WGCM18, with Grigory Nikulin representing CORDEX.*

## 4. Archives, ESGF, data policy

### a. Data policy, parameter list

The status of the CORDEX archiving activities was presented by Grigory Nikulin. The overview included a detailed overview of all CORDEX archive related documents (authors, a principal maintainer, web pages) and information where the CORDEX simulations can be found. There are 4 regional data portals with the CORDEX data in addition to the CORDEX-ESGF archiving which becomes more and more popular. The first CORDEX simulations were published on ESGF in the middle of September 2013 and 542 users have already registered in the CORDEX-ESGF group (12 May 2014). The CORDEX simulations are visible on almost all ESGF datanodes but only 5 European datanodes provide full support for searching the CORDEX data. Simulations for 10 CORDEX domains are available via ESGF although for many domains only one or two modeling groups have contributed. At the same time number of CORDEX simulations on ESGF is growing and more simulations are expected to be published in coming months. The first statistics shows that, perhaps to be expected, the 5 most popular variables for downloading are: precipitation, near-surface temperature (mean/max/min) and wind.

He concluded by providing an estimate of the number of groups involved in each CORDEX domains:

- Euro-CORDEX (about 27 groups)
- Med-CORDEX (about 12 groups)
- Arctic (about 10 groups)
- Antarctic (2 groups + 4 groups are going to participate)
- North America (about 6-8 groups)
- South America (about 10 groups)
- MENA (8 groups)
- Central Asia (1 group)
- Africa (about 15 groups)
- Australia (4 groups)
- South Asia (about 4 groups)
- South East Asia (about 9 groups)
- East Asia (about 4-5 groups)
- Central America (about 6 groups)

*The SAT noted the list of reference documents, including the CORDEX experimental framework produced in 2009, the CORDEX list of domains (currently maintained by Eleanor O'Rourke), the CORDEX archive specification, the CORDEX variable requirement table and the CORDEX Terms of Use. Discussions emphasized the need to clarify the ownership and decision-making on such material to avoid duplication and inconsistencies, and also the need to agree on definitions (e.g. "commercial", "research"), building on the CMIP5 experience. ENES was proposed to play a key role with WCRP to achieve this goal. The SAT also recommended publication of at least a minimum number of variables most commonly used, which will need to be identified. The SAT was also interested knowing who are the end-users of data published on the ESGF and recommended acknowledging data*

*producers. The SAT strongly encourages CORDEX EA, SA and Med-CORDEX to become ESGF nodes.*

#### **b. Archives, ESGF, ToU**

See previous agenda item.

## **5. CORDEX SAT Business**

### **a. Memberships**

The JPS representative explained that nominations for membership effective 1 January 2015 will be considered by the JSC at the 35<sup>th</sup> session in Heidelberg, Germany. The SAT noted that ESD is well represented across the CORDEX regional POCs, but could deserve some additional representation at the SAT. The question was posed as to the balanced between modeling experts versus VIA representation on the SAT, which should reflect the future scope of CORDEX Phase II.

### **b. Decision making process**

It was proposed that the SAT would make explicit decisions regarding the CORDEX experiment framework and domains in close consultation with POCs. Regarding proposals on data archives, Terms of Use and variables decisions suggested to be delegated to ENES, an implicit/tacit approval by the SAT after one month was recommended.

### **c. Next SAT Meeting – Date/Venue**

It was proposed to hold the SAT2 session in Cape Town, South Africa in February 2015. Chris Lennard will check with Bruce Hewitson about the possibility to organize the session back-to-back with an Empirical Statistical Downscaling workshop.

### **d. AOB**

Bill Gutowski reported briefly on the NASA effort to support CORDEX through observations based model assessments.

### **e. Review of Draft actions list**

Draft actions were reviewed and can be found in APPENDIX A.

## **APPENDIX A - ACTION LIST**

### **CORDEX scope, framework and experimental framework**

1. Develop CORDEX scoping document and figure (Gutowski, June)
2. Review CORDEX ToR/goals (Gutowski, Giorgi, June)
3. Sharpen pilot studies framework doc (Giorgi, end of June by JSC35)
4. Finalize 1 pager on criteria for CORDEX (general and pilot studies) domains (Nikulin, Gutowski, end of June by JSC35)
5. Review experimental framework document to include 'added value' consideration (Gutowski, Giorgi, end of June)

### **Funding, sponsors**

6. Contact DOE, NOAA and NASA to advocate for CORDEX (Rixen, June)
7. Future Earth: provide science-policy CORDEX contribution to FE (Rixen, 23 May, cancelled pending further guidance from WMO and WCRP leadership)

### **ESGF**

8. Forward data publication and ESGF guidelines to SAT, POCs and CORDEX mailing lists arrange for updates on ENES web page (Nikulin, after Rixen talks to ENES)
9. Encourage RegCM, EA, SA and Med to become ESGF nodes and publish their data on ESGF (Kang, Krishnan, Sanjay, Giorgi)
10. Synthesize most used variables for selection as essential subset (Nikulin)
11. Provide info on ESGF end-users (Nikulin)
12. Contact ENES (S. Joussaume) to consolidate all CORDEX data related reference documents (Terms of Use, Parameter list, Archive specifications) on the ENES web page in close consultation with DMI and additional non-EU experts (e.g. Set Mc Guinness NARCAP and one person from NIMR), propose a decision-making process with one-month implicit approval to be developed within an MoU (Rixen)

## **Regions - domains**

13. Develop/update regional web site with mandatory content (POCs)
14. CA: contact Russia to investigate interest to run Central Asia simulations (Nikulin, June)
15. Asia: optimize APN meetings sequence with MAIRS to include one meeting in Australasia (Krishnan/Sanjay, Tangang, early June)
16. LAC-Caribbean: include CORDEX statement in LAC conference outcome with Carlos and explore options for activities in 2015 (Stephenson, Solman, May)
17. East-Asia and Southeast-Asia: finalize proposals for domains before SEA meeting in Bangkok (Tangang, Kang, August)
18. East-Asia: ensure involvement of China (Kang, June) and further explore PKNU offer to provide computing and archiving resources for other regions (Kang, June)
19. Inform and liaise with regional POC for relevant activities (ALL SAT, JPS, POCs)

## **Outreach, WEB, publications**

20. Update CORDEX main page regarding reference documents (Rixen)
21. BAMS paper with examples of added-value (Giorgi, Timbal, open deadline, tentatively next few months)
22. Send SAT1 report to POCs and draw attention to POCs relevant issues (Rixen, after SAT1 report)

## **ESD**

23. Develop scoping doc (Timbal, Stephenson, before workshop in July)
24. Discuss review of CORDEX web site at July ESD workshop to include ESD material, ESD POCs for each domain (Timbal, Tannecia)

## **CMIP**

25. Develop CMIP6 endorsed MIP submission to include regional RCM, ESD and attribution requirements (Gutowski, Giorgi, Timbal with POCs, Sept 2014)
26. Add Grigory Nikulin on WGCM18 invitation list (Rixen, DONE)

### **Business, memberships and POCS**

- 27. Africa: provide additional POC (Lennard, June)
- 28. Med-CORDEX: replace POC Paolo Ruti (Giorgi, June)
- 29. MENA: add second POC when RICCAR decision is made (Nikulin, end of 2014)
- 30. Australasia: add a POC from New Zealand and/or SIDS (Timbal, June)
- 31. Central America: check whether Teresa Cervazos (Mexico) is willing to serve as POC (Gutowski, DONE)

### **Meetings, conferences**

- 32. Investigate possibility to co-organize next CORDEX conf with Lund conference (Giorgi, Solman, Nikulin, Lennard, June)
- 33. SAT2: propose dates in Feb 2015 (Lennard, Hewitson, June)



## APPENDIX B – CONTACT LIST

### CORDEX SAT members

Dr Filippo Giorgi (Co-Chair)  
The Abdus Salam International Centre for Theoretical Physics  
Strada Costiera 11  
P.O. Box 586  
I-34100 Trieste  
Italy  
Tel: + 39-040 2240 425  
Fax: + 39-040 2240 449  
Email: [giorgi@ictp.trieste.it](mailto:giorgi@ictp.trieste.it)

Professor William Gutowski (Co-Chair)  
3021 Agronomy Hall  
Dept. of Geological & Atmospheric Sciences  
Dept. of Agronomy  
Iowa State University  
Ames, Iowa 50011-1010  
USA  
Tel: 1-515-294-5632  
Fax: 1-515-294-2619  
Email: [gutowski@iastate.edu](mailto:gutowski@iastate.edu)

Dr Isabelle Anguelovski  
Universitat Autònoma de Barcelona  
Institute for Environmental Science and Technology (ICTA)  
Barcelona  
Spain  
Email: [Isabelle.Anguelovski@uab.cat](mailto:Isabelle.Anguelovski@uab.cat)

Dr R. Krishnan  
Executive Director, Centre for Climate Change Research (CCCR)  
Indian Institute of Tropical Meteorology  
Dr. Homi Bhabha Road, NCL Post  
Pashan, Pune 411008  
India  
Tel: +91-20-25904301  
Fax: +91-20-25865142  
Email: [krish@tropmet.res.in](mailto:krish@tropmet.res.in)

Dr W.T. Kwon  
Science Advisor  
Climate Research Laboratory  
National Institute of Meteorological Research  
61 Yeoeuidaebang-ro 16-gil, Dongjak-gu  
Seoul, 156-720  
Republic of Korea  
Tel: +82-70-7850-6665  
Email: [wontk@korea.kr](mailto:wontk@korea.kr)

Dr Christopher Lennard  
Climate System Analysis Group  
University of Cape Town  
Rosebank  
7701  
Cape Town  
South Africa  
Tel: +27 21 6502684  
Fax: +27 21 650 5773  
Email: [lennard@csag.uct.ac.za](mailto:lennard@csag.uct.ac.za)

Dr Grigory Nikulin  
Rossby Centre  
Swedish Meteorological and Hydrological Institute (SMHI)  
Norrkoping  
Sweden  
Tel: +46-11-4958652  
Fax : +46-11-4958001  
email: [grigory.nikulin@smhi.se](mailto:grigory.nikulin@smhi.se)

Dr Silvina Solman  
CIMA – Ciudad Universitaria Pab. II Piso 2  
Argentina  
Tel: +54 11 4787 2693  
Fax: +54 11 4788 3572  
Email: [solman@cima.fcen.uba.ar](mailto:solman@cima.fcen.uba.ar)

Dr Tannecia Stephenson  
University of the West Indies  
Department of Physics  
Mona, Kingston 7  
Jamaica  
Tel: 876 927 2480  
Fax: 876 977 1595  
Email: [tannecia.stephenson02@uwimona.edu.jm](mailto:tannecia.stephenson02@uwimona.edu.jm)

Dr Bertrand Timbal  
Centre for Australian Weather and Climate Research  
GPO Box 1289  
Melbourne VIC 3001  
Australia  
Tel: +61 3 9669 4697  
Email: [B.Timbal@bom.gov.au](mailto:B.Timbal@bom.gov.au)

## **Experts**

Dr J. Sanjay  
Scientist  
Centre for Climate Change Research  
Indian Institute of Tropical Meteorology  
Pashan, Pune 411008  
India  
Tel: +91 2025904534  
Email: [sanjay@tropmet.res.in](mailto:sanjay@tropmet.res.in)

Dr Fredolin Tangang  
IPCC Working Group I Vice-Chair  
Fellow (FASc), Academy of Sciences Malaysia  
Professor, School of Environmental  
and Natural Resource Sciences  
Faculty of Science and Technology  
Universiti Kebangsaan Malaysia  
(*The National University of Malaysia*)  
43600 Bangi Selangor  
Malaysia  
Tel: +603-89213826 / +6019-2718986  
Fax: +603-89253357  
Email: [ftangang@gmail.com](mailto:ftangang@gmail.com)

Dr Hyun-Suk Kang  
Climate Research Laboratory  
National Institute of Meteorological Research  
Korea Meteorological Administration  
Town  
Republic of Korea  
Tel: +82-64-780-6653  
Email: [hyunskang@korea.kr](mailto:hyunskang@korea.kr)

## **WCRP JPS**

Dr Michel Rixen  
Senior Scientific Officer  
World Climate Research Programme  
c/o WMO  
7bis, avenue de la Paix  
Case postale 2300  
CH-1211 Geneva 2  
Switzerland  
Tel: +41 22 730 8528  
Fax: +41 22 730 8036  
Email: [mrixen@wmo.int](mailto:mrixen@wmo.int)

## APPENDIX C - Experiments completed for Central America

Group	RCM	Driving Data	Period	Res.	Protocol for accessing data	Contact	Email
CICSE, Mexico	RegCM4	ERA-Interim	1982-2008	50km	done, will be published on ESGF	R. Fuentes-Franco	rfuentes@ictp.it
CICSE, Mexico	RegCM4	Had-GEM2-ES-Historical	1970-2005	50km	done, will be published on ESGF	R. Fuentes-Franco	rfuentes@ictp.it
CICSE, Mexico	RegCM4	Had-GEM2-ES-RCP8.5	2005-2100	50km	done, will be published on ESGF	R. Fuentes-Franco	rfuentes@ictp.it
CICSE, Mexico	RegCM4	MPI-ESM-ER - Historical	1970-2005	50km	done, will be published on ESGF	R. Fuentes-Franco	rfuentes@ictp.it
CICSE, Mexico	RegCM4	MPI-ESM-ER - RCP8.5	2005-2100	50km	done, will be published on ESGF	R. Fuentes-Franco	rfuentes@ictp.it
CSGM, Jamaica	RegCM4	Had-GEM2-ES-Historical	1960-2005	50km	done, will be published on ESGF	J. Campbell	jayaka.campbell@outlook.com
CSGM, Jamaica	RegCM4	Had-GEM2-ES-RCP4.5	2020-2100	50km	done, will be published on ESGF	J. Campbell	jayaka.campbell@outlook.com
CSGM, Jamaica	RegCM4	CNRM-CM5-Historical	1960-2005	50km	done, will be published on ESGF	J. Campbell	jayaka.campbell@outlook.com
CSGM, Jamaica	RegCM4	CNRM-CM5-RCP4.5	2020-2100	50km	done, will be published on ESGF	J. Campbell	jayaka.campbell@outlook.com
CSGM, Jamaica	RegCM4	CNRM-CM5-Historical	1960-2005	20km	done, will be published on ESGF	J. Campbell	jayaka.campbell@outlook.com
CSGM, Jamaica	RegCM4	CNRM-CM5-RCP4.5	2020-2100	20km	done, will be published on ESGF	J. Campbell	jayaka.campbell@outlook.com
CSGM, Jamaica	RegCM4	MPI-ESM-MR-Historical	1960-2005	50km	done, will be published on ESGF	J. Campbell	jayaka.campbell@outlook.com
Iowa State Univ., USA	RegCM4	ERA-Interim	1989-2009	50, 25km		R. Arritt	rwarritt@bruce.agron.iastate.edu
SMHI, Sweden	RCA4	ERA-Interim	1980-2012	50km, up to 40N	done, will be published on ESGF	G. Nikulin	grigory.nikulin@smhi.se
SMHI, Sweden	RCA4	HadGEM2-ES historical	1951-2005	50km	planned (ESGF)	G. Nikulin	grigory.nikulin@smhi.se
SMHI, Sweden	RCA4	HadGEM2-ES rcp45	2006-2099	50km	planned (ESGF)	G. Nikulin	grigory.nikulin@smhi.se
SMHI, Sweden	RCA4	HadGEM2-ES rcp85	2006-2099	50km	planned (ESGF)	G. Nikulin	grigory.nikulin@smhi.se
SMHI, Sweden	RCA4	MPI-ESM-LR historical	1951-2005	50km	planned (ESGF)	G. Nikulin	grigory.nikulin@smhi.se
SMHI, Sweden	RCA4	MPI-ESM-LR rcp45	2006-2100	50km	planned (ESGF)	G. Nikulin	grigory.nikulin@smhi.se
SMHI, Sweden	RCA4	MPI-ESM-LR rcp85	2006-2100	50km	planned (ESGF)	G. Nikulin	grigory.nikulin@smhi.se
CSGM, Jamaica	RegCM4	Had-GEM2-ES-RCP4.5	2020-2100	20km	planned (ESGF)	J. Campbell	jayaka.campbell@outlook.com
CSGM, Jamaica	RegCM4	CNRM-CM5-Historical	1960-2005	20km	planned (ESGF)	J. Campbell	jayaka.campbell@outlook.com
CSGM, Jamaica	RegCM4	CNRM-CM5-RCP4.5	2020-2100	20km	planned (ESGF)	J. Campbell	jayaka.campbell@outlook.com
CSGM, Jamaica	RegCM4	CNRM-CM5-Historical	1960-2005	20km	planned (ESGF)	J. Campbell	jayaka.campbell@outlook.com
CSGM, Jamaica	RegCM4	CNRM-CM5-RCP4.5	2020-2100	12km	planned (ESGF)	J. Campbell	jayaka.campbell@outlook.com
CSGM, Jamaica	RegCM4	MPI-ESM-MR-Historical	1960-2005	20km	planned (ESGF)	J. Campbell	jayaka.campbell@outlook.com