CORDEX Africa Analysis Campaign Phase 2

1 CORDEX initiative

The Coordinated Regional Downscaling Experiment[1] (CORDEX) was set up by the World Climate Research Programme[2] (WCRP) in 2009 to coordinate Regional Climate Downscaling and provide a set of high-resolution regional climate projections for the majority of global land regions. Additionally making this data available, and importantly useable, to impact and adaptation communities was a fundamental goal. The first years of CORDEX were very successful in developing a framework in which scientists around the world adopted a common protocol to guide the development of high-resolution Regional Climate Model (RCM) and empirical statistical downscaling (ESD) projections, and the intercomparison of these projections, on each continent, with a particular focus on the African region. Ongoing CORDEX activities aim to enhance the dialogue with end users so as to meet the growing demand for tailored high-resolution regional climate information. Capacity building is also an important goal of the programme with regular workshops and trainings carried out across the various CORDEX domains (there are 14 domains covering the entirety of global land areas).

2 CORDEX Africa Analysis Campaign Phase 1, 2011-2013

The CORDEX-Africa initiative has been developed to analyse downscaled regional climate data over the African domain of CORDEX, train young scientists in climate data analysis techniques, and engage users of climate information in both sector specific and region/space-based applications. One component of these activities have been four training and analysis workshops, funded by the Global Change System for Analysis Research and Training[3] (START) and coordinated by the University of Cape Town (UCT), which took place during 2011 and 2013, to analyse the first CORDEX-Africa downscaled data. During the first workshop three regional analysis teams were formed, namely: East, West and Southern African regions. Each regional team is composed of senior members and early career scientists and students, who have been mentored by senior members during the workshop activities. Major research questions for each region were elucidated and initial analysis of the data begun. The second workshop refined the regional analysis objectives and analysis of the CORDEX model data was continued. During the third workshop, climate data analysis continued and additionally each analysis group was linked with vulnerability-impact-adaptation (VIA) scientists to understand and address the types of climate related questions of these communities. The VIA scientists represented ecological, hydrological, health and agricultural sectors and input from this community helped refine some of the research questions to be addressed in later CORDEX activities. The fourth workshop focused on writing up the climate analysis work of the previous workshops and four journal papers were submitted in time to qualify for review in the Intergovernmental Panel on Climate Change[4] (IPCC) Fifth Assessment Report (AR5). To date 11 papers have been published in peer-review journals, all lead-authored by members of the regional groups and most by early

[1] www.cordex.org
[2] www.wcrp-climate.org
[3] www.start.org
[4] www.ipcc.ch

career scientists or post-graduate students[5]. There have also been highly successful engagements with communities that require climate information. These took the form of two further workshops in which members from the CORDEX regional teams engaged (a) with health sector practitioners in West Africa to understand their needs with respect to climate information[6] and (b) representatives from five African cities to understand city-scale climate vulnerabilities and information needs[7].

3 CORDEX Africa Analysis Campaign Phase 2, 2015-2017

The CORDEX-Africa analysis campaign was to have continued with an analysis of new regional climate projection data that become available through CORDEX during 2013/2014, however, the initiative has stalled over two years through lack of funding despite the extremely beneficial outcomes. In 2014, to respond to expanding CORDEX activities worldwide, a dedicated International Project Office for CORDEX (IPOC) was established at the Swedish Meteorological and Hydrological Institute (SMHI). From the beginning the IPOC was actively involved in supporting resource mobilization for the CORDEX regions and in fundraising for the CORDEX activities. With IPOC support the CORDEX-Africa analysis activities were re-initiated again in 2015. Future envisioned activities in CORDEX-Africa were formulated as

a) the further assessment of downscaled reanalysis data for both model evaluation and climate process understanding,

b) analysis of downscaled CMIP5 GCM data to assess potential changes in regional climate and

c) continued engagement of communities that need climate information to distil the implications of climatic changes at their regional scales.

It was proposed that activities for themes a) and b) above would take the form of a series of five workshops, modelled on previous CORDEX-Africa analysis workshops, each with distinct objectives and goals.

3.1 1st Scoping workshop, May 2015

Representatives from across the CORDEX Africa community came together for the first scoping workshop of the next phase of CORDEX-Africa Analysis Workshops in Johannesburg on 26th & 27th May 2015. This workshop series follows on from a highly successful first series, which has led to 9 peer reviewed journal articles authored by members of the African regional teams. The workshop was funded through a combination of support from the Swedish Secretariat for Environmental Earth Systems Science[8] (SSEESS), WCRP and SMHI.

The goals of this first scoping workshop were to: reinstate the regional teams and also initiate the new Central Africa regional team; identify key regional research questions; develop or adopt appropriate methodologies to address these; and to discuss how to engage the user community. The focus of this meeting was to provide context from the wider CORDEX and international strategy, provided by participation of the IPOC Director and International Council for Science

[5] *http://www.csag.uct.ac.za/cordex-africa/cordex-africa-publications/*
[6] *http://start.org/download/2012/ouaga.pdf*
[7] *http://start.org/programs/cordex-af*
[8] www.sseess.org

(ICSU) representative, and to set the research agenda of the workshops to follow and thus only included senior regional team members. A number of participants who were unable to join physically connected through Skype for key discussion sessions.

The workshop was highly successful resulting in a list of clearly defined research questions to be addressed by each of the regional teams, a publication plan initiated, training and infrastructure requirements highlighted, and a plan for effective liaison with end users and other relevant programmes and initiatives. Details from the meeting can be found on the CORDEX-Africa website[9].

The 1st Scoping workshop, May 2015, Johannesburg. From left to right: Grigory Nikulin (SMHI, Sweden), Francois Engelbrecht (CSIR, South Africa), Chris Lennard (UCT, South Africa), Daniel Michelson (SMHI, Sweden), Genito Maure (Universidade Eduardo Mondlane, Mozambique), Vincent Ajayi (Akure Federal University of Technology, Nigeria), Sarah Osima (Tanzania Meteorological Agency), Eleanor O'Rourke (IPOC), Wilfried Pokam (University of Yaounde, Cameroon) and Daniel Nyanganyura (ICSU African Regional Office, South Africa).

At the same time funding from the Swedish Ministry of the Environment and Energy[10] was confirmed for the next two workshops to take place in November 2015 and February 2016.

3.2 2nd Analysis Workshop, November 2015

The second CORDEX-Africa Analysis workshop was held at the University of Cape Town on 16-20th November 2015. About 25 scientists from across Africa participated in the workshop

[9] www.csag.uct.ac.za/cordex-africa/cordex-africa-analysis-phase-2/inception-workshop-may-2015
[10] www.government.se/government-of-sweden/ministry-of-the-environment

forming four regional teams: West, East, Central and Southern Africa. The goal of this workshop was to bring the four regional teams, including young scientist, together to refine the scientific questions identified at the Scoping Workshop and to formulate the first ideas for planned papers, their themes and content. Also, there was a strong capacity development focus.

The participants worked in the regional teams identifying first global and local physical processes influencing climate in their regions and metrics to describe processes identified. Based on this information, the teams reviewed availability of variables necessary for analysis of both climate simulations and observational datasets. Almost all CORDEX-Africa simulations available in November 2015 and a number of observational data sets had been collected before the workshop and were distributed to the regional teams on external disks (about 6 Tb of data each). Next step for the participants was formulations of themes for papers and structuring papers prioritised. Each team developed ideas for at least three papers with focus on i) understanding physical process, ii) evaluation of ability of global and regional climate models to simulate processes relevant for each regions and iii) analysis of future climate projections. A common thread running through these three themes is an assessment of the added value downscaling brings to each. Special attention was given to the inclusion of impact modellers in the analysis strategy and on providing climate information to the user community.

The 2nd CORDEX Africa Analysis Workshop, November 2015, Cape Town.

All teams also worked on developing ideas for the CORDEX Flagship Pilot Studies[11] (FPS). The FPS will focus on sub-continental-scale targeted regions, so as to allow a number of capabilities towards addressing key scientific questions and needs of the vulnerability, impact & adaptation community and end users. During the workshop a number of presentations covering a wide range of scientific topics were given by invited speakers and the UCT scientists.

[11] www.cordex.org/index.php?option=com_content&view=article&id=256&Itemid=771

3.3 3rd Analysis Workshop, February 2016

The third workshop in the CORDEX-Africa Analysis Campaign Phase 2 series was held at the University of Cape Town between the 8th and 12th of February 2016. The week-long workshop was well attended by about 25 participants representing all four CORDEX Africa regions i.e. West, Central, Eastern, and Southern Africa. The goals of the meeting were to build on the research questions developed at the 2nd analysis workshop, refine the proposed paper ideas and come up with proposals for the CORDEX Flagship Pilot Studies.

The 3rd CORDEX Africa Analysis Workshop, February 2016, Cape Town

The meetings opened with an introduction of participants, of which a couple of the expected members were unavoidably absent, and new participants attending for the first time were welcomed. Each group then presented a review of the scientific research questions and roadmap paper ideas developed from the 2nd analysis workshop. These ideas were refined and concretized into actual, structured publication titles.

Between the 2nd and 3rd workshops the COP21 conference was held in December 2015. One important outcome of this meeting was an agreement to try and limit global warming levels to 1.5°C above pre-industrial values. As a result of this agreement the UNFCC requested that the IPCC draft a special report in 2018 on the impacts of 1.5C warming on key regions of the globe. In the light of the 1.5°C target and probable IPCC special report, the 3rd workshop devoted some discussion time to the analysis of climate change impacts over Africa at a 1.5°C global warming and potential differential impacts between 1.5°C, 2.0°C and higher end climate change scenarios. Based on these discussions, a CORDEX FPS proposal was developed to assess

regional African climate change and impacts at 1.5C global warming and compare these to impacts at other key warming levels.

Methods of data analysis were discussed based on available RCM and GCM simulations as well as variables available for various studies. By the end of the meetings, lead authors emerged to coordinate the writing of no less than twelve starting publications combined from all regional teams. The planned papers cover topics ranging from model evaluation, regional dynamics to climate change projections and vulnerability impact assessment studies.

The participants also deliberated on proposals for the CORDEX FPS initiative. Three proposals were in focus: one on a vulnerability and impacts assessment in Africa at different global warming levels, one on convection in Africa and one on aerosols and wildfires. The first CORDEX-Africa FPS proposal "Assessing the impact of 1.5, 2, 3 and 4 degree global warming targets on important climate thresholds in the African context" has been submitted (the first deadline 15th February 2016). Two other proposals, on convection and on aerosols are still under development and submission is planned to meet the second deadline (15th June 2016). The main challenge for finalizing these two proposals is that almost all CORDEX modelling groups that could potentially generate regional simulations for Africa are based on other continents and should be contacted first to confirm their interest in the CORDEX-Africa FPS submissions.

Highly engaging and interesting keynote presentations were given by invited seasoned climate scientists on different topics including: earth system modelling, a CMIP6 overview, bias correction of climate simulations, climate services and co-development of climate information services to positioning of CORDEX Africa within the Sixth IPCC Assessment Report vision.

It was not all lab activities as participants went on a field trip to Cape Point. The six hour long tour gave the participants a unique appreciation of the diverse flora and fauna of the region and an appreciation of the breathtaking views the natural landscape around the Cape Peninsula.

By the end of the meeting, participant groups had developed regional work plans for the next 6-8 months which gave time lines for various milestones of the paper writing effort. There were also discussions on securing funding to continue the workshops into 2016 and 2017, with a writeshop proposed for the latter part of 2016. All in all, it was a successful workshop and participants were motivated to continue the group effort toward achieving set goals.

3.4 Future Workshops, 2016-2017

The initial plan for this phase of CORDEX Africa was to hold two more workshops in mid 2016 and early 2017. Given the impetus now associated with assessing African climate impacts at 1.5°C warming, we aim to have a 3rd workshop in the 2nd half of 2017 in order to facilitate the drafting of suitable articles on this subject for the planned IPCC special report in 2018.

Contact information:

Chris Lennard, Climate System Analysis Group (CSAG), University of Cape Town (UCT)

lennard@csag.uct.ac.za

Grigory Nikulin, Rossby Centre, Swedish Meteorological and Hydrological Institute (SMHI)

grigory.nikulin@smhi.se