WCRP CORDEX News

Coordinated Regional Climate Downscaling Experiment

2021 IPCC launched the IPCC Interactive Atlas and the IPCC AR6 report, The Physical Science Basis. Several researchers from the CORDEX community have contributed to both the IPCC Atlas and the AR6 report. In this CORDEX Newsletter some of our Points of Contact (POCs) and leaders of our Flagship Pilot Studies (FPS PIs) share their experience of the work with the report, the outcomes and their own contributions.

Read the AR6 report here: https://www.ipcc.ch/report/ar6/wg1/

Check out the Interactive Atlas: https://interactive-atlas.ipcc.ch/

IPCC Interactive Atlas: CORDEX-SAM simulations at hand

Maria Laura Bettolli is a POC for the CORDEX South America domain and also the leader of the Flagship Pilot Study on Extreme precipitation events in Southeastern South America:. She describes how she finds that the IPCC Atlas provides an unprecedent complementary product:

"The recent IPCC Assessment Report of WGI exposed the growing scientific evidence of climate change with its uneven intensities over the different regions of the world.

Most scientific studies on climate change are focused on specific regions due to the need for understanding regional/local climate change-related processes and evaluating specific impacts. The large number of scientific studies that must be considered and whose results must be integrated to achieve a consistent evaluation of the past, present, and future climate make the assessment report a great challenge. In particular, the assessment of climate change over South America poses additional challenges due to the lack of observational records with high spatial and temporal coverage that limits studies on observed changes and models' evaluation over specific regions of the continent.

In this sense, the IPCC Atlas Chapter and the Interactive Atlas supported assessment provide an unprecedent complementary product that gathers a broad range of data sources including observational products, GCM simulations (from CMIP5 and CMIP6) and CORDEX-RCM simulations. This allows to interactively explore and compare regional climate information using different seasons, baselines, warming levels, extreme indices, and climatic impact-drivers.

The availability of CORDEX-RCM simulations over the South American continent, through this versatile tool, enabled a disaggregated regional climate information detail. This was a key element when amalgamating the assessment of scientific research conducted over South America and the synthesis of observations, trends, models' performance, and projections together with observational uncertainty and spread among models, including RCMs and their driving GCMs."

IPCC AR6 Interactive Atlas of regional climate information for the Antarctic and Arctic chapters provides projected climate change information on key variables for these regions

Andrew Orr (British Antarctic Survey) and Annette Rinke (Alfred Wegener Institute) are Points of Contact for the Antarctic CORDEX and Arctic CORDEX activities, respectively.

Below a bit more info on the IPCC AR6 Interactive Atlas from their perspective:

Andrew and Annette were both very pleased to have been involved in the newly launched IPCC AR6 Interactive Atlas of regional climate information (https://interactive-atlas.ipcc.ch/) for the Antarctic and Arctic chapters, which provides projected climate change information on key variables for these regions. Much of the information for these chapters of the Atlas was provided by regional CORDEX simulations of the recent past and future, which they provided expert advice on. They also contributed with expert advice on the report that accompanies the Interactive Atlas, which provides a comprehensive assessment of each region and contains many publications that were based on Antarctic and Arctic CORDEX activities. The efforts of the various modelling centers and institutions that provided the CORDEX simulations are greatly appreciated.

Nacreous (polar stratospheric) clouds over Hut Point and McMurdo Sound, Antarctica. Photo John Cassano

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CORDEX simulations an important contribution

Stefan Sobolowski (co-coordinator of Euro-CORDEX and co-leader of the CORDEX FPS on Convection over Europe and the Mediterranean) was a contributing author in the Atlas Chapter of the AR6. These are his thoughts:

"The AR6 represents a milestone in IPCC history as it is the first report to truly consider the scales at which climate change will be most acutely felt by human and natural systems. This has been mainly through the inclusion of CORDEX simulations in the assessment as well as their inclusion in the interactive Atlas. The interactive Atlas provides an intuitive user experience for both specialists and non-specialists alike. It provides ready access to information on climate change across multiple regions and scenarios worldwide. It has proven extremely useful both as a user and provider of climate information. For example, I am able to quickly assess changes and confirm key messages when preparing for media interviews. Likewise, rather than just direct interviewers, stakeholders or clients to the SPM or other more technical documents, I can direct them to the Atlas and encourage them to explore the implications of different scenarios for their regions of interest. On a personal note, it has been tremendously satisfying to see the visibility of CORDEX heightened through its robust inclusion in the AR6. It is a testament to our vision and all the hard work put in by the community over the past decade. Well done!"

The AR6 WGI report goes regional

José Manuel Gutiérrez, Coordinating Lead Author of the Atlas Chapter and the Interactive Atlas, Member of the IPCC Task Group on Data (TG-Data) and Member of the CORDEX-Science Advisory Team has been highly involved in the AR6:

"One of the novelties of the AR6 WGI report is the regional focus (around 1/3 of the report focuses on regional aspects), in particular Chapter 10 (methodological aspects on information for regions), Chapter 11 (extremes), Chapter 12 (climatic impact-drivers, CIDs), and the Atlas (regional synthesis). A new set of 46 subcontinental land (and 12 open ocean) reference regions has been defined for summarizing regional assessment consistently across the chapters focusing on mean changes, extremes and climate impact-drivers (CIDs). Besides the global projections from CMIP6 (and CMIP5 for comparability with previous reports), the new report builds on CORDEX regional simulations from most of the available domains (those with large enough ensembles covering most of the land regions) as well as on the available CORDEX literature. The high degree of consistency between the global and regional projections over the reference regions (even from overlapping domains) is further evidence of the robustness of the results. The main conclusion derived from this regional analysis is

that *“Climate change is already affecting every region on Earth, in multiple ways. The changes we experience will increase with further warming”* (see in particular SPM, Subsection C.2 and Figure SPM.9).

A number of innovative tools have been developed to support the regional assessment, facilitating reproducibility and reusability. In particular, many of the variables and indices assessed in the different chapters are included in the Interactive Atlas (http://interactive-atlas.ipcc.ch) and intermediate data and scripts for reproducing some of the figures are available from a GitHub repository (https://github.com/IPCC-WG1/Atlas)."

CORDEX plays an important role on the regional scale which is shown in the WG I report

William Gutowski, former co-chair of CORDEX and POC for the North American domain is happy that the role of CORDEX has increased since the last report:

"It is gratifying to see how much the stature of CORDEX has grown in the world’s climate community. In the AR5, CORDEX was not mentioned at all in the WG I report (although there were six papers cited in Chapter 9 with “CORDEX” in the title). The AR5 WG II report mentioned CORDEX once, in Chapter 14. In contrast, “CORDEX” appears well over 900 times in the AR6 WG I report. CORDEX is cited frequently in the so-called regional chapters (Chapters 10, 11, and 12) and the Atlas. But it is also mentioned in Chapters 1 and 8 and in Annexes II, V and VI. And this is only the WG I report: what will see in the WG II report? For assessing the impacts of climate change, there likely will be a similar growth in using CORDEX output.

CORDEX is clearly playing an important role in advancing our understanding of climate and climate-change impacts where they are especially important: on the regional scale. This growth in the recognition of CORDEX as a major player on the world stage is an outcome of great work by many people over many years, since the inception of CORDEX. Through the past and ongoing energetic efforts of many, CORDEX has a strong foundation for further important contributions going forward. Keep it going!"

Major role in providing multi-model multi-scenario regional climate projections

Faye Cruz, POC for the CORDEX Southeastern domain says:

"In the Working Group I contribution to the Sixth Assessment Report of the IPCC, there is notably more information on the regional-scale observed and projected changes in climate, in comparison with the previous assessment reports. Researchers and scientists who are involved in CORDEX have significantly contributed to the report as authors (Lead Authors and Contributing Authors) and expert reviewers. CORDEX has played a major role in providing multi-model, multi-scenario regional climate projections that have also been analyzed in peer-reviewed scientific literature, contributing to a more robust assessment of regional climate changes in the report. Figures for each region showing future changes, for example, in mean temperature, mean precipitation, and climatic impact-driver indices related to heat, dryness and wind, using data from CORDEX alongside data from CMIP5 and CMIP6 are also included in the report, and can also be viewed online using the Interactive Atlas."

Feedback on the IPCC AR6 Interactive Atlas

Rasmus Benestad POC for the Empirical Statistical Downscaling gives his view of the IPCC AR6 Interactive Atlas:

The recent publication of IPCC AR6 was accompanied by an interactive Atlas, and I was curious to check it out. I expected it would provide climate information relevant for my

work, and the regional synthesis has an impressive layout and artistic style. I often try to bridge science and society and wondered if people would think it is perhaps a little bit too abstract? If I were a city mayor who wanted to devote part of my city's budget to prevent flooding and heatwaves, would the information be useful and how would I use it to guide my decisions - the meaning behind the graphics requires careful interpretation. As a climate scientist, the Atlas provides a nice global overview. The advanced interactive map is an impressive tool and is intuitive and interactive, although choosing between datasets: CMIP5, CMIP6 or CORDEX presents a challenge that might be a bit demanding even for advanced users.

There is a need for discussions about the data selections as there are pronounced interannual variations in confidence intervals which may give non-scientists a wrong impression. This shortcoming can be improved by including both RCMs and ESD to ensure robust results as they have different and independent strengths and weaknesses. RCMs are in some parts inconsistent with their parent GCMs and if the ensembles are too small they don't always well represent the spread found in the CMIP simulations. CORDEX domains have been chosen for comparing different results in a standardised manner which is not always optimal as it is important for regional climate models to capture relevant key processes for particular case, such as convection and local geographical effects.

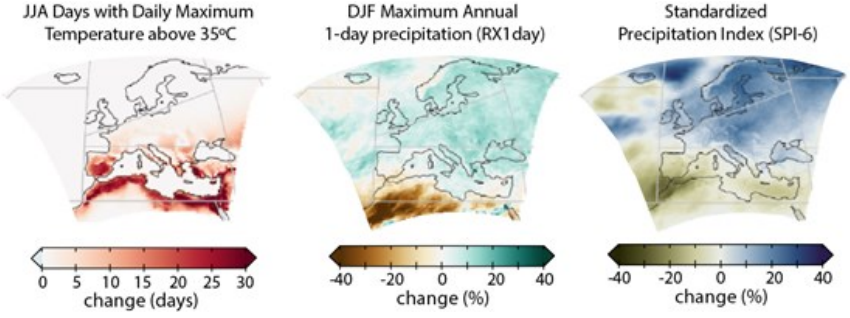
Even if I will use inhouse tools for providing regional climate information the Atlas is a nice starting point for demonstrating what climate models have to offer, and a great basis for debating regional climate change I hope it can be updated and improved more regularly than the IPCC assessment reports.

The role of CORDEX as the main product and achievement of the regional climate community is highlighted

Erika Coppola, POC for the CORDEX Mediterranean domain and the leader for the FPS on Convective phenomena shares her experience as a lead author:

"My role in the IPCC WGI AR6 has been that of a lead author in Chapter 12 "Climate change information for regional impact and for risk assessment", the co-cordinator of the section 4 of the Technical Summary "Regional Climate Change" and the co-coordinator of the C.2 subsection of the Summary for Policy Maker (SPM) "Climate Information for Risk Assessment and Regional Adaptation ". For the first time in IPCC WGI several chapters have been dedicated to the regional assessment of climate change information and the role of CORDEX as the main product and achievement of the regional climate community is highlighted. In Chapter 10, Chapter 11, Chapter 12 and the Atlas chapter all the literature based on CORDEX simulations has been assessed and several figures in all continents are based on the CORDEX datasets. In particular in Chapter 12 have figures showing several Climatic Impact-Drivers (CID) based on 3 different model ensembles; the CMIP6, CMIP5 and the CORDEX regional ensemble. These have been computed for all AR6 regions, for 2 different scenarios RCP8.5 and RCP2.6 and SPP1-2.6 and SSP5-8.5 and 3 global warming levels (1.5 degree C, 2 degree C, 4 degree C). In the interactive Atlas (IA) several products are available based on the same 3 model ensembles and a whole section is dedicated to the regional information and the regional synthesis both also based on CORDEX data.

Based on the report several fact sheets have been produced with figure produced by the IA representing the climate change signal of several CIDs at different warming levels. These are few example figures based on CORDEX data for several continents."



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