



Coordinated Regional Downscaling Experiment (CORDEX)

40th Session of the WCRP Joint
Scientific Committee

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Progress and achievements

Project Meetings, Workshops, Conference Sessions

➤ AFRICA

- CORDEX African Impact Atlas - 3 workshops in 2018

➤ EUROPE

- FPS airsea (Med) + Med-CORDEX meeting, Majorca, Spain, March 2018
- Polar CORDEX meeting, Institute of Geophysics Polish Academy of Sciences (IG PAS), Warsaw, Poland, October 2018
- 9th EURO-CORDEX General Assembly, Hamburg, Germany, January 2019
- "Regional Climate Modeling, including CORDEX", EGU, Vienna, April 2019.

➤ ASIA

- Workshop for SEACLID/CORDEX SE Asia, Selangor, Malaysia, May 2018
- Int. Workshop for CORDEX East Asia, Jeju Province, Korea, April 2019

➤ SOUTH & CENTRAL AMERICA

- CORDEX Central Am. & South Am. Training Workshop on Downscaling Tech., La Paz, Bolivia, June 2018

➤ NORTH AMERICA

- FACETS/NA-CORDEX project meetings, Boulder, CO, USA, June 2018 & MARCH 2019

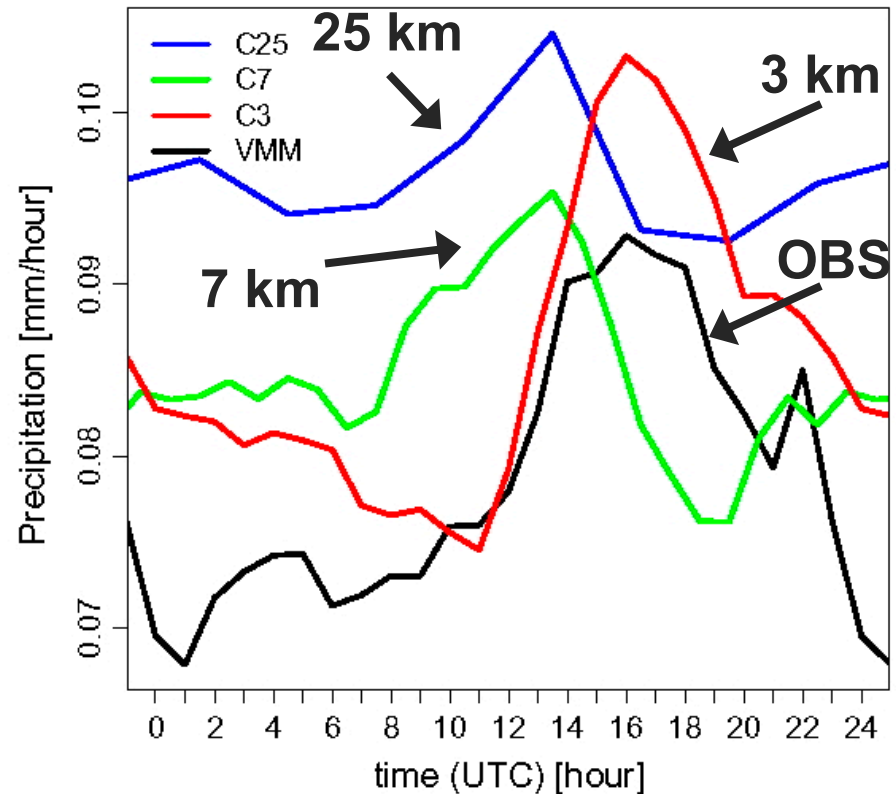
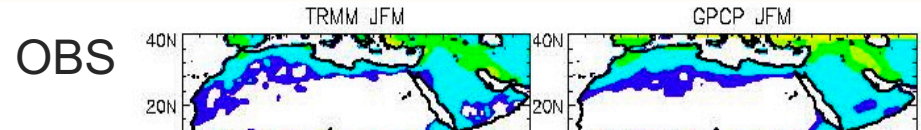
- **Data on ESGF**
- **Substantial contribution to the IPCC 1.5 report & AR6 Atlas**
- **Dozens of papers and contributions to national/regional reports**

Progress and achievements

Added Value

Regional
SE Australia
Daily precipitation
Summer mean
variability
precipitation
(JFM)
(DJF)

Brisson et al. (2016, *Clim. Dyn.*)
Dobro et al. (2016, *Clim. Dyn.*)
DiLuca et al. (2016, *JGR*)



Progress and achievements

CORDEX demonstrator

Adapt to climate change? African Impact Atlas: impacts in Africa under different degrees of warming. Threshold exceedance in key sectors.

Co-produce
Co-explore
Co-design
Co-define
Co-refine

Analysis approach

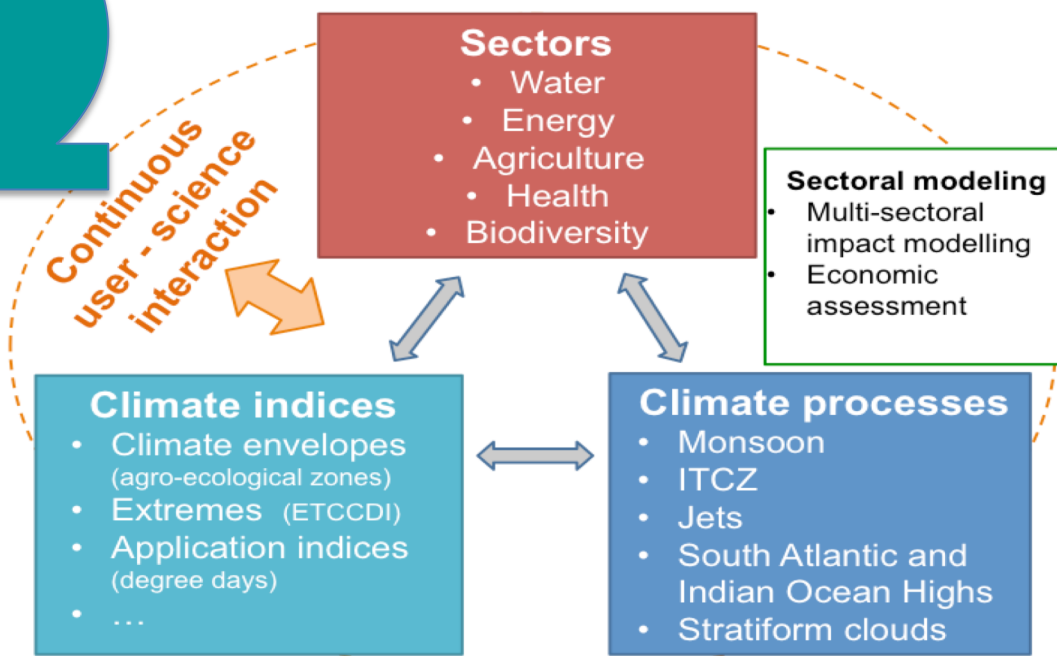


Image © AlJazeera

Regional expertise essential to develop this information
=> Good links between African and other institutions

Future plans



ICRC-CORDEX 2019 will

- Provide a platform for scientists and users from all parts of the globe
- Advance capacity development, training and knowledge exchange
- Build new and enhance existing co-operations

Sessions on

Advances in Regional Downscaling: Added value & uncertainties, conv permitting, ESD, HiResGCM

Coupled Models: Ocean-ice-atmosphere, atmosphere-land, biogeochemical modeling

Climate-Change Impacts: Extremes, implications for renewable energy, high-mountain environments

Side meetings: Third Pole, RCMES, 1.5 & 2 °C, Urban env., ESGF, Climate services, Hybrid meth.



Opportunities:

- Discussion of new strategic plan
- Input on implementation plan



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Future plans

New Joint WCRP Coordination Office for Regional Activities: WCRP CORA

Hosted by

- ❖ The Climate Service Center Germany in Hamburg, Germany (GERICS), and
- ❖ The Bjerknes Centre for Climate Research (BCC) in Bergen, Norway.



Opportunity to promote joint activities:

- Among Core Projects and Major Initiatives
- With boundary organizations

Future plans

From a white paper: *Futures Challenges for CORDEX*

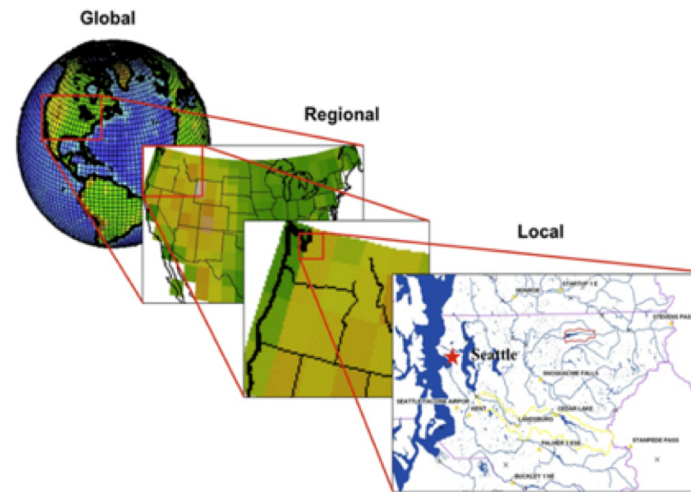
Smaller domains & Increasing resolution

- **Challenge**

Pressure to do simulations at high resolution in smaller domains than the CORDEX domains, e.g., *convection-permitting-resolution domains*. At the same time, GCMs are using resolutions of 25-50 km in HighResMIP for CMIP6, reaching the RCM scale. Probably this resolution will be the standard in CMIP7.

Collaboration has started with HighResMIP.

However, one major strength of CORDEX has been the performance and analysis on common domains.



Source: Andrew Wood

Future plans

From a white paper: *Futures Challenges for CORDEX*

Increasing complexity

- **Challenge**

RCMs → Earth System Models:

integrate two-way coupled processes, e.g., dynamic vegetation (carbon cycle), oceans (and sea-ice), more complex precipitation processes, interactive aerosols, lakes, glaciers, etc.: Computing time needed increases

Exascale computing

- **Challenge**

New generation of high-performance computers, using GPUs, specialized processors, etc. A trend of more processors or processing units. Models have to be adapted to this new development.



Source: Pexels.com

Future plans

Linking with other programs

CMIP6

- CORDEX as a CMIP6 Diagnostic MIP (Gutowski et al., 2016, *GMD*, doi:10.5194/gmd-9-4087-2016)
- Collaboration started with HighResMIP (analyses, boundary conditions)



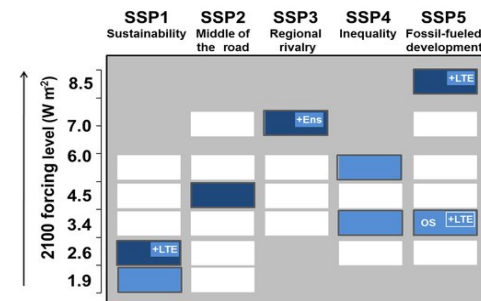
IPCC AR6

- CORDEX Coordinated Output for Regional Evaluations (CORE)
- Anticipated extensive use in AR6 regional chapters (10, 11, 12 & Atlas)



SSPs

- Explore regional climatic impacts of land-use changes



(O'Neill et al., 2018)



WORLD
METEOROLOGICAL
ORGANIZATION



United Nations
Educational, Scientific and
Cultural Organization



Intergovernmental
Oceanographic
Commission



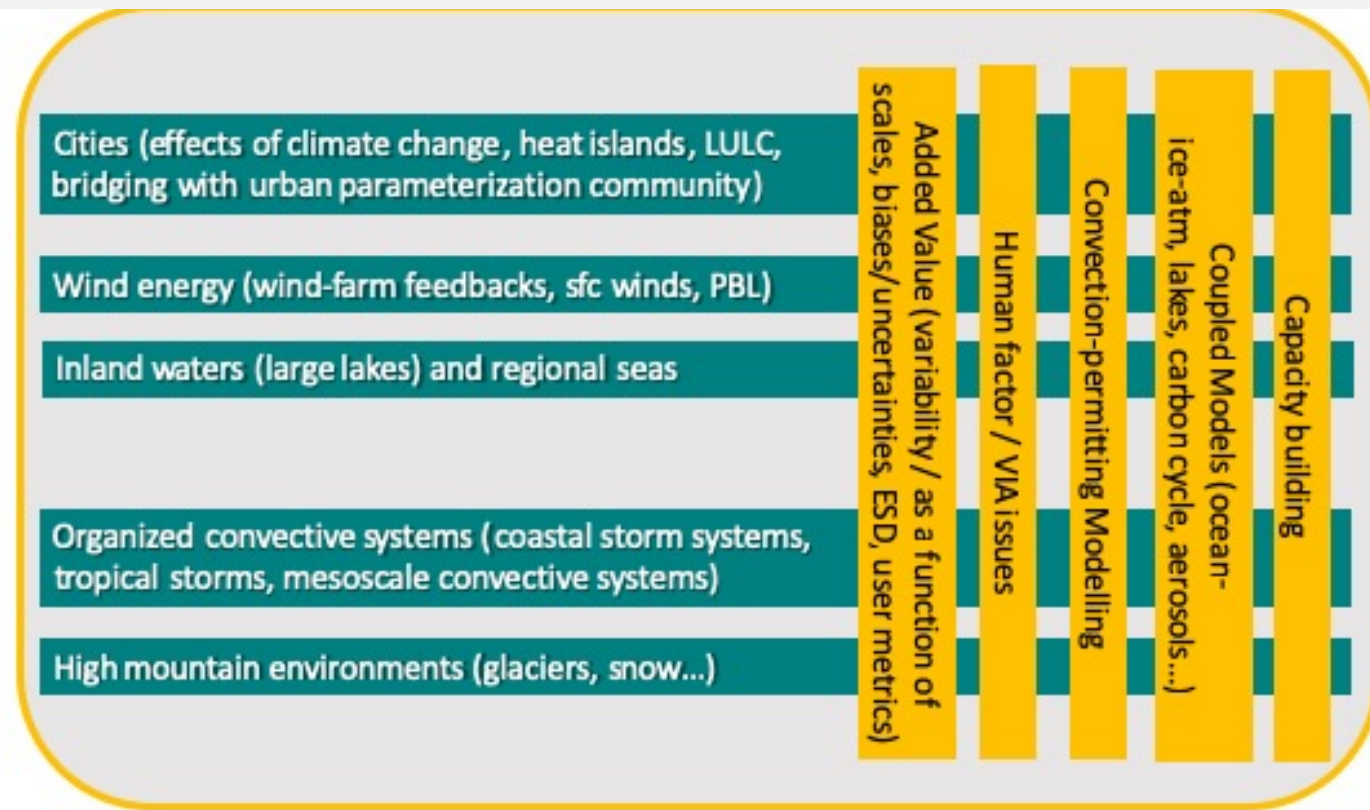
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Links to the WCRP Strategic and Implementation Plans

Goal 1: “We will support and facilitate the advancement of sciences that enable an integrated and fundamental understanding of the climate, its variations and its changes, as part of a coupled physical, biogeochemical, and socio-economic system.”

CORDEX Scientific Challenges



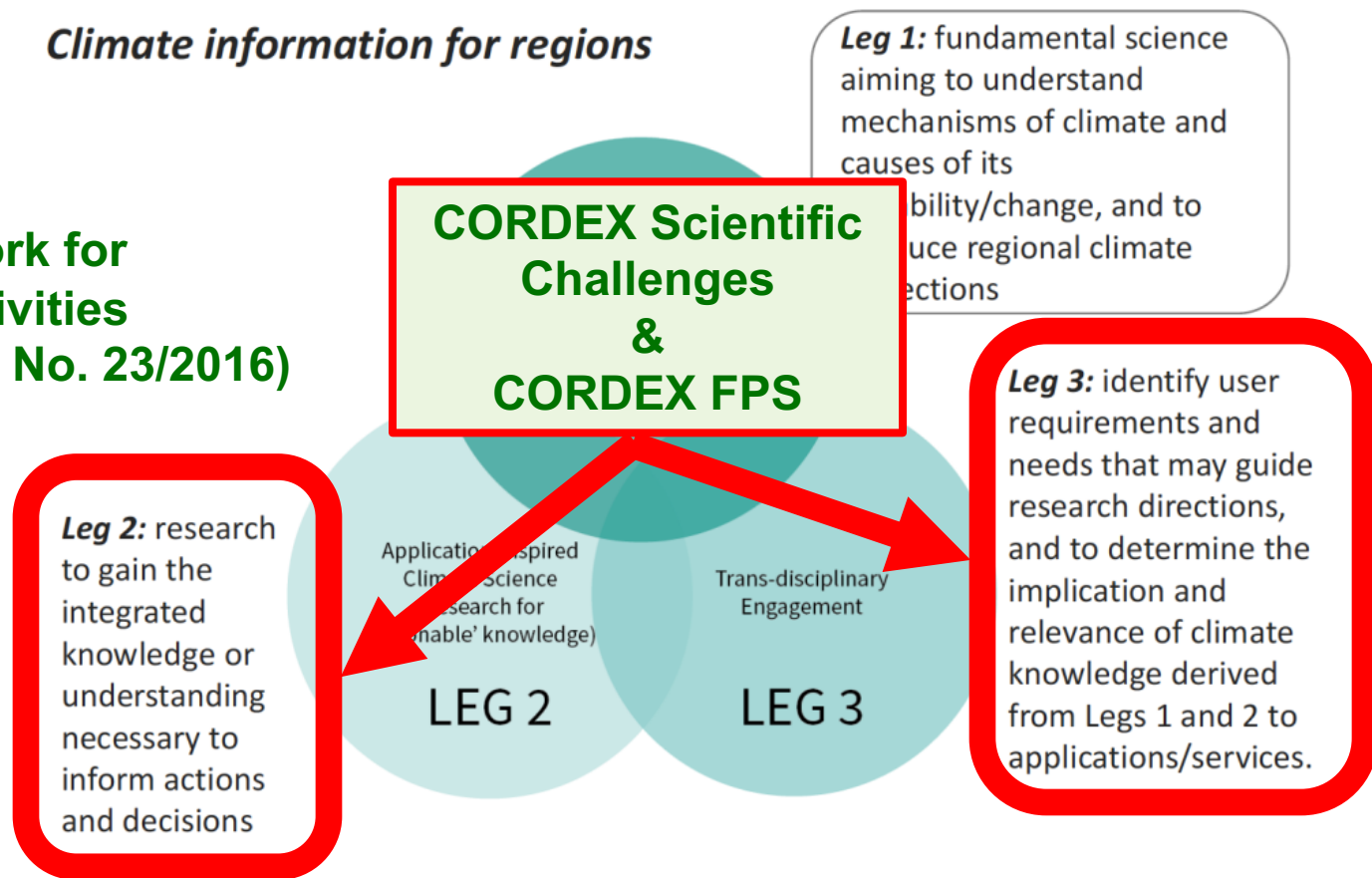
Goal 3: “We will quantify the responses, feedbacks and uncertainties intrinsic to the changing climate system on longer timescales.”

Links to the WCRP Strategic and Implementation Plans

Goal 4: “We will support innovation in the generation of decision-relevant information and knowledge about the evolving Earth system.

Climate information for regions

from:
Scoping a framework for
WCRP regional activities
(WCRP Publication No. 23/2016)



Goal 2: “We will push the frontiers of predictions and quantify the associated uncertainties for subseasonal to decadal time scales across all climate system components.”??

Emerging issues

- Strategies for obtaining funding for CORDEX activities, especially outside Europe and the U.S.
 - Uneven development across regions
 - Capacity building
- Computing resources, esp. for developing regions
- Engaging statistical downscaling (including machine learning, other “big data” techniques)
- Communication between groups/core projects – limited staffing
- Exascale computing

Additional Slides



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Progress and achievements

CORDEX FPS - Flagship Pilot Studies

Requirements

- Strong basis in fine-scale processes important to region's climate (*physical basis*)
- Observational basis for verification (*analysis basis*)
- User applications (*VIA basis*)
- Potential connection with other WCRP programs, esp. GEWEX

<http://cordex.org/experiment-guidelines/flagship-pilot-studies/>



Africa: Coupled regional modelling of land-atmosphere-ocean interactions over western-southern Africa under climate change

Contact person Francois Engelbrecht FEngelbrecht@csir.co.za

Africa: ELVIC - Climate Extremes in the Lake Victoria Basin, Nicole van Lipzig

Contact person Nicole van Lipzig nicole.vanlipzig@kuleuven.be

South America: Extreme precipitation events in Southeastern South America: a proposal for a better understanding and modeling

Contact person Maria Bettolli bettolli@at.fcen.uba.ar

Europe+ Mediterranean; Convective phenomena at high resolution over Europe and the Mediterranean

Contact person Erika Coppola coppolae@ictp.it or Stefan Sobolowski stefan.sobolowski@uni.no

Europe; Impact of land use changes on climate in Europe across spatial and temporal scales

Contact person Diana Rechid diana.rechid@hzg.de

Mediterranean; Role of the natural and anthropogenic aerosols in the Mediterranean region: past climate variability and future climate sensitivity

Contact person Solmon Fabien fsolmon@ictp.it or Marc Mallet marc.mallet@earo.obs-mip.fr

Mediterranean; Role of the air-sea coupling and small scale ocean processes on regional climate

Contact person Gabriel Jordà gabriel.jorda@uib.cat or Gianmaria Sannino gianmaria.sannino@enea.it

