CORDEX:
The Coordinated Regional Downscaling Experiment

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With input from M. Rixen, C. Jones

Details at:
http://wcrp-cordex.ipsl.jussieu.fr/
(Search: “WCRP CORDEX climate”)
General Aims and Plans for WCRP CORDEX

Provide a set of *regional climate scenarios* covering the period 1950-2100, for the majority of the populated land-regions of the globe.

Make these *data sets readily available and useable* to the impact and adaptation communities.

Provide a *generalized framework for testing and applying* regional climate models and downscaling techniques for both the recent past and future scenarios.

Foster coordination between regional downscaling efforts around the world and *encourage participation* in the downscaling process of local scientists/organizations.
# CORDEX Science Advisory Team

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<tr>
<th>Name</th>
<th>Institution</th>
<th>Region/Specialty</th>
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</table>
| Filippo Giorgi        | Earth System Physics Section  
The Abdus Salam International Centre for Theoretical Physics - Trieste, ITALY | JSC, Med-COR                              |
| (co-chair)            |                                                                                                                           |                                            |
| William Gutowski      | Dept. of Geological & Atmospheric Sciences  
Iowa State University - Ames, Iowa, USA                                         | North America                             |
| (co-chair)            |                                                                                                                           |                                            |
| Silvina Solman        | Universidad de Buenos Aires  
Fac. Ciencias Exactas Y Nat.- Buenos Aires, ARGENTINA                                                                            | South America                             |
| R. Krishnan           | Centre for Climate Change Research (CCCR)  
Indian Institute of Tropical Meteorology - Pune, INDIA                                                                          | South Asia                                |
| Won-Tae Kwon          | National Institute of Meteorological Research  
Korea Meteorological Administration - Seoul, REPUBLIC OF KOREA                                                                     | East Asia                                 |
| Isabelle Anguelovski  | Universitat Autònoma de Barcelona – Barcelona, SPAIN                                                                          | VIA                                       |
| Chris Lennard         | University of Cape Town – Cape Town, SOUTH AFRICA                                                                            | Africa                                    |
| Grigory Nikulin       | SMHI, Rossby Center – Norrköping, SWEDEN                                                                                     | Data Management                           |
| Tannecia Stephenson   | University of West Indies – JAMAICA, TRINIDAD & TOBAGO, BARBADOS                                                              | Statistical Downscaling                   |
| Bertrand Timbal       | Bureau of Meteorology – Melbourne, AUSTRALIA                                                                                | Statistical Downscaling                   |
WCRP Working Group on Regional Climate
(http://www.wcrp-climate.org/index.php/regional-climate)

Bruce Hewitson, CSAG/Univ of Cape Town (Co-Chair)
Clare Goodess, Univ of E Anglia (Co-Chair)

Tim Carter, Finland Environment Institute
David Behar, San Francisco Public Utility (U.S.A.)
Seita Emori, National Inst. for Environmental Studies (Japan)
Kendra Gotango, Ateneo de Manila University (Phillippines)
Fernanda Zermoglio, Sector Azul (Chile)
Igor Shkolnik, Dynamic Meteorology Dept. (Russia)
Filippo Giorgi, CORDEX SAT Co-Chair (Italy)
CORDEX Phase I experiment design

Model Evaluation Framework

Climate Projection Framework

Multiple regions (Initial focus on Africa) 50 km grid spacing

ERA-Interim LBC 1989-2007

AMIP-like

Regional Analysis Regional Databanks

CMIP-like

RCP4.5, RCP8.5 1951-2100 or 1980-2050


Multiple AOGCMs
Coordinated Regional Downscaling Experiment (CORDEX) ~ Regions ~

(C. Jones, 2009)
Two new CORDEX domains are being proposed:

- MENA Domain
- South East Asia Domain
CORDEX Data Management

• **Lots being done …**
  – CORDEX output will use the Earth System Grid (ESG), like CMIP5
  – Substantial development of output formatting, metadata, file structure, etc.
  – New: file/format compliance checker prior to data upload
  – CORDEX nodes planned at BADC, DKRZ, DMI, SMHI, ENEA (MedCORDEX), UCT, IITM, KMA
  – Current testing of the system by SMHI

• **… but useful to applications work?**
The Conference brought together the international community of regional climate scientists to present and discuss results from WCRP regional climate studies, with a particular emphasis on the CORDEX initiative.

- **Attendance**
  - Over 500 registrations
  - ~470 abstracts submitted

- **Plenary + Poster sessions + side focused meetings**
  - CORDEX progress/achievements
  - Issues in dynamical and statistical downscaling
  - Application to IAV work
  - Future developments/directions
(A climate scientist view of)
The CORDEX Paradigm

Global model (AOGCM)

Time-slice AGCM, VARGCM

Regional Model (RCM)

Statistical Downscaling

Impacts

Flood
Drought
Water Resources
Energy
Agriculture
Landuse Change
Pollution
Health
Fisheries
Ecosystems

Storms

(A climate scientist view of)
The CORDEX Paradigm
The CORDEX Paradigm

Impacts

Global model (AOGCM)

Time-slice AGCM, VARGCM

Regional Model (RCM)

Statistical Downscaling
Issue I: Improve dialogue and co-exploration with end-users

What is this for? Who cares?
Generation of small scales by a high-resolution RCM driven by low-resolution GCM data (900 hPa specific humidity) (From R. Laprise)

Issue II: Added Value
Issue III: Uncertainty

- Socio-Economic Assumptions
- Emissions Scenarios
- Concentration Calculations
  - Biogeochemical/Chemistry Models
    - Global Climate Change Simulation
      - AOGCMs, Radiative Forcing
    - Regional Climate Change Simulation
      - Regionalization Techniques
- Impacts
- Policy Responses: Adaptation and Mitigation
- Interactions and Feedbacks
- Land Use Change

Natural Forcings
Fraction of uncertainty explained by different sources as a function of lead time

Internal variability
Scenario uncertainty
Model configuration uncertainty

Decadal temperature - Global

Decadal temperature – British Isles

Hawkins and Sutton 2009
Issue IV: Competing demands to improve regional climate projections.
CORDEX Future Directions

✦ Develop a co-learning community among all participants.
  • More guidance in design from VIA community and from operational practitioners (e.g., water managers, health officials, etc.)
  • User-oriented diagnostic and graphic tools

✦ Assess much more rigorously the added value of downscaling.

✦ Better characterize signal and “noise” (uncertainty).
  • Signal versus “noise” as a function of scale (temporal/spatial)
  • Quantification of confidence levels

✦ Develop optimal approaches to regional information.
  • Cross comparison of methods (RCMs, statistical, hi-res GCMs)
  • Hybrid approaches
Thank You!
Additional Slides
ERA-Interim Africa CORDEX multi-RCM matrix

Precipitation (pr) | JAS | 1998-2008

- GPCP11
- TRMM-3B42
- UDEL201
- GPCC5
- ERA-INTERIM
- ENSEM. MEAN (RCMs)
- SMHI-RCA35
- DMI-HIRHAM5
- CLMcom-CCLM48
- MPI-REMO
- KNMI-RACMO22
- CNRM-ARPEGE51
- ICTP-RegCM3
- UCT-PRECIS
- UC-WRF31
- UQAM-CRCM5

(C. Jones, 2012)
South America

7 RCMs using ERA-Interim boundary conditions (1990-2008)

Temperature Bias (°C)

JJA

DJF

Precipitation Bias (mm/month)

JJA

DJF

Ensemble vs. (CRU & UDEL)

Ensemble vs. (GPCC, CRU, UDEL & CPC)

(Solman et al., 2012 - submitted)
Further Issues – CORDEX Internal

- Needed: Mechanism for better coordination across activities in the different CORDEX domains and more generally across the wider CORDEX community
- Better communication across the CORDEX community (ongoing)
- Improvement in the CORDEX web-site management (ongoing)
- Mechanism for approving new CORDEX domains and activities
- Search for some core funding (CORDEX activities currently on voluntary basis)