

# Coordinated Regional Downscaling Experiment (CORDEX)



ICRC CORDEX-2016



# CORDEX Scientific Vision

*To advance and coordinate the science and application of regional climate downscaling through global partnerships*

## Goals:

- To better understand relevant regional/local climate phenomena, their variability and changes, through downscaling.
- To evaluate and improve regional climate downscaling models and techniques
- To produce coordinated sets of regional downscaled projections worldwide
- To foster communication and knowledge exchange with users of regional climate information



# CORDEX – Scientific Challenges

## ✧ Added value

Internal variability & added value as functions of scale; Bias correction uncertainties and consistency; User-oriented metrics

## ✧ Human element

Coupling of regional climate and coastal megacities; Bridging with urban parameterisation development; Land use change

## ✧ Coordination of regional coupled modelling

Ocean-ice-atmosphere; Lakes; Dynamic land surface; Cryosphere; Natural fires; Atmospheric chemistry; Carbon cycle; Aerosols; Marine biogeochemistry

## ✧ Precipitation

Convective systems; Coastal storm systems; MJO/Monsoon

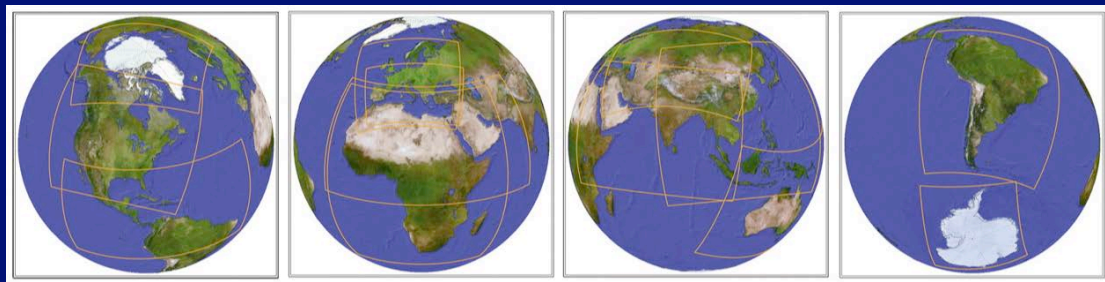
## ✧ Local wind systems

Wind storms; Strong regional winds; Wind energy



# Flagship Pilot Studies (FPS)

- Coordinate developments in conv.-permitting climate sim.
- Should have 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
- First FPS call closed 15 Feb. 2016
- 9 proposals reviewed from 6 CORDEX regions
- Details: [www.cordex.org](http://www.cordex.org)



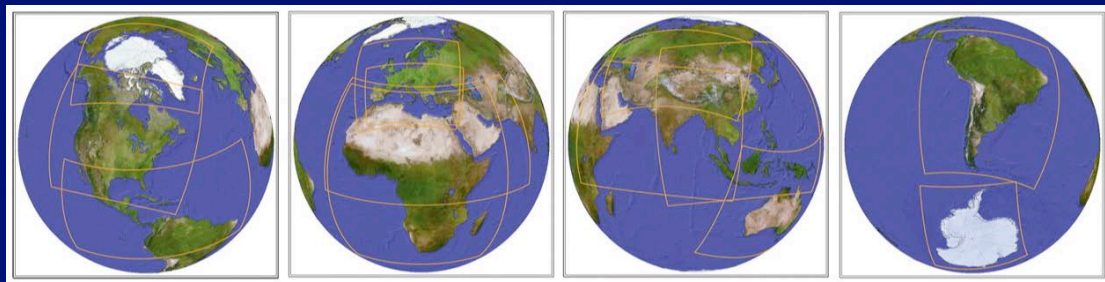
# Flagship Pilot Studies (FPS)

Five ready to go forward:

- ✓ EUR+MED: Convective phenomena
- ✓ EUR: Impact of land use changes
- ✓ S. AM: Extreme precipitation events.
- ✓ MED: Role of natural and anthropogenic aerosols
- ✓ MED: Role of air-sea coupling and small-scale ocean processes

Three we will work with further.

One that can fit better with other CORDEX activity.



# CORDEX – A CMIP6 Diagnostic MIP

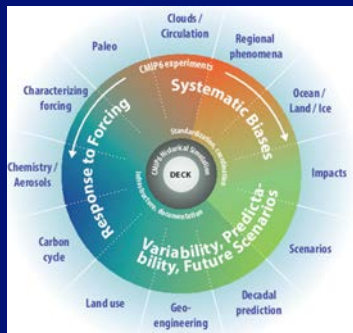
## Primary CMIP6 Question Addressed:

How can we assess future climate changes given climate variability, predictability and uncertainties in scenarios?

## Primary WCRP Grand Challenges Addressed:

1. Weather and climate extremes
2. Regional climate information (status?)

**Coordination:** ScenarioMIP, HighResMIP



# CORDEX – IPCC Interest

## CORDEX Coordinated Output for Regional Evaluations (CORDEX CORE)

- In development
- Motivated by IPCC Workshop on Reg. Climate (Sept. 2015)
- Elements
  - ◆ Succinct set of downscalings for each region
  - ◆ Provide a core foundation for additional work by others
  - ◆ Span plausible range of climate change => 3 distinct GCMs?
  - ◆ CMIP5? Historical + RCP8.5?
  - ◆ Downscaling: 3-4 RCMs? ESD methods?
  - ◆ Resolution?
  - ◆ Contribute to IPCC Special Reports?
  - ◆ *How far should CORDEX reach toward climate services?*

# CORDEX Statistical and Dynamical Downscaling: Workshop Series

Sept 2013 - ICTP, Trieste, Italy

July 2014 - Univ. Buenos Aires, Argentina

June 2015 - Univ. Cape Town, South Africa



# CORDEX Statistical and Dynamical Downscaling: Workshop Series

- Advancing each for climate information
- Coordinating comparison of methods: advantages of each?
- Exploration of hybrid approaches



# CORDEX – Other Recent Science

👉 Review paper in *Ann. Rev. of Environment and Resources*

[DOI: 10.1146/annurev-environ-102014-021217]

## Regional Dynamical Downscaling and the CORDEX Initiative

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Annu. Rev. Environ. Resour. 2015. 40:467–90

First published online as a Review in Advance on July 24, 2015

The *Annual Review of Environment and Resources* is online at [environ.annualreviews.org](http://environ.annualreviews.org)

### Keywords

regional climate modeling, dynamical downscaling, regional climate, CORDEX, RCM, climate change, model evaluation, downscaling added value, regional Earth system modeling, high-resolution modeling

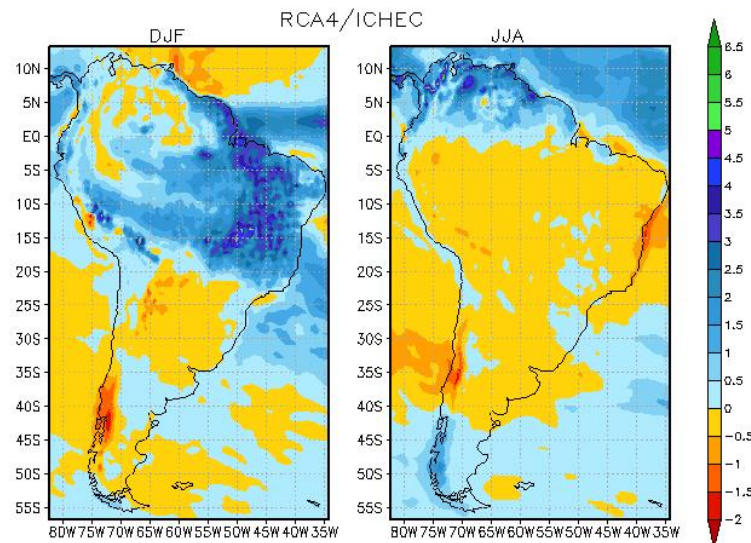
# CORDEX – Other Recent Science

Submitted paper: *Geoscientific Model Development (GMD)*  
Special collection of papers on CMIP6

## WCRP COORDINATED REGIONAL DOWNSCALING EXPERIMENT (CORDEX): A Diagnostic MIP for CMIP6

William J. Gutowski, Jr.<sup>1</sup>, Filippo Giorgi<sup>2</sup>, Bertrand Timbal<sup>3</sup>, Anne Frigon<sup>4</sup>, Daniela Jacob<sup>5</sup>, Hyun-Suk Kang<sup>6</sup>, R. Krishnan<sup>7</sup>, Boram Lee<sup>8</sup>, Christopher Lennard<sup>9</sup>, Grigory Nikulin<sup>10</sup>, Eleanor O'Rourke<sup>10</sup>, Michel Rixen<sup>8</sup>, Silvina Solman<sup>11</sup>, Tannecia Stephenson<sup>12</sup> and Fredolin Tangang<sup>13</sup>

Mean precipitation CHANGE (2071–2100)–(1980–2005) RCP4.5



# WCRP CORDEX ICRC-CORDEX 2016

17<sup>TH</sup>-20<sup>TH</sup> MAY 2016 STOCKHOLM, SWEDEN



## Goal:

Promote the CORDEX vision to advance and coordinate the science and application of regional climate downscaling through global partnerships

## Focus:

- Analysis guided by CORDEX Science Goals.
- High resolution climate information
- Applications to VIA community and other end users



- Over 350 registered
- Special event for Early Career Scientists
- European Climate Research Alliance (ECRA) side event

<http://www.icrc-cordex2016.org/>

**Thank You!**

~

**Tack!**



# CORDEX CORE

## Ideal GCM output for downscaling:

- 1) Sufficient for dynamical and empirical statistical downscaling  
*[transient climate-change simulation]*
- 2) Multiple realizations of the same GCM for both the pre-industrial and transient climate-change simulations  
*[explore unforced variability]*
- 3) Pre-industrial control runs (CMIP DECK) and runs with changes in only one climate forcing (as available)  
*[explore regional detection and attribution]*



# CORDEX CORE

## Targeted GCM simulations should:

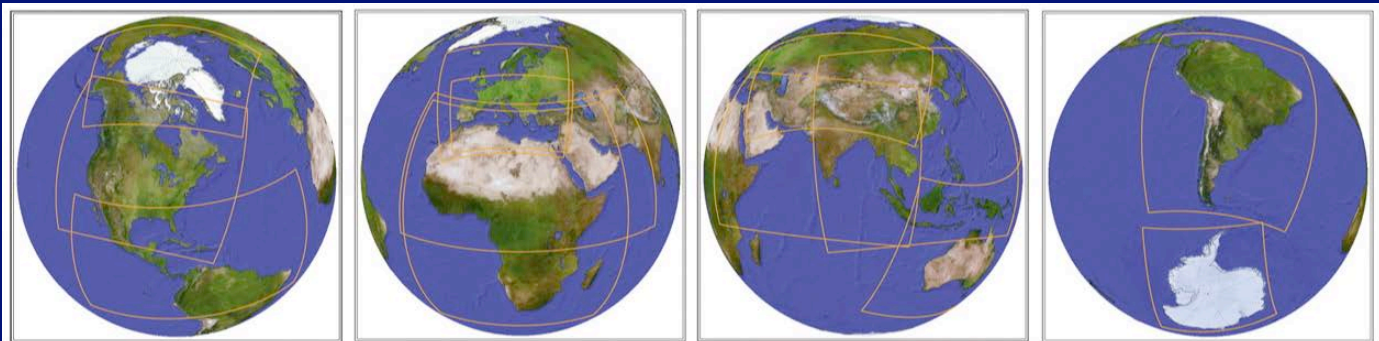
- cover as well as possible the range of GCM climate model sensitivity;
- provide acceptable quality of historical climate simulations in the regions where they supply boundary conditions;
- provide acceptable quality of historical climate simulations for important large-scale features affecting regional climates, such as ENSO, NAO, etc.;
- have a distinctive model development history.



# CORDEX – Management & Science Issues

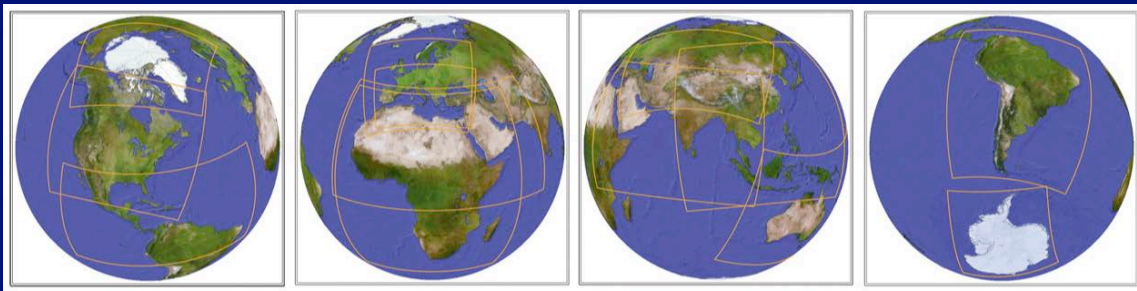
## ➤ Funding for a widely dispersed program

- Connecting with APN, GFCS, EU, World Bank, Asian Dev. Bank . . .



# CORDEX – Data Issue

- **Observational deficiency: Climatological observations at spatial/temporal scales of regional phenomena**
  - Processes resolved by dynamical models
  - Targets for statistical downscaling
  
- **Flagship Pilot Studies are one avenue for overcoming this**



# CORDEX – Regional Issues

## ➤ Coordination beyond CORDEX:

- WGRC & FOCI Projects
- IS-ENES2 (ESGF & data policy)
- Future Earth (through WCRP and regional office)
- Obs4MIPS, TGICA, GFCS
- Connecting with APN, GFCS, EU, World Bank, Asian Dev. Bank . . .

