Coordinated Regional Downscaling Experiment (CORDEX)

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Coordinated Regional Downscaling Experiment (CORDEX)

- Background and history
- Vision and goals
- CORDEX data
- CORDEX in the New WCRP Strategic Plan
- Future directions

World Climate Research Programme

- **CORDEX is part of the WCRP**
- **The WCRP mission …**

... is to facilitate analysis and prediction of Earth system variability and change for use in an increasing range of practical applications of direct relevance, benefit and value to society.

The two overarching objectives of WCRP are:

to determine the predictability of climate

to determine the effect of human activities on climate

CORDEX – Brief History

- Call by WCRP for greater coordination across downscaling activities
  - (WCRP JSC-28, 2009)

- WCRP Task Force on Regional Climate Downscaling (2010)
  - F. Giorgi and C. Jones, Co-chairs

- 1st Pan-CORDEX Conference (ICTP, Trieste, 2011) – 180 participants

- Formal WCRP program, with Science Advisory Team (2012)

- 2nd Pan-CORDEX Conference (Brussels, 2013) – 400 participants

- International Project Office for CORDEX (IPOC) established (SMHI, 2015)

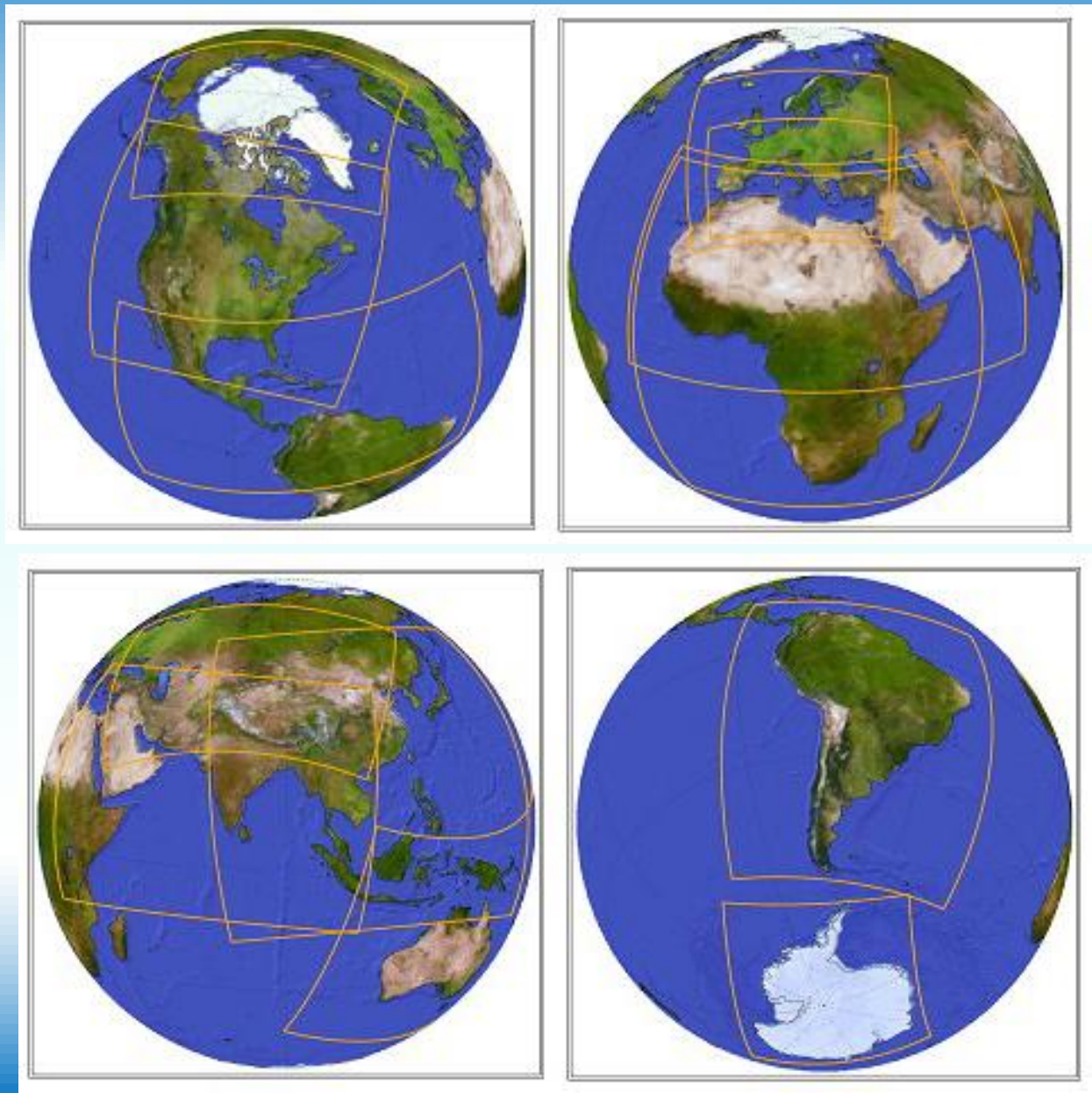
- 3rd Pan-CORDEX Conference (Stockholm, 2016) – 500 participants

WCRP CORDEX

CORDEX Background

CORDEX aims:

- Link regional expertise
- Build on prior experiences with regional simulations and processes
- Engage all forms of downscaling (RCM, ESD, variable res GCM)
- Cover all major land masses + Arctic
- 14 CORDEX Domains



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

- Six key challenges to help drive CORDEX forward.
- Five cross cutting themes to focus activities across the CORDEX domains, promote cross domain interaction, and allow for close interaction with the VIA and climate service community.

Cities (effects of climate change, heat islands, LULC, bridging with urban parameterization community)

Wind energy (wind-farm feedbacks, sfc winds, PBL)

Inland waters (large lakes) and regional seas

Small Islands (island-generated climatology, storm surge)

Organized convective systems (coastal storm systems, tropical storms, mesoscale convective systems)

High mountain environments (glaciers, snow…)

Added Value (variability / as a function of scales, biases/uncertainties, ESD, user metrics)

Human factor / VIA issues

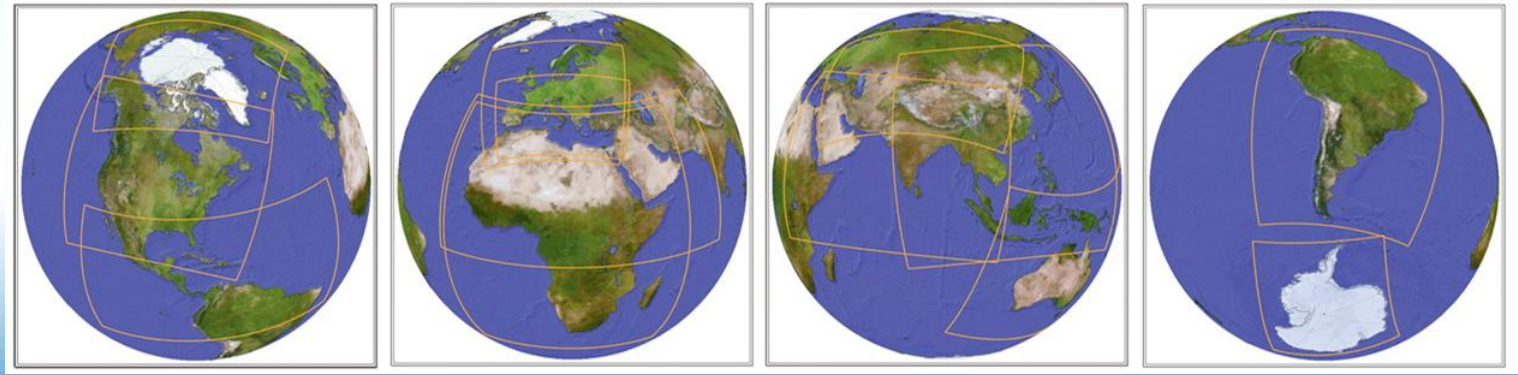
Convection-permitting Modelling

Coupled Models (ocean-ice-atm, lakes, carbon cycle, aerosols…)

Capacity building

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, e.g., GEWEX
- Cumulatively - 7 proposals endorsed from 6 CORDEX regions
- **One call a year - in February**
- Details: www.cordex.org



Flagship Pilot Studies (FPS)

Seven FPS now established:

- ✓ EUR+MED: Convective phenomena at high resolution over Europe and the Mediterranean
- ✓ EUR: Impact of land use changes on climate in Europe across spatial and temporal scales
- ✓ S. AM: Extreme precipitation events in Southeastern South America: a proposal for a better understanding and modeling
- ✓ Africa: Coupled regional modelling of land-atmosphere-ocean interactions over western-southern Africa under climate change
- ✓ Africa: ELVIC - Climate Extremes in the Lake Victoria Basin
- ✓ MED: Role of the natural and anthropogenic aerosols in the Mediterranean region: past climate variability and future climate sensitivity
- ✓ MED: Role of the air-sea coupling and small scale ocean processess on regional climate

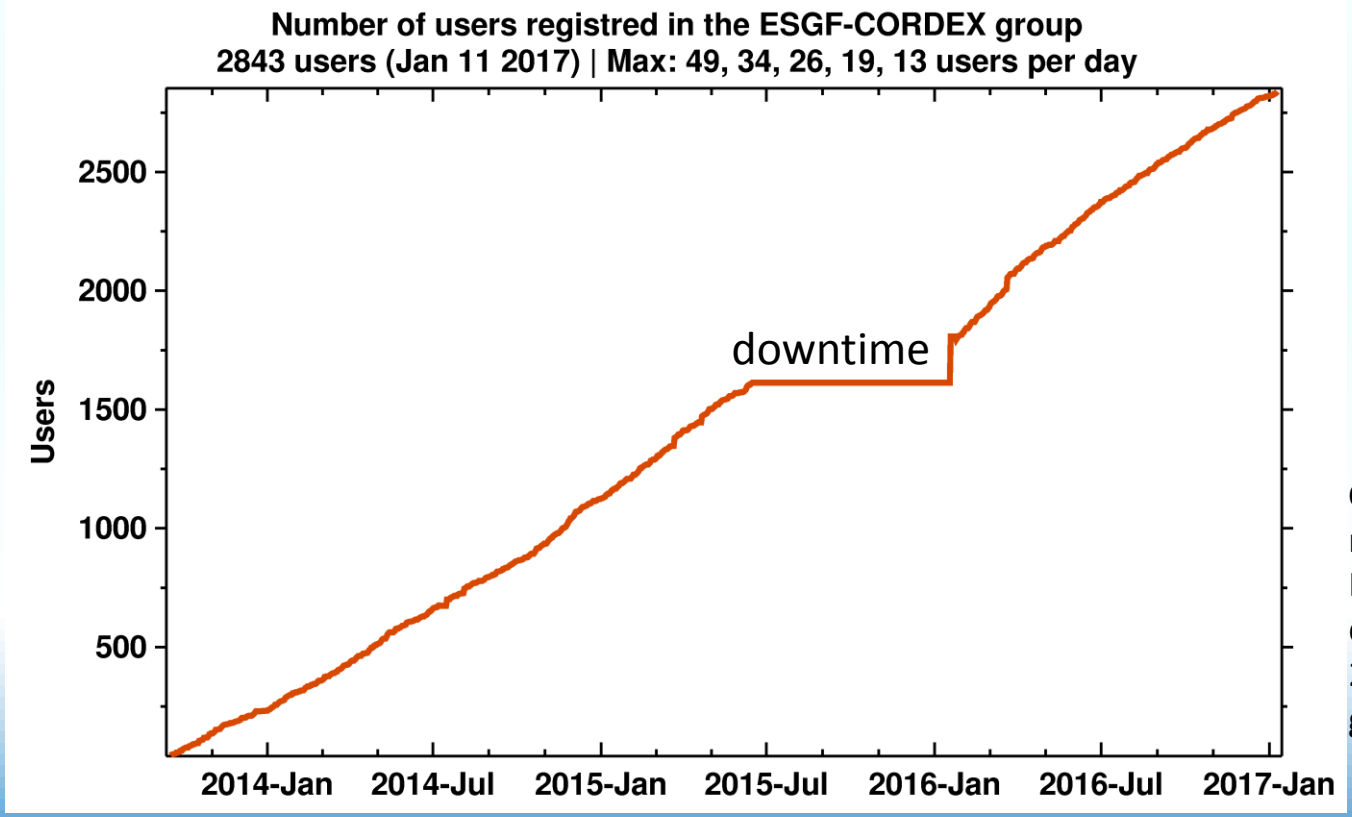
Data Access

WCRP CORDEX
Coordinated Regional Climate Downscaling Experiment

http://www.chrismadden.co.uk/cartoons/environment-cartoons/global-warming-cartoons/

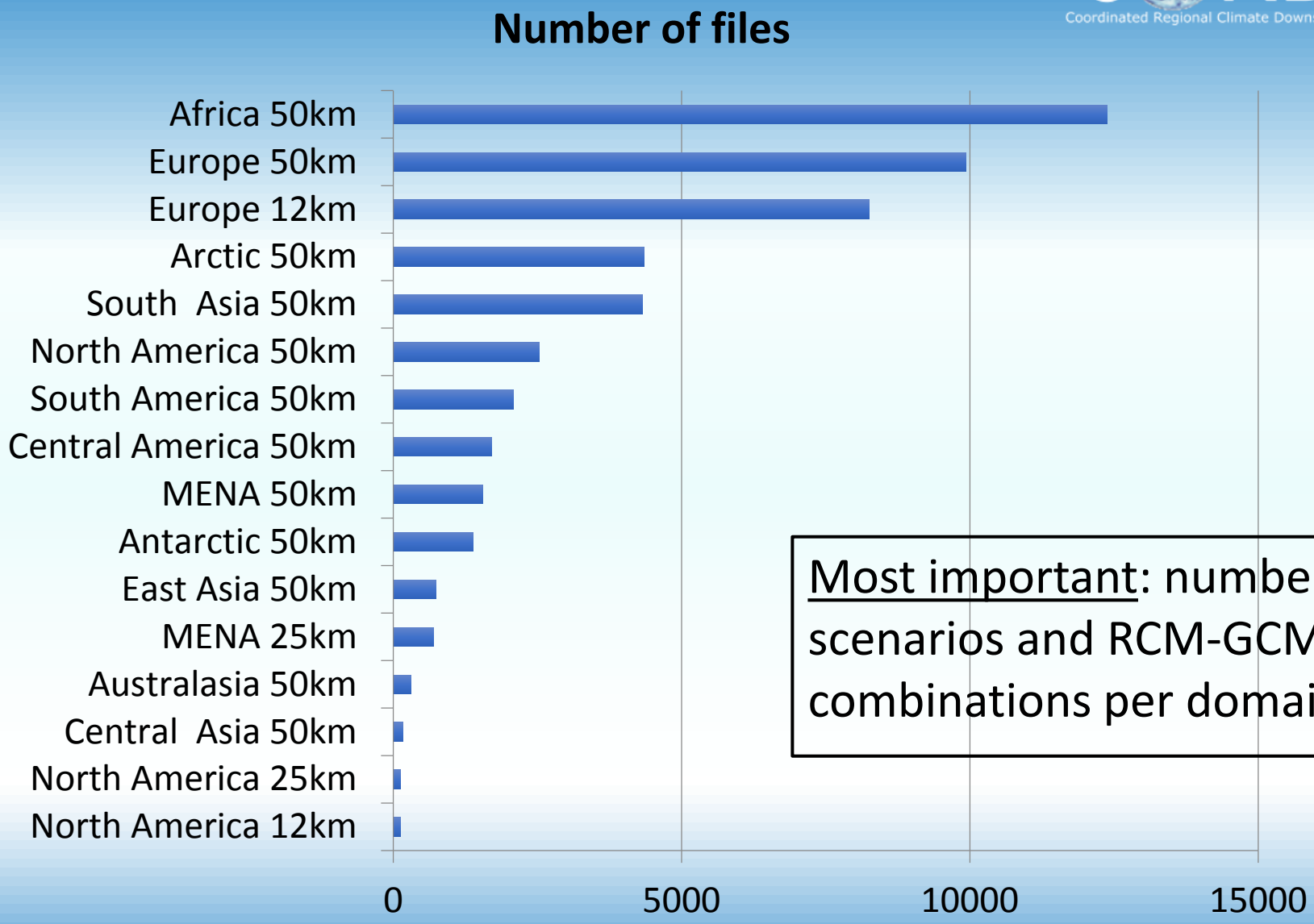
CORDEX simulations can be accessed using:

1. ESGF
2. Regional Data Portals (Med-CORDEX, South and East Asia)
3. Impact portals (only ESGF segment)
4. Servers at Individual modelling groups



CORDEX-ESGF in operation since mid September 2013
Number of users growing, available data sets growing
2843 users in the CORDEX-ESGF group (11 Jan 2017)

CORDEX data on ESGF

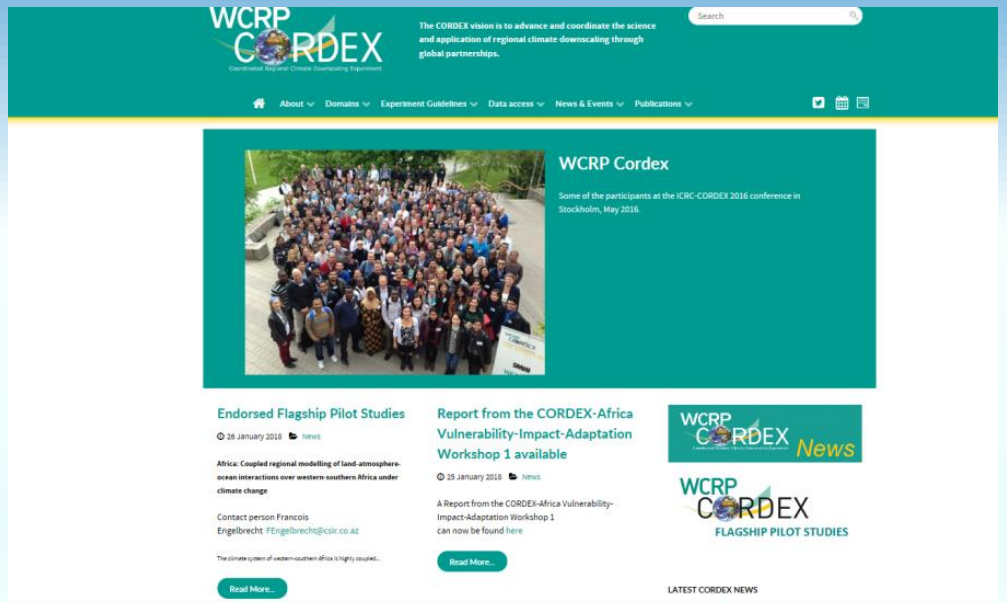


Most important: number of scenarios and RCM-GCM combinations per domain

provided by DKRZ (Jan 2017)

On the web

- **CORDEX web: http://www.cordex.org**
- **CORDEX status – simulations for each domain/group**
- **Web calendar; Coming plans, workshops, meetings, conferences, presentations**
- **Annual reports from FPSs**



CORDEX Statistical and Dynamical Downscaling: Workshop Series

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

NSF

Meteorologisk institutt
150 år

is-enes
INFRASTRUCTURE FOR THE EUROPEAN NETWORK FOR EARTH SYSTEM MODELLING

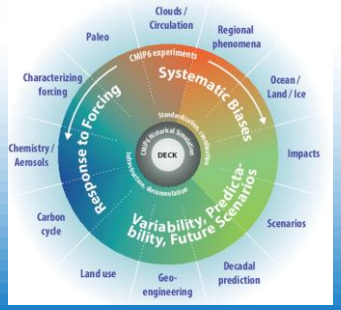
CORDEX – A CMIP6 Diagnostic MIP

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, VIACS AB, . . .

Gutowski et al., 2016: WCRP Coordinated Regional Downscaling Experiment (CORDEX): A Diagnostic MIP for CMIP6. *Geoscientific Model Development* [doi:10.5194/gmd-9-4087-2016]



CORDEX CORE

CORDEX Coordinated Output for Regional Evaluations

- **Motivated and further promoted by**
  - IPCC Workshops on Regional Climate (Sept. 2015; May 2018)
  - WCRP Scoping Workshop on a framework for reg. studies (Sept. 2016)
  - Regional focus in AR6 WGI (3 chapters)
- **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 (CMIP6): Historical + RCP2.6 & RCP8.5 (to 2100)
  - Downscaling: currently 5 RCMs + ESD methods
  - Resolution: 12.5 – 25 km

CORDEX in the New WCRP Strategic Plan

Emphasis-5. The regions in the climate system

CORDEX and regional climate phenomena at the nexus of two key strategic plan issues:

- The product of multi-scale interactions between large-scale processes and smaller-scale processes
- A direct link between climate and communities impacted by climate variability and change

CORDEX in the Strategic Plan

E-5. The regions in the climate system – Goals:

- Regional analysis of global coupled models and the variety of downscaling tools
- Some focuses: convective systems, frontal behavior and processes driven by topography, land-water cover and land-use.
- Processes producing regional “hotspots” that have strong global impacts or are particularly sensitive to large-scale forcings
- Advance the production of regional climate information
- **KEY NEED:** high quality, fine scale, multivariate observations

October 2019 BEIJING, CHINA

ICRC-CORDEX 2019

Opportunities:

1. Discussion of new strategic plan
2. Input on implementation plan

ICRC-CORDEX 2019

- Outcomes from last conference in Stockholm 2016

Whereas CORDEX has contributed vastly to the development and production of regional climate data and information, there are still both knowledge gaps and coverage gaps, which is why further development of models, infrastructure, tools and knowledge exchange are needed.

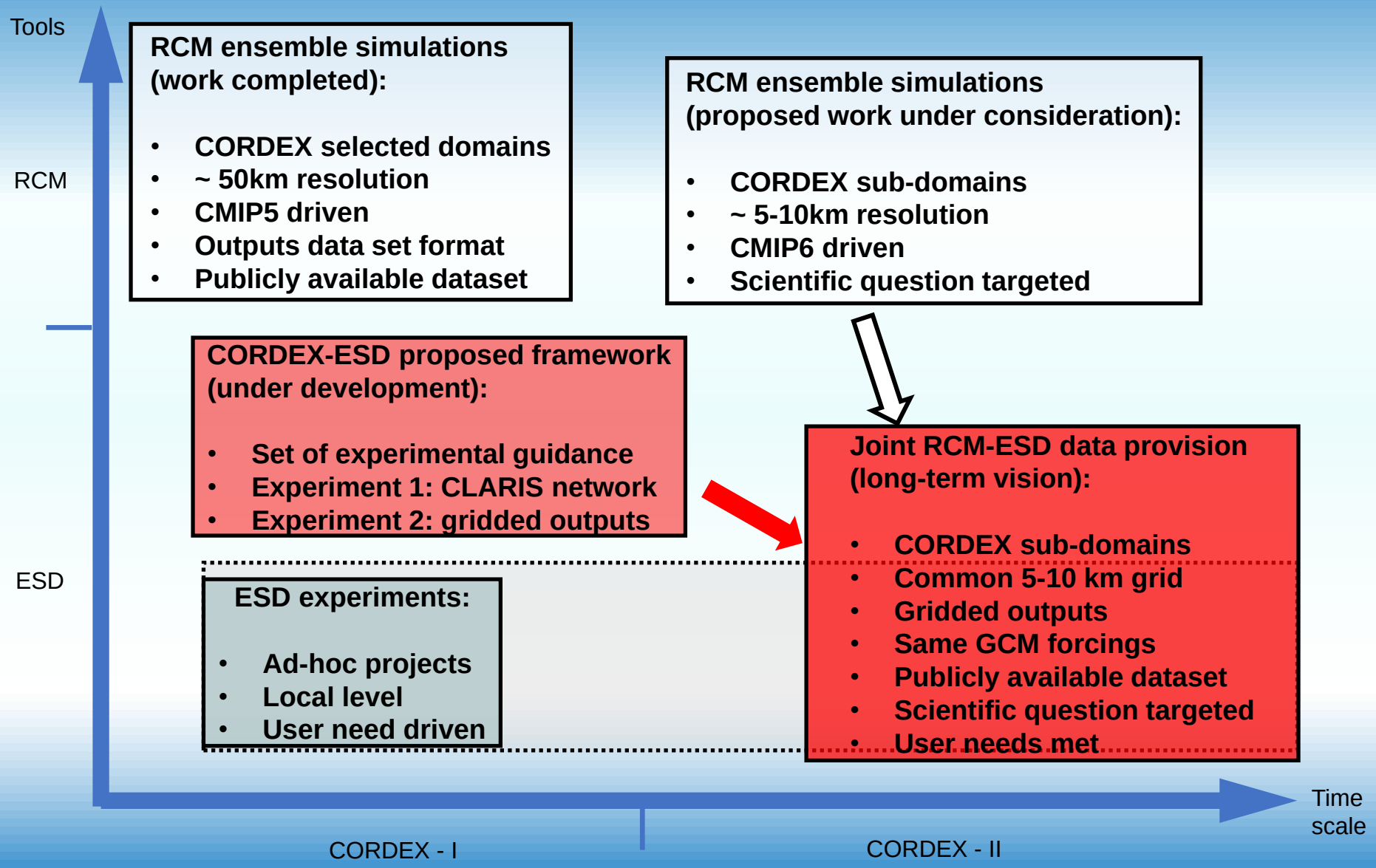
- Objectives for 2019 in Nanjing

Some recurring challenges and opportunities were identified at the ICRC-CORDEX2016 and will thus be part of the objectives for ICRC-CORDEX 2019:

- lack of observations,
- distillation of information from data, resolution versus computational costs,
- risk analysis and uncertainties,
- the need for earth system models,
- representing and projecting extremes at useful scales for users,
- the scale mismatch of models and observations and of models and impact-assessment needs,
- possibilities in facilitating and planning model and method inter-comparison and assessment.

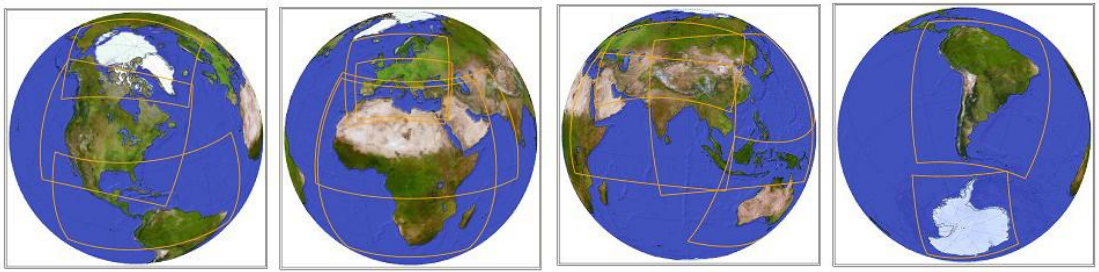
The effort to further streamline and coordinate the work and information sharing in the CORDEX domains continues and is of essence for a unified voice towards users.

CORDEX future plans
Integrating RCM and ESD outputs



CORDEX Challenges

- Role of CORDEX within the evolving WCRP structure
- Further interactions with CMIP6 and other WCRP activities
- Two CORDEX SAT co-chairs rotating off within two years
- Clarifying scientific boundaries of CORDEX
- Coordination across different regional CORDEX activities
- Communication across CORDEX regional communities
- Strategies for obtaining funding for CORDEX activities, especially outside Europe and the U.S.
- Uneven development across regions
- GCMs operating at higher resolutions pushing RCMs to increase resolution as well, but whay about CORDEX domains?



WCRP CORDEX

Thank You!