

World Climate Research Programme

CORDEX Asia and Climate Adaptation

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Joint Planning Staff, WCRP



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World Climate Research Programme

Mission & Objectives

World Climate Research Programme supports **climate-related decision making** and planning **adaptation to climate change** by coordinating research required to improve

- (1) climate predictions and
- (2) our understanding of human influence on climate

“for use in an increasing range of practical applications of direct relevance, benefit and value to society”

(WCRP Strategic Framework 2005-2015).



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WCRP Core Projects



Climate Variability and Predictability

Mission: To identify the physical processes involved in the Climate dynamics, including anthropogenic effects, and develop models and predictive capabilities

Climate and Cryosphere

Mission: To assess and quantify the impacts that climatic variability and change have on components of the cryosphere and its overall stability



Stratospheric Processes and their Role in Climate

Mission: To focus on climate-chemistry interactions; detection, attribution and prediction of stratospheric change; stratospheric-tropospheric dynamical coupling

Global Energy and Water Cycle Experiment

Mission: To observe, analyze, understand and predict the variations of the global energy cycle and hydrological regime and their impact on atmospheric and surface dynamics



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Future Earth Research for Global Sustainability

A 10-year initiative of international scientific collaboration on Earth system research led by ICSU and Belmont Forum



The Interdisciplinary Nature of Climate Science

- Atmosphere, Oceans and Climate
- Cryosphere and Climate
- Atmospheric Chemistry and Dynamics
- Water, Energy and Climate



Meeting the Information Needs of Society

Activities in Support of Key Deliverables

- Decadal Variability, Predictability and Prediction
- Sea-Level Variability and Change
- Climate Extremes
- Atmospheric Chemistry and Dynamics
- Centennial Climate Change Projections
- Seasonal Climate Prediction
- Regional Climate



Activities in Support of WCRP Integrating Themes

- Climate-Quality Data Sets and Analyses
- A New Generation of Climate/Earth System Models
- Next Generation of Climate Experts: Developing Capacity Regionally and Globally

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IMPLEMENTATION
PLAN 2010-2015

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Climate Research in Service to Society

WCRP Open Science Conference

24-28 October 2011

Denver, Colorado, USA

<http://conference2011.wcrp-climate.org>

Registered Participants:

- 1907 from 86 countries
- 541 Early Career Scientists & Students
- 332 from Developing Countries

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WCRP Grand Challenges

- **Provision of skillful future climate information on regional scales (includes decadal and polar predictability)**
- Regional Sea-Level Rise
- Cryosphere response to climate change (including ice sheets, water resources, permafrost and carbon)
- Improved understanding of the interactions of clouds, aerosols, precipitation, and radiation and their contributions to climate sensitivity
- Past and future changes in water availability (with connections to water security and hydrological cycle)
- Science underpinning the prediction and attribution of extreme events



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WCRP Organization

Joint Scientific Committee

Joint Planning Staff

Modeling Advisory Council

Data Advisory Council

Working Groups on: Coupled Modelling (WGCM), Regional Climate (WGRC), Seasonal to Interannual Prediction (WGSIP), Numerical Experimentation (WGNE)





Future Directions: Actionable Science

Defined as: data, analysis, and forecasts that are sufficiently predictive, accepted and understandable to support decision-making, including capital investment decision-making.

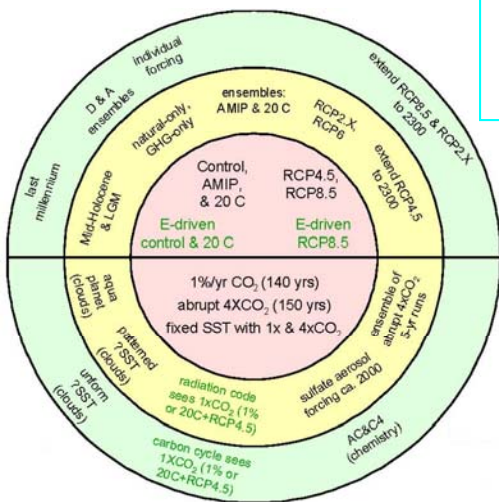


WCRP strives to respond to expanding users needs, that includes information:

- At regional scale
- For key sectors of global economy
- For adaptation, mitigation and risk management



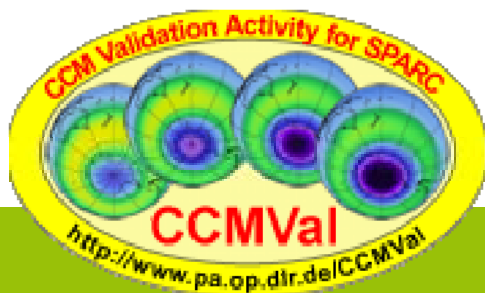
Major Climate Prediction and Projection Experiments



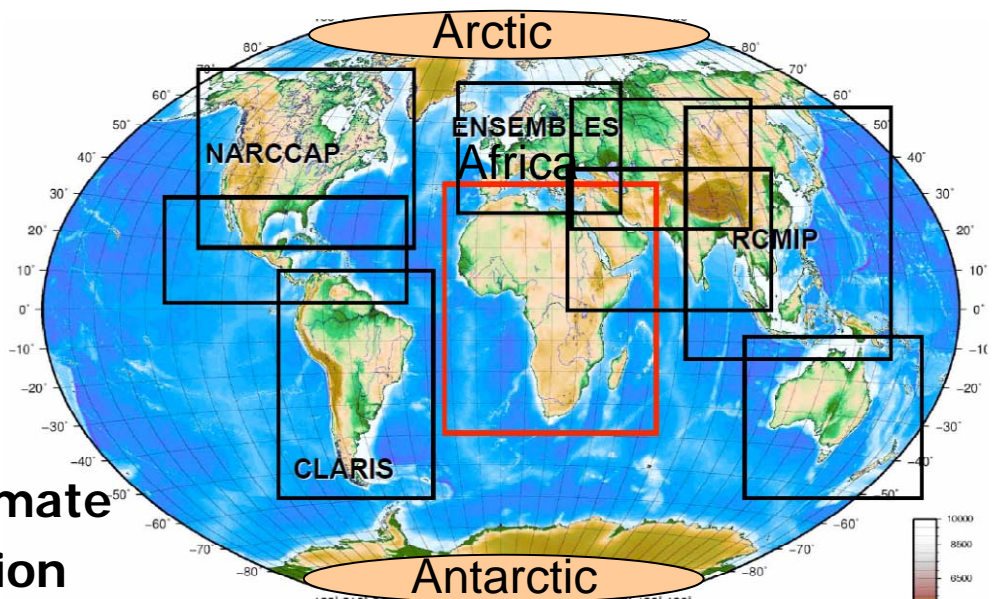
Climate-system Historical Forecast Project - CHFP

Coordinated Regional Downscaling Experiment – CORDEX → IPCC AR5

Coupled Model Intercomparison Phase 5 – CMIP5 → IPCC AR5



Chemistry-Climate Model Validation



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Coordinated Regional Downscaling Experiment - CORDEX

Modeling framework designed to:

- Evaluate and improve Regional Climate Downscaling (RCD) models and techniques
- Provide a coordinated set of RCD-based projections/predictions for regions worldwide
- Facilitate the communication with the VIA community and the involvement of the research community from developing countries



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Model Evaluation Framework

Climate Projection Framework

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

Same Boundary Conditions
ERA-Interim 1989-2007

Regional Climate Scenarios
1951-2100 or 1980-2050

Regional Analysis
Regional Databanks

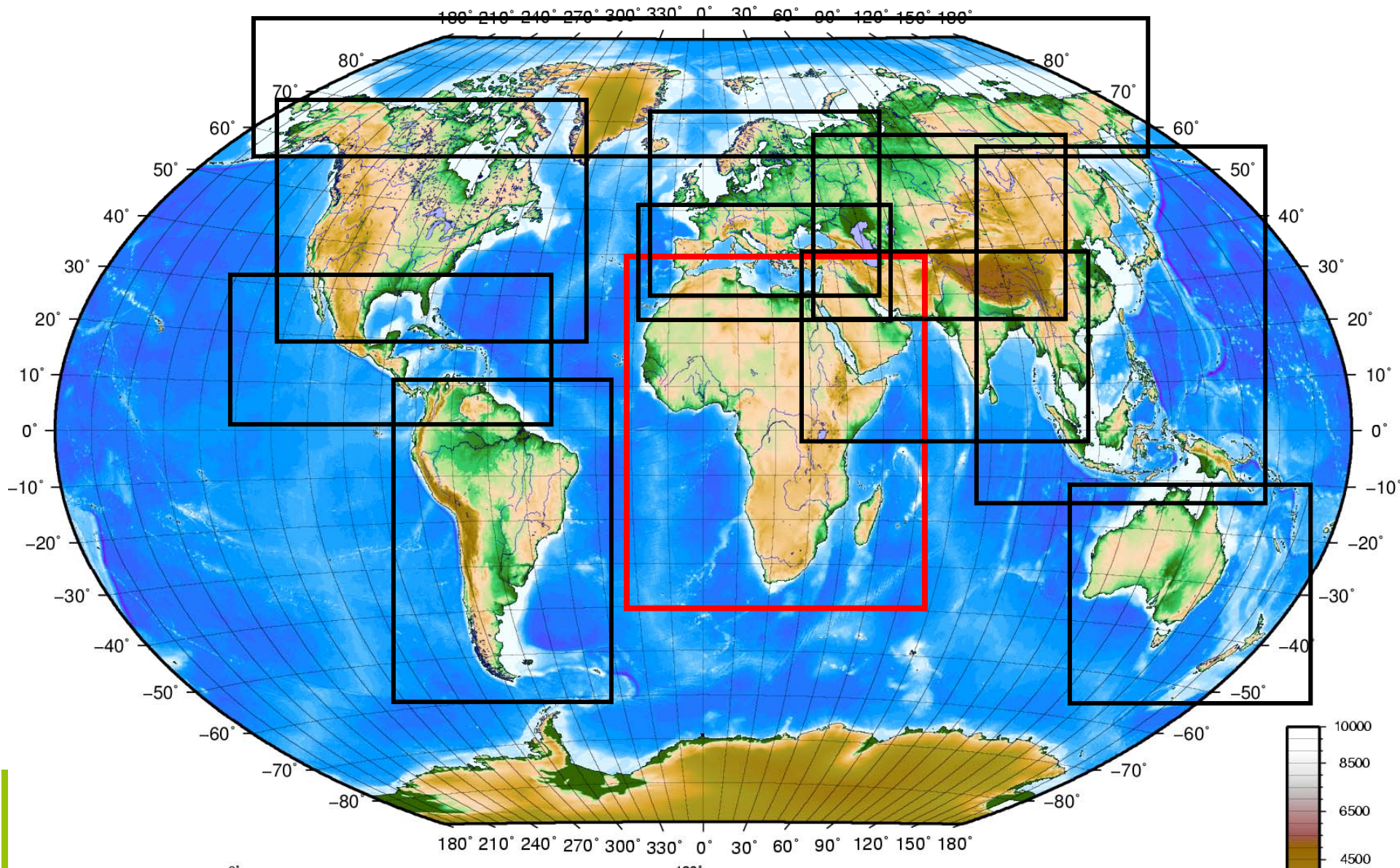
Decadal predictions
1980-2010, 1990-2000
and 2005-2035

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CORDEX Domains



CORDEX Science Advisory Team (SAT)

F. Giorgi, ITPC Italy

C. Jones, SMHI Sweden

C. Goodess, UEA UK

W. Gutowski, IOWA Uni. USA

B. Hewitson, UCT South Africa

K. Krishnan, IITN India

W.T. Kwon, NIMR South Korea

S. Solman, CIMA Argentina

+ future additions from other CORDEX regions
(Australia, Arctic, Arab, C. America)

CORDEX Progress

- Numerous CORDEX presentations at major meetings
- Papers appearing with explicit use of CORDEX framework (Journal of Climate, Climate Dynamics, Journal of Geophysical Research, Climate Research, etc....)



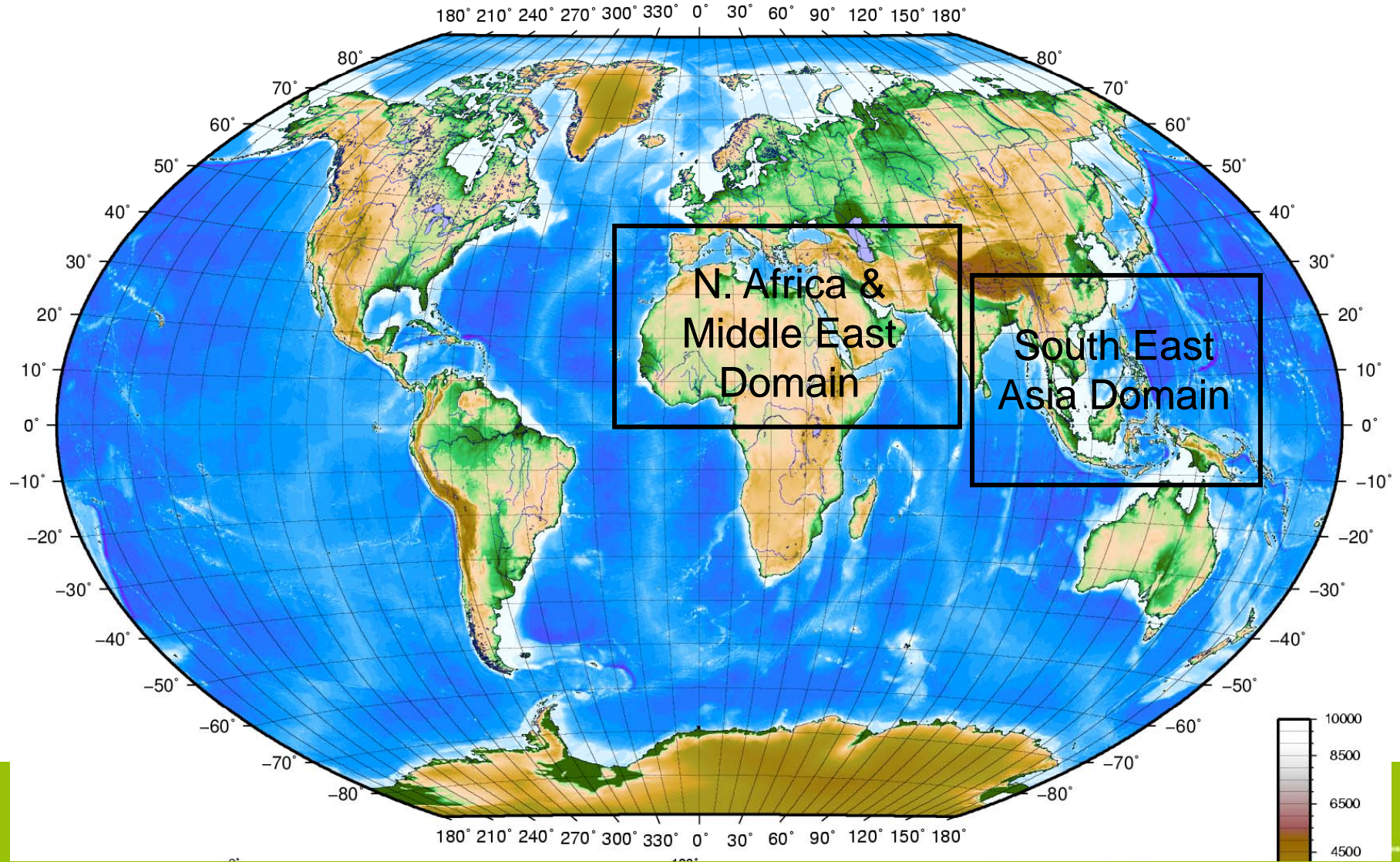
- **CORDEX meetings/workshops organized - selection**
 - Med-CORDEX: Toulouse, France, 28-30 March 2012
 - Euro-Cordex: Hamburg, Germany, November 2011
 - East-Asia Cordex: Jeju, Korea, 22-23 September 2011
 - South-Asia Cordex: Pune, India, 25-26 February 2012 and 17-20 October 2012
- **CORDEX data** will be saved and distributed through the Earth System Grid (ESG). CORDEX nodes planned at BADC (UK), DKRZ (Germany), DMI (Denmark), SMHI (Sweden), ENEA (Italy), UCT (South Africa), IITM (India), KMA (South Korea)

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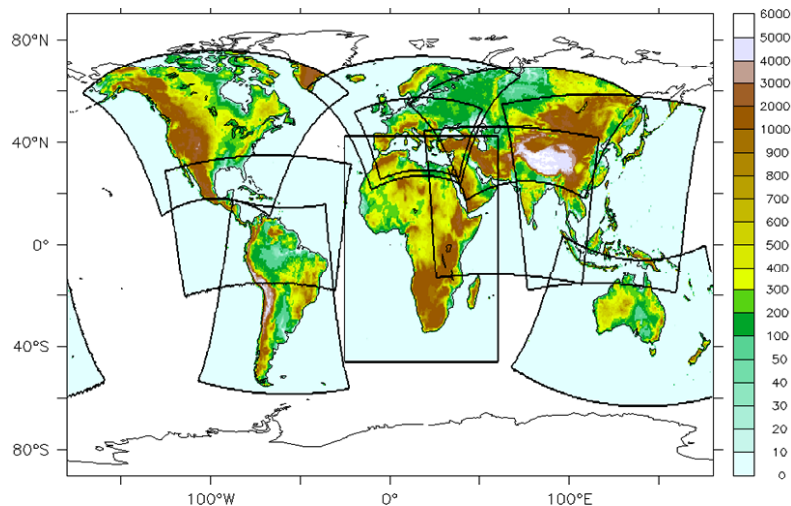


Two New CORDEX Domains





Skillful Regional Climate Information

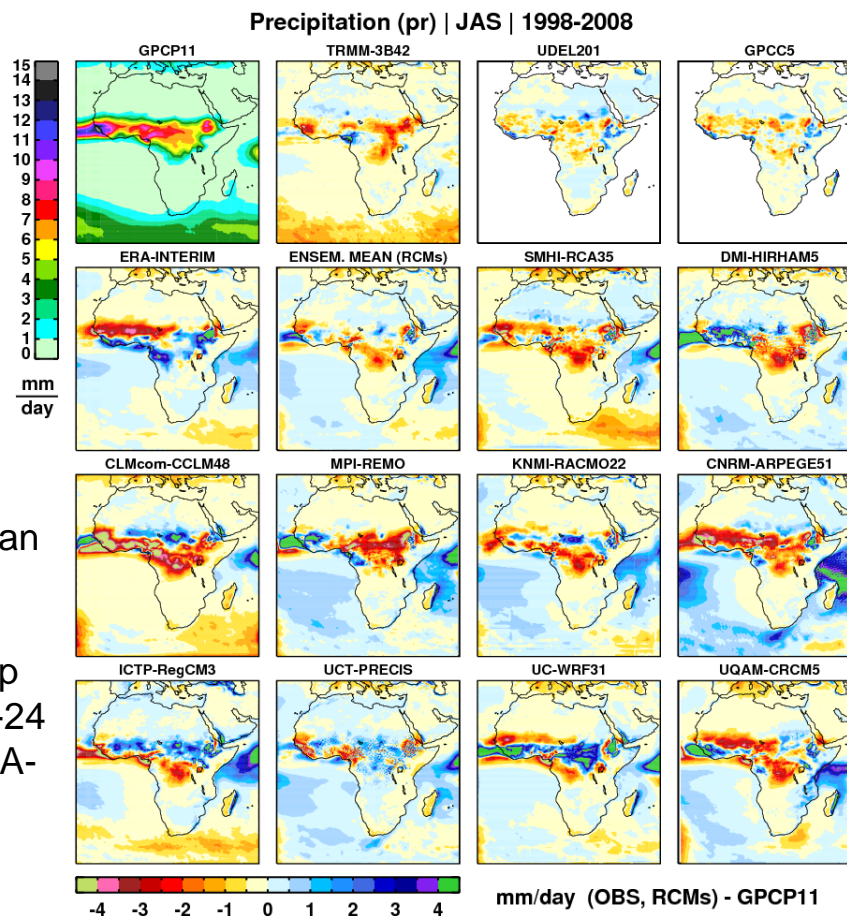


CORDEX

- 12 domains with a resolution of 0.44° (approx. $50 \times 50 \text{ km}^2$)
- Focus on Africa
- High resolution $\sim 0.11^\circ \times 0.11^\circ$ for Europe (by some institutions)

July to September mean precipitation for 1998-2008.

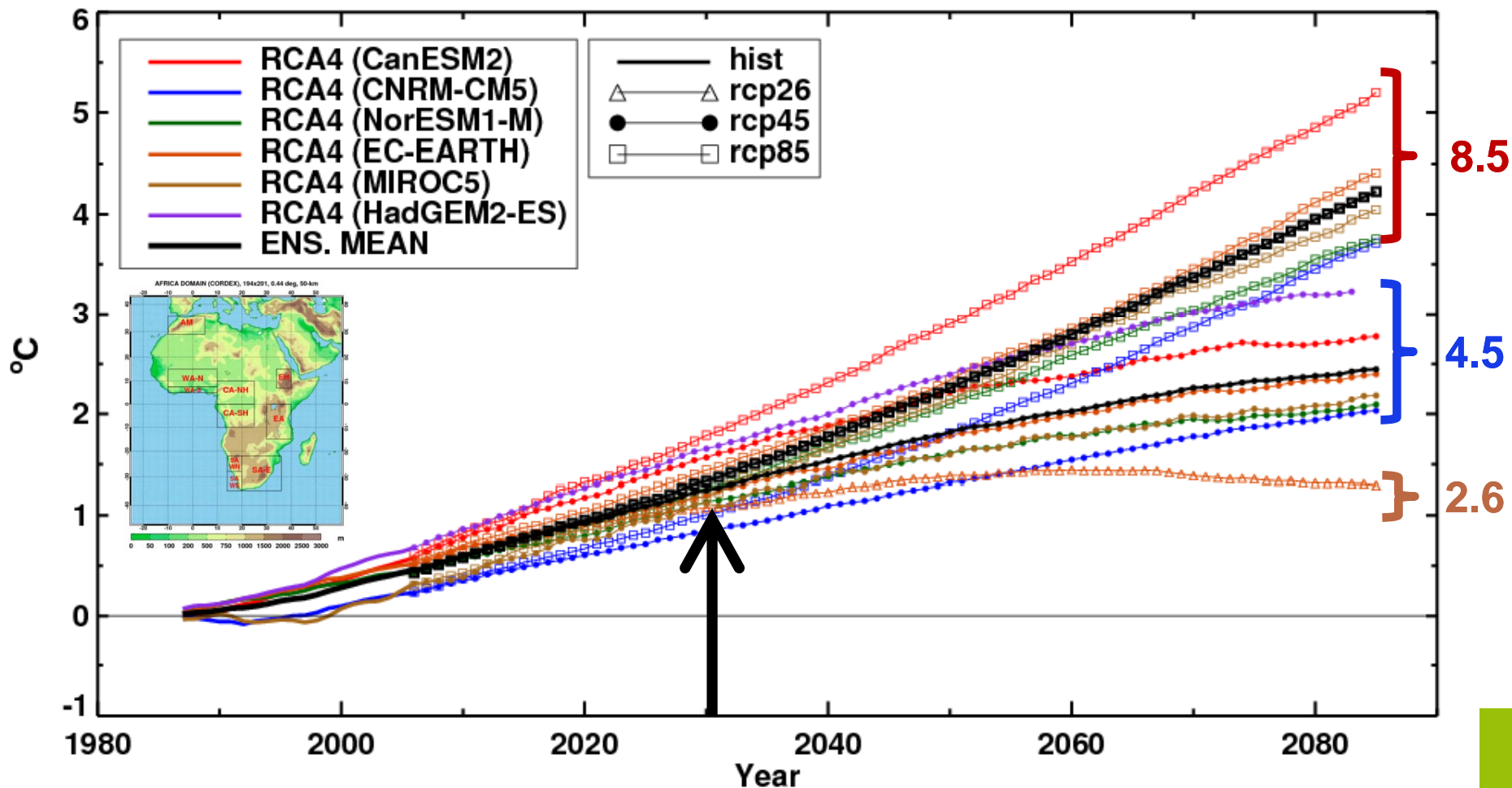
Four observational (top row), accumulated 12-24 hour forecast from ERA-Interim reanalysis, the ensemble mean and individual Regional Climate Models





Trends on a Continental Scale

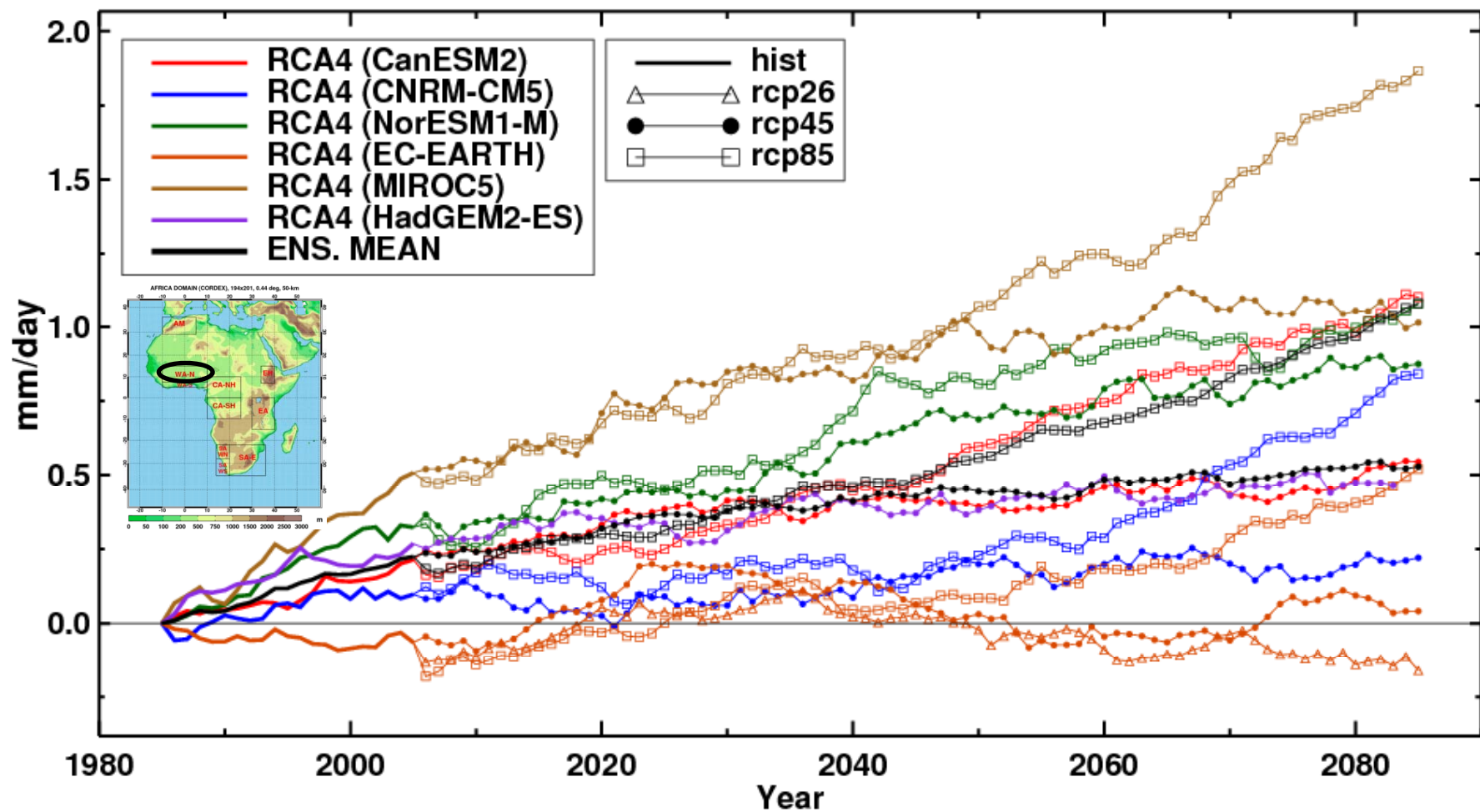
2m Temperature anomalies wrt 1970-2000 | 31-yr. mov. mean | (tas) | ANN |
Africa (AFR) 20W-50E 40S-35N | land





Trends on a regional scale

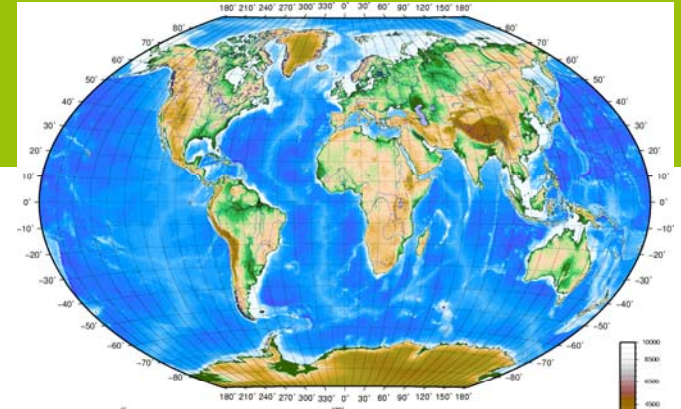
Precipitation anomalies wrt 1970-2000 | 31-yr. mov. mean | (pr) | JAS |
 West Africa/Sahel - North (WA-N) 10W-10E 7.5N-15N | land





Asia Domain

- World's highest mountains
- Heat source of Tibetan Plateau
- Seasonal monsoon affects water and food resources
- Range of natural hazards
- Anthropogenic aerosols
- 3.6 billion people
- Rapid urbanization
- Vulnerable coastal development

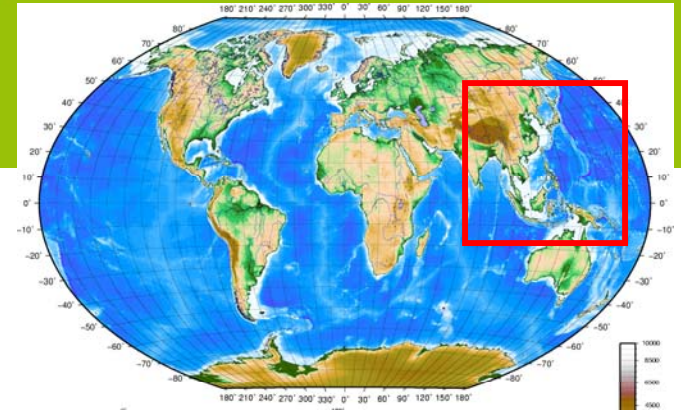


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CORDEX East Asia



- CORDEX-EA domain is the largest one among the world-wide 12 CORDEX domains
- Covers part of central Asia to the west, the entire Tibetan Plateau, maritime continents and even north of Australia to the south
- Unique geographical and/or meteorological situation that is a challenge to the understanding of regional climate characteristics including long- term climatology, variability, teleconnection, and climate extremes as well



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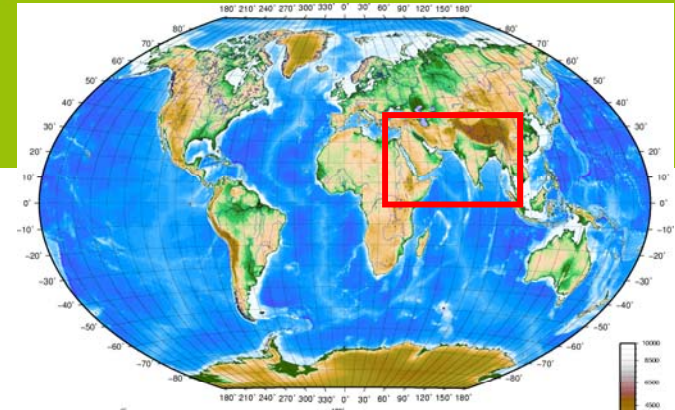


CORDEX East Asia

- Coordinator: W.T. Kwon (KMA)
- 9 modeling groups participating
- Simulations under way or planned at 50 km and 12 km horizontal (for some sub-regions) grid spacing
- Data stored at KMA
- Two meetings in Jeju (Korea) in September 2011 and November 2012

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CORDEX South Asia

- To bring together researchers/scientists from the Climate Science and those involved in vulnerability, impacts and adaptation (VIA) research from the Asian region
- to interpret model outputs for information on climate variability and change
- to analyze how climate changes impact social/economic sectors, such as health, agriculture and water security in regions across the continent.
- To build capacity and expertise within the South Asia region and use CORDEX results for decision making and adaptation



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CORDEX South Asia

- Coordinator: K. Krishnan (IITM)
- 10 modeling groups participating
- Simulations under way or planned at 50 km and 12 km horizontal grid spacing
- Data stored at IITM
- Two meetings in Pune (India) in February and October 2012

CORDEX in Monsoon Asia

In Collaboration with MAIRS (Monsoon Asia Integrated Regional Study)

Plan for a series of **3 CORDEX workshops** to be held in 2013, 2014 and 2015 in **South-Asia, East-Asia and South-East Asia** respectively:

- application of climate downscaling for adaptation and vulnerability studies
- transfer of know-how and tools to maximize effectiveness of regional efforts
- review of CORDEX data exchange standards and best practices across the regions
- exchange of suitable data sets for model initialization, assessment and validation
- improve hands-on training and analysis skills
- enhance regional synthesis on pan-regional climate change
- improve understanding of current uncertainties in climate projections
- building capacity contributing to a Global Framework for Climate Services

CORDEX in Monsoon Asia

Main Issues/Objectives in the Asian-Pacific Region:

- Variability and predictability of regional climate and monsoons
- Water resources and the water cycle
- Prediction of the regional hydrological cycle
- Seasonal to decadal prediction at regional scales
- Impacts of regional climate variability and change on agriculture, health, water and disaster reduction
- Integrating regional datasets into global products
- Vulnerability to extremes and adaptation strategies
- Best practices and effectiveness in CORDEX capacity building activities

CORDEX Outlook

- Consolidate regional CORDEX teams and activities
- Produce a set of publications with the first scenario simulations for input into the IPCC process
- Data provision for impact applications
- Greater involvement of the statistical downscaling community
- Extension to seasonal to decadal prediction experiments
- Organization of a major Pan-CORDEX conference in Fall 2013

WCRP and APN Collaboration

- CORDEX activities for regional climate information
- Capacity Building enhancement through WCRP CORDEX activities
- Delivery of products that can be used by the science community and policy-makers