



# Climate change science update for Africa: Climate variability and forecasting, and downscaling climate projections in Africa

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# Outline

Overview of the Hadley Centre's DfID-funded Climate Science Research Partnership (CSRP)

Improved understanding of climate modelling and forecasting over Africa

Capacity building

Recommendations from CSRP experience to date

CORDEX-Africa (Coordinated Regional Downscaling)

Summary



# CSRP: climate and modelling research, applications, capacity building – Africa

## **Initial consultation with African users of climate predictions**

- To determine priority prediction and capacity building needs

## **Science component:**

- 1. Improved understanding and modelling of drivers of African climate – remote (e.g. ENSO), local (e.g. soil moisture);**
- 2. Develop and trial new user-driven climate services (monthly, seasonal, decadal) and attribution analysis;**
- 3. Develop system to downscale climate forecasts and make available to African centres;**

## **Capacity building component:**

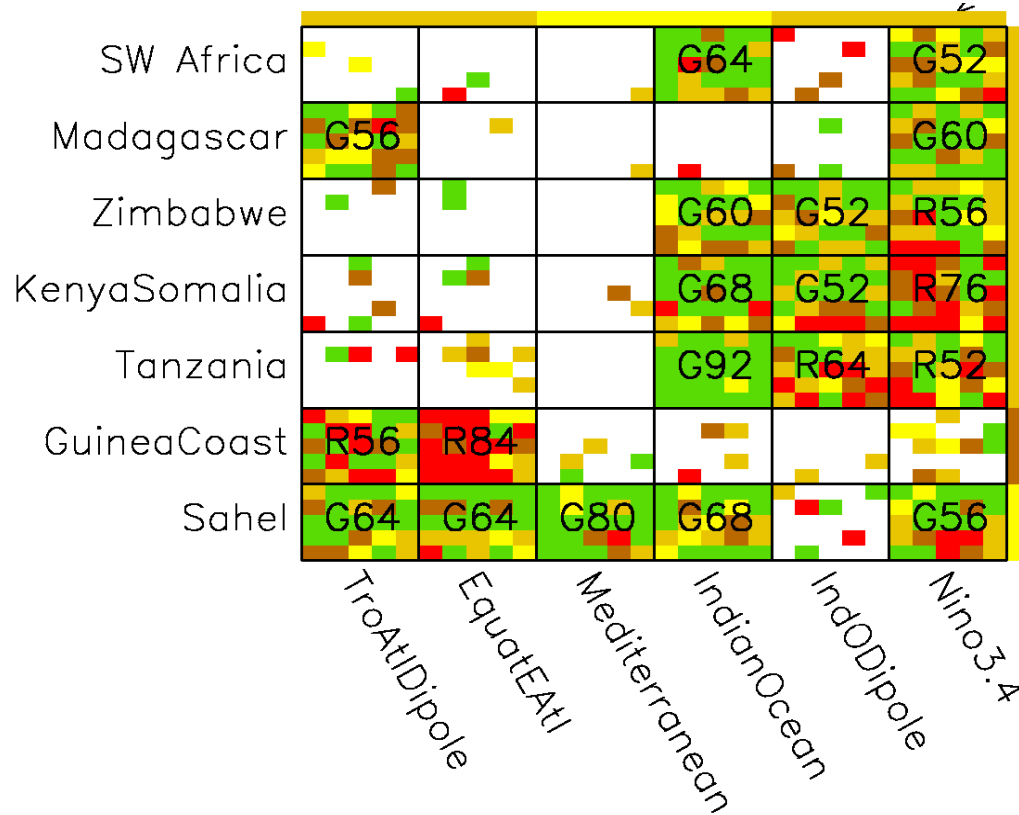
- 4. CSRP Fellowship scheme: 11 fellows now appointed;**
- 5. Workshops: Capacity building workshops in climate science**



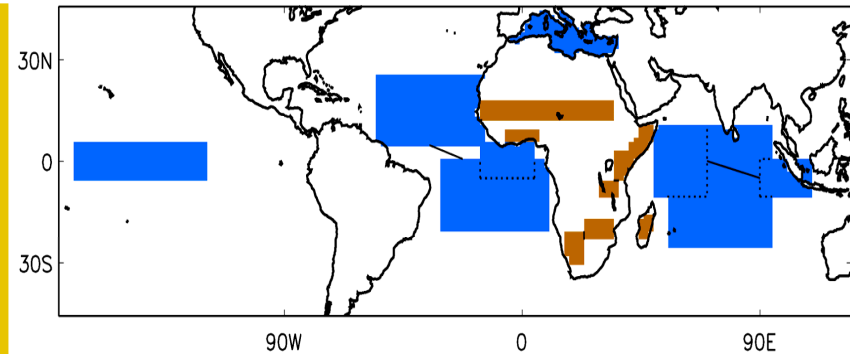
# Science component (1): Teleconnections

How well do the CMIP3 models represent observed correlations between sea temperatures and rainfall

## Assessment of model teleconnections



## Regions used in correlations



Sea-surface temperatures (SSTs) averaged over blue regions

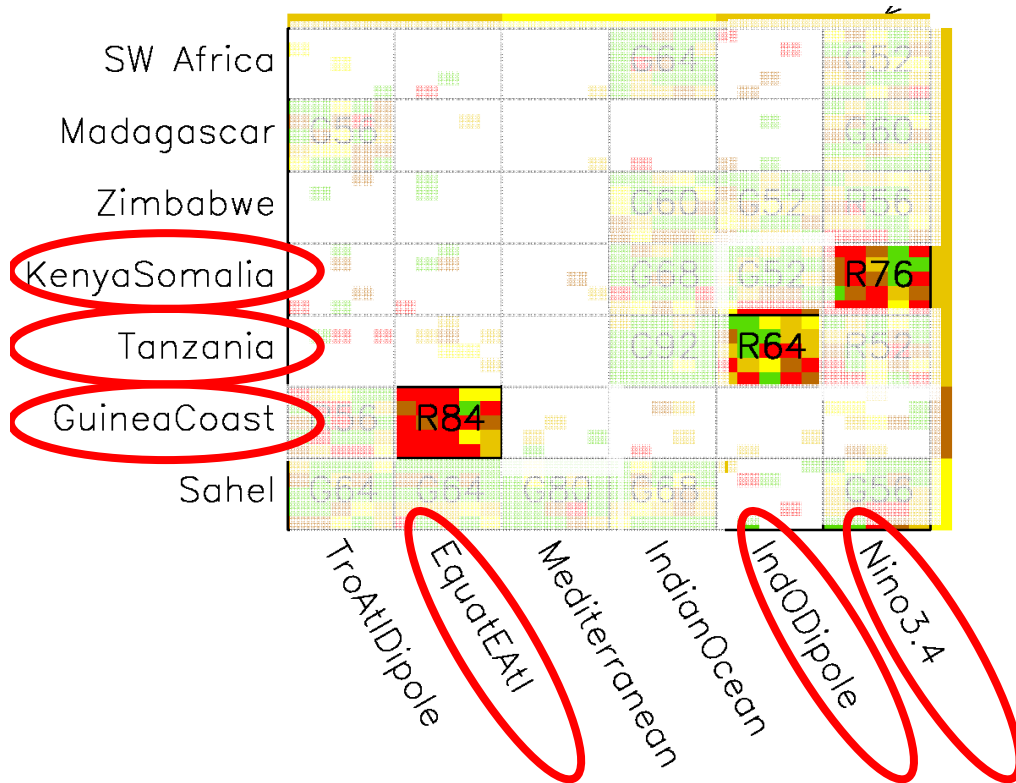
Precipitation averaged over brown regions



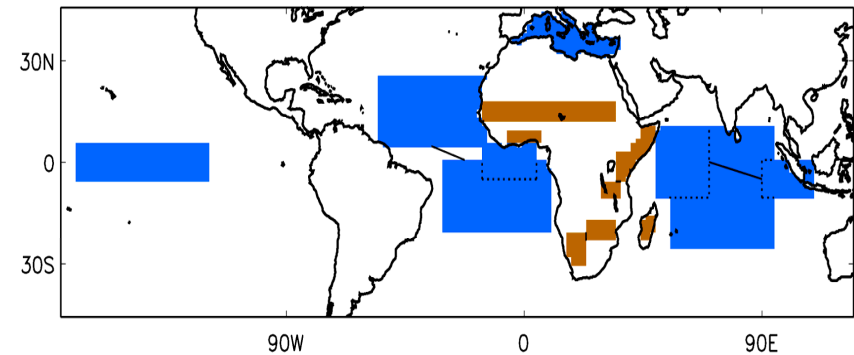
# Science component (1): Teleconnections

How well do the CMIP3 models represent observed correlations between sea temperatures and rainfall

## Assessment of model teleconnections



## Regions used in correlations



Most models represent several SST/ African rainfall teleconnections poorly

Teleconnection errors due to:

- Variability and/or climatology of SSTs in ocean-atmosphere models
- Atmosphere-only processes

Provides information on relevance of models for given applications

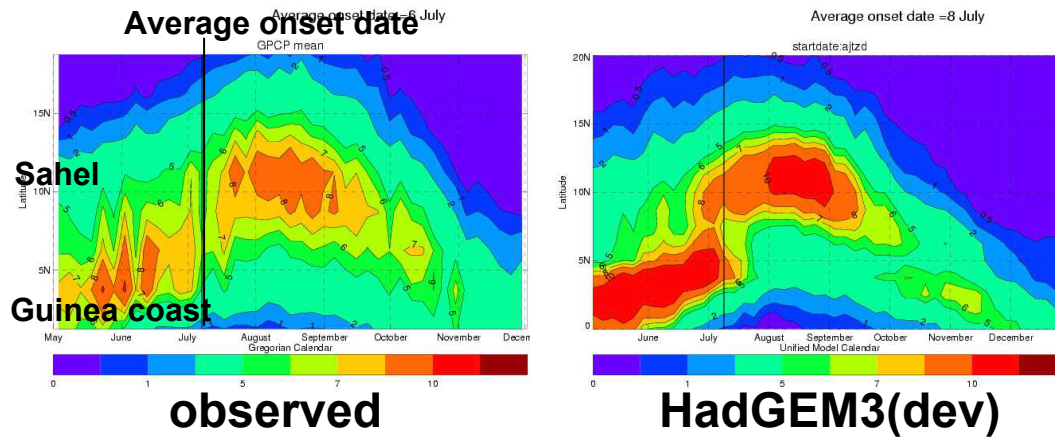




# Science component (2): Rainy season onset

## How well do CMIP3 models represent onset?

### West African Monsoon (latitude/time)

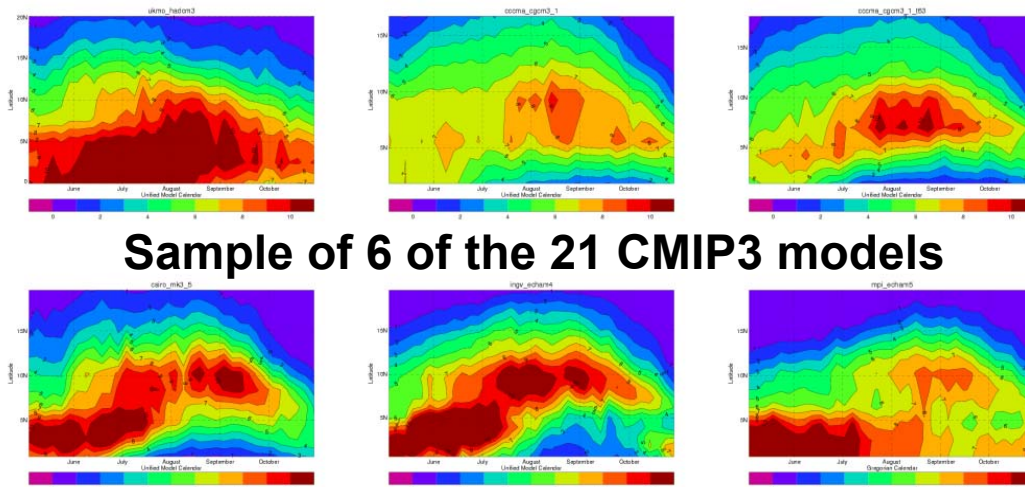


- Most CMIP3 models do not have a good representation of the WAM onset
- Investigation of HadGEM3 suggests good representation is very sensitive to...

- e.g. balance of latent and sensible heating over land

- Opportunity to improve understanding of mechanisms driving onset

### Sample of 6 of the 21 CMIP3 models

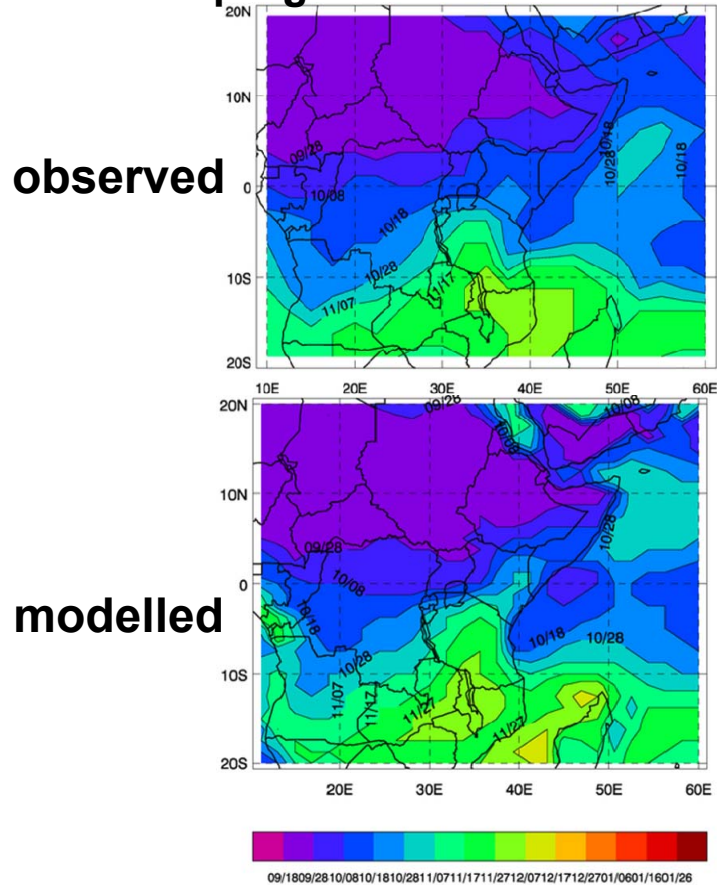




# Science component (3): Predicting onset timing

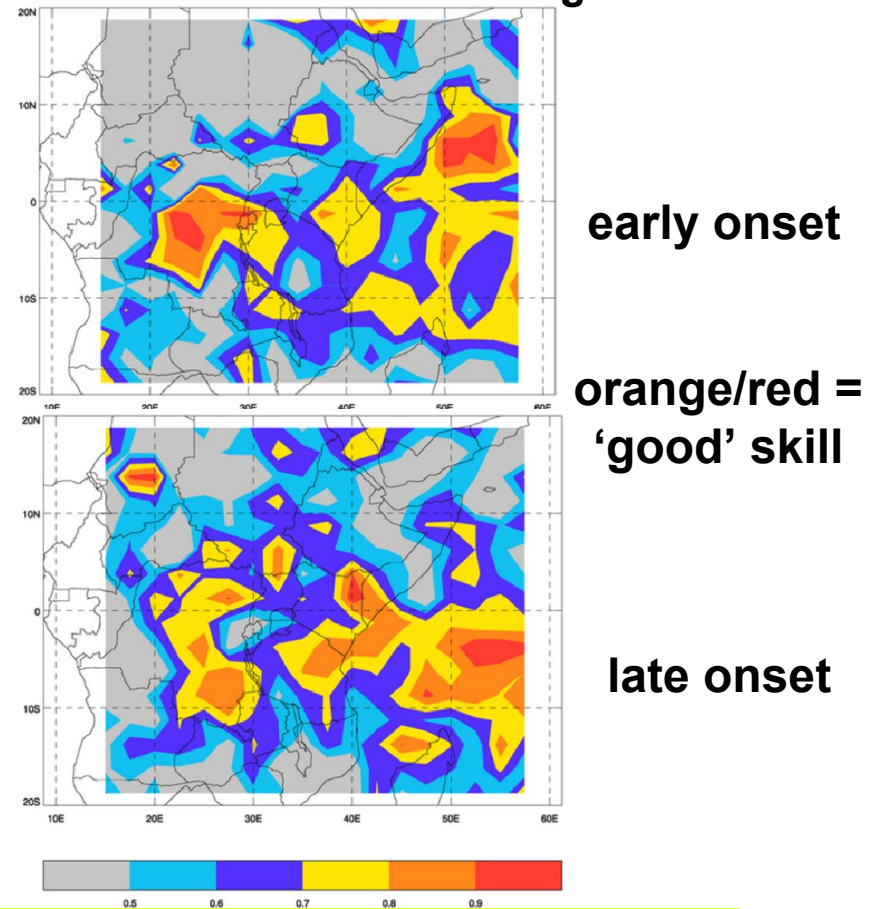
based on local time of arrival of 20% of long-term seasonal average

**Average southward progression of rains with ITZC**



**Example:  
East Africa  
short-rains  
(OND)**

**Skill of Met Office seasonal forecasts of onset timing**



**Encouraging first results: trial onset forecasts have been provided to Regional Climate Outlook Forums ICPAC, ACMAD and SADC-DMC**



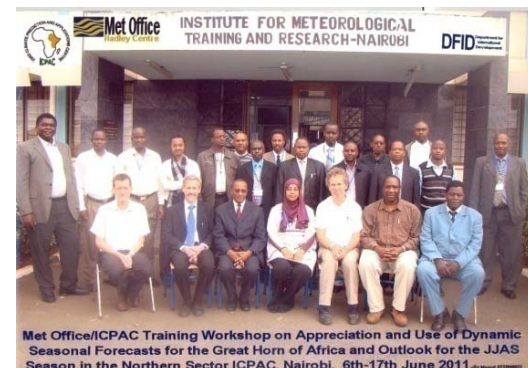
# Capacity building component:

## CSRP Fellowship scheme

- 11 African climate scientists appointed as CSRP fellows;
- 4 West; 4 East Africa; 1 Central and 2 southern Africa;
- Fellows will work on CSRP research themes;
- Each fellow has been assigned a (Met Office) expert as mentor;
- Fellows are based at African Institutes, with 4-week visit to the Met Office

## Workshops in climate science and applications

- 'Use of dynamical seasonal forecasts for the Greater Horn of Africa' – hosted by ICPAC Nairobi (June 2011);
- 15 participants from countries of the GHA;
- Tools and methods developed helping to enhance regional seasonal forecasting;
- Opportunities for longer-range (ENSO-based) predictions explored – potential for longer-lead drought/flood warnings.







# Recommendations

- Increased Africa-focused climate research is urgently needed to improve models and reduce prediction uncertainties in user-relevant climate variables.
- Testing skill of models to simulate or predict climatic features relevant to users should be agreed for climate models and monthly-seasonal-interannual prediction systems. Results of testing should be published.
- Relevance must be guided by increased liaison between model developers and the African climate prediction and user communities (Regional Centres, NMSs, Regional Climate Outlook Forums and their “customers”);
- Application of longer-range (~6 months – 2 years) dynamical model ENSO predictions is a particular opportunity for Africa.

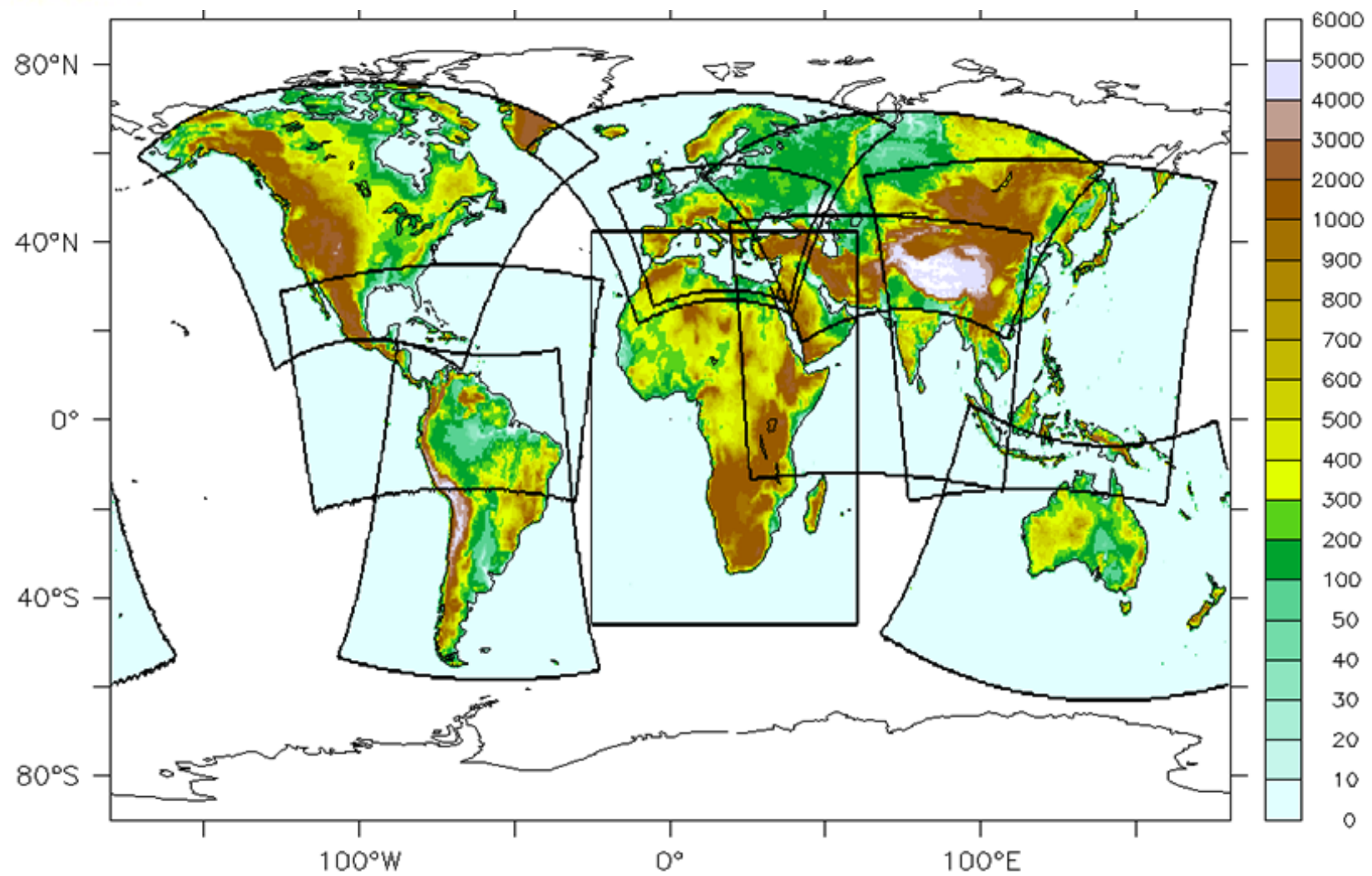


# Introduction to CORDEX

WCRP initiated and sponsored activity enabling:

1. Downscaling of the new CMIP5 GCMs projections;
2. Downscaled scenarios for any land regions of the globe
3. High resolution data available and useable for the impact and adaptation communities.
4. A generalized framework for testing, applying and evaluating downscaling techniques
5. Coordination between downscaling research and application around the world
6. Participation of local scientists/organizations

# Cordex (non-polar) domains





# Details of CORDEX protocols

1. CMIP5 GCMs to output 6- hourly 3-D fields for at least 1 RCP4.5 and 1 RCP8.5 simulation and projection of 1950-2100.
2. The standard RCM resolution is 50km (many groups plan to also run higher resolutions for selected domains). 50km as base resolution to include as many groups as possible
3. Groups are encouraged to run as many of the RCM domains as possible using the ERA-interim data as boundary conditions (1989-2008) for model evaluation
4. An initial focus for future climate scenarios will be Africa with an aim to provide something for IPCC AR5



# Current CORDEX-Africa activities

1. Group of African climate scientists analysing ERA-Interim regional climate model simulations over the Africa domain
2. CDKN-START project funding workshops for collaborative analysis, sharing of results and coordinating with users
3. Groups formed to analyse simulations over E African, southern African and Guinea Coast/Sahel regions
4. Initial plans to produce publications on these analyses and then to analyse and make available downscaled CMIP5 projections

For more details see:

<http://web.csag.uct.ac.za/csag-wp/cordex/cordex-africa/>



# Summary

Focused model development and providing insights into the modelling and forecasting of African climate

CSRP approach includes engagement of and providing research opportunities to African climate scientists

CORDEX provides a significant opportunity to develop globally approaches to regional downscaling

Focus of initial CORDEX activities on Africa being lead by African scientists builds on this to develop both relevant African climate information and science-base