Assessing the North American Multi-Model Ensemble (NMME) forecasts for seasonal forecasting and decision making over Africa

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Princeton University

APEC Climate Symposium 2015

From Science to Action: The use of weather and climate information for efficient disaster risk management

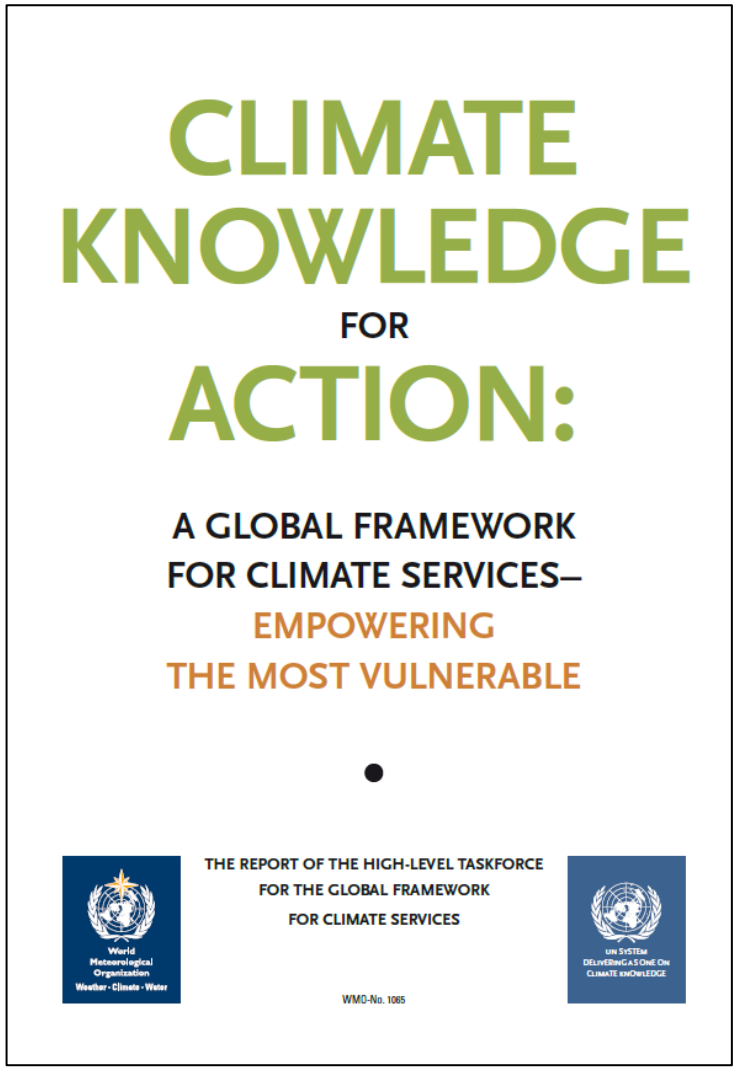
Manila, Philippines

2 – 4 November 2015

Outline of the talk

1. A framework for providing climate information for society
2. Princeton's African and Latin American flood and drought monitoring and forecasting systems
3. Recent skill assessment using seasonal forecasts from the North American Multi-Model Ensemble (NMME) system
4. WMO's Global Framework for Climate Services (GFCS): a feasible or infeasible system?

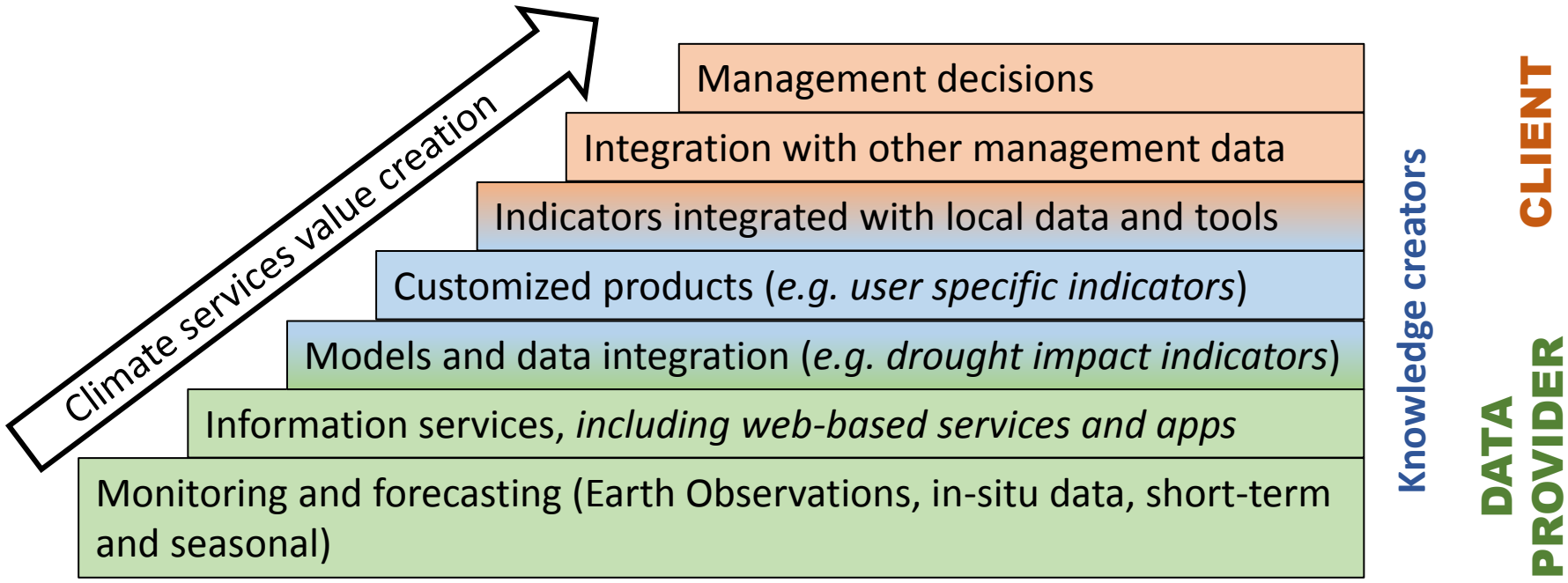
www.gfcs.wmo.int



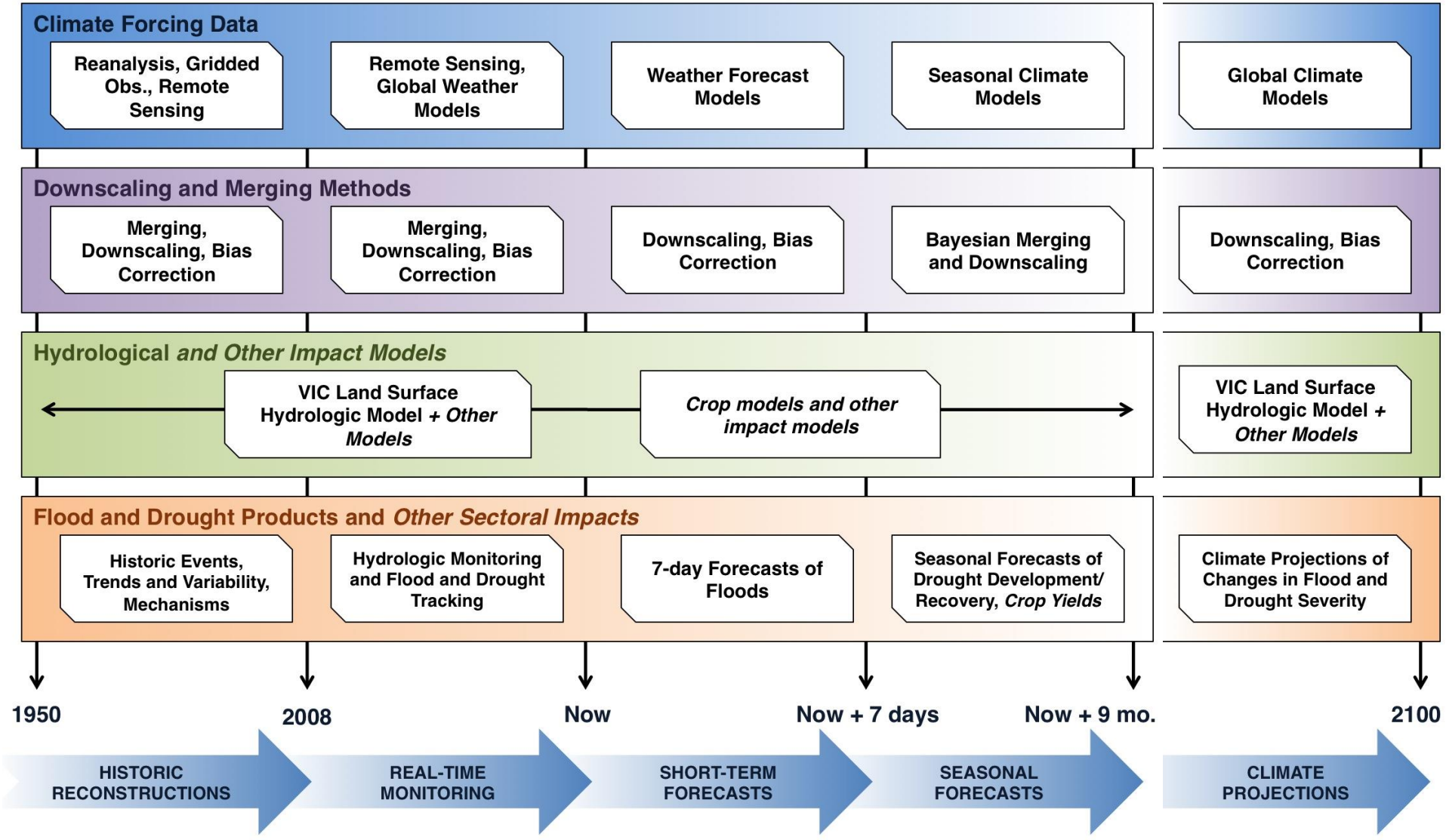
Climate product:
The end result of a process of synthesising climate science and data.

Climate service:
Climate information prepared and delivered to meet a user's needs.

Climate service staircase:
From data to knowledge for decision making



Monitoring and forecasting (Earth Observations, in-situ data, short-term and seasonal)

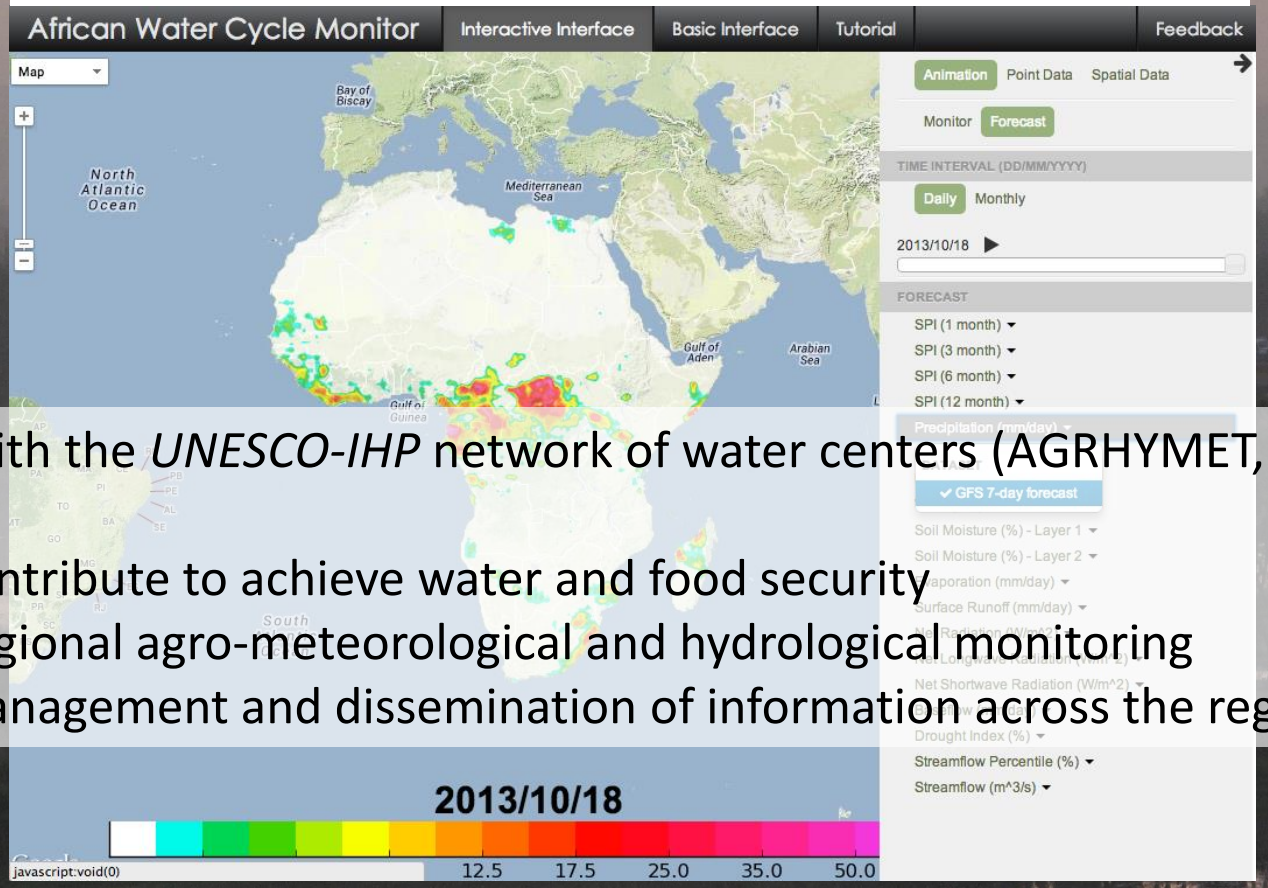


Sheffield, J., et al., 2014; A drought monitoring and forecasting system for sub-Sahara African water resources and food security. *Bull. Am. Met. Soc.*, in

Monitoring and forecasting (Earth Observations, in-situ data, short-term and seasonal)

Princeton's African drought and flood monitoring and forecasting system

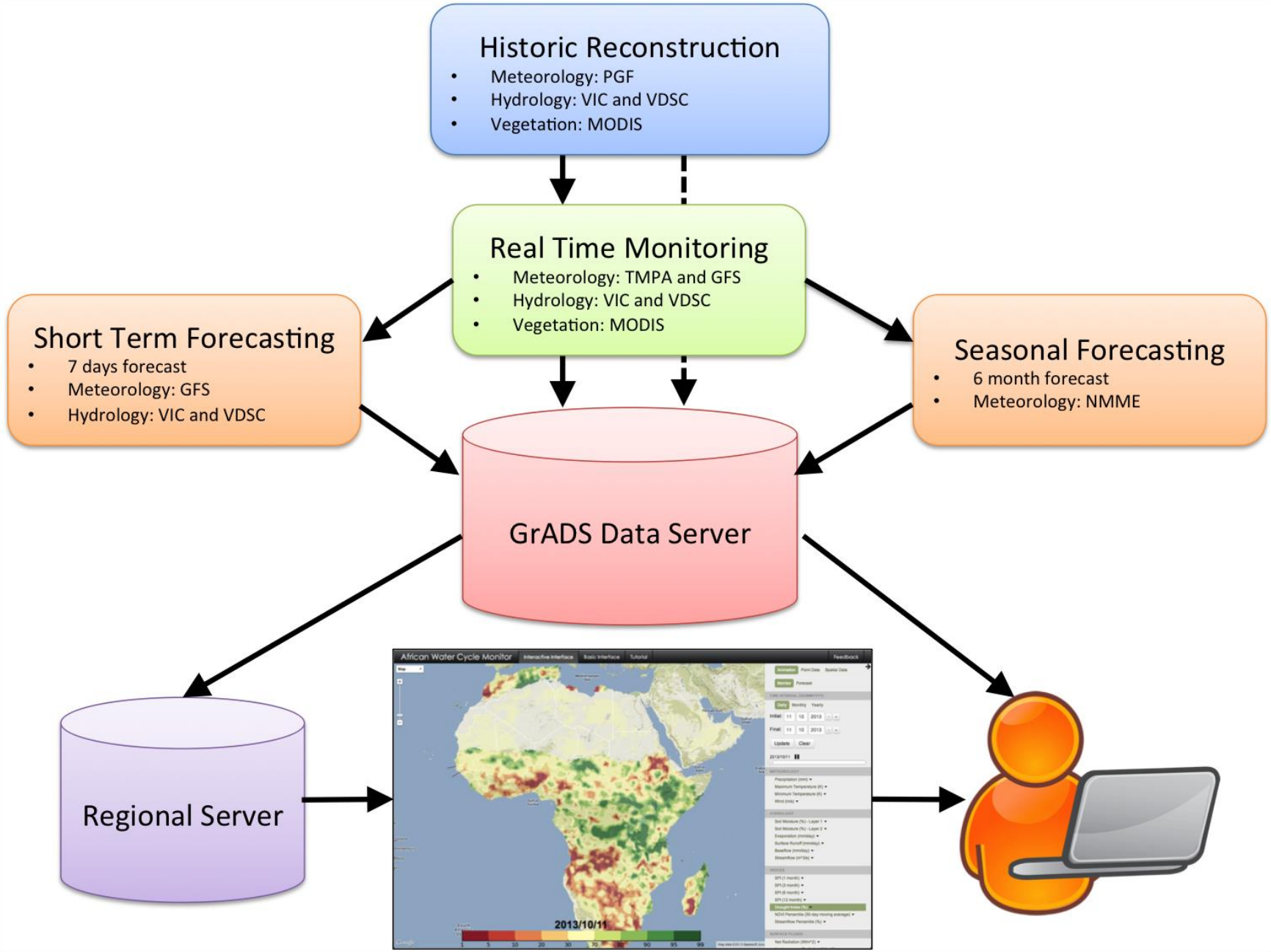
http:hydrology.princeton.edu/monitor



Partner with the *UNESCO-IHP* network of water centers (AGRHYMET, ICPAC, SADC, …)

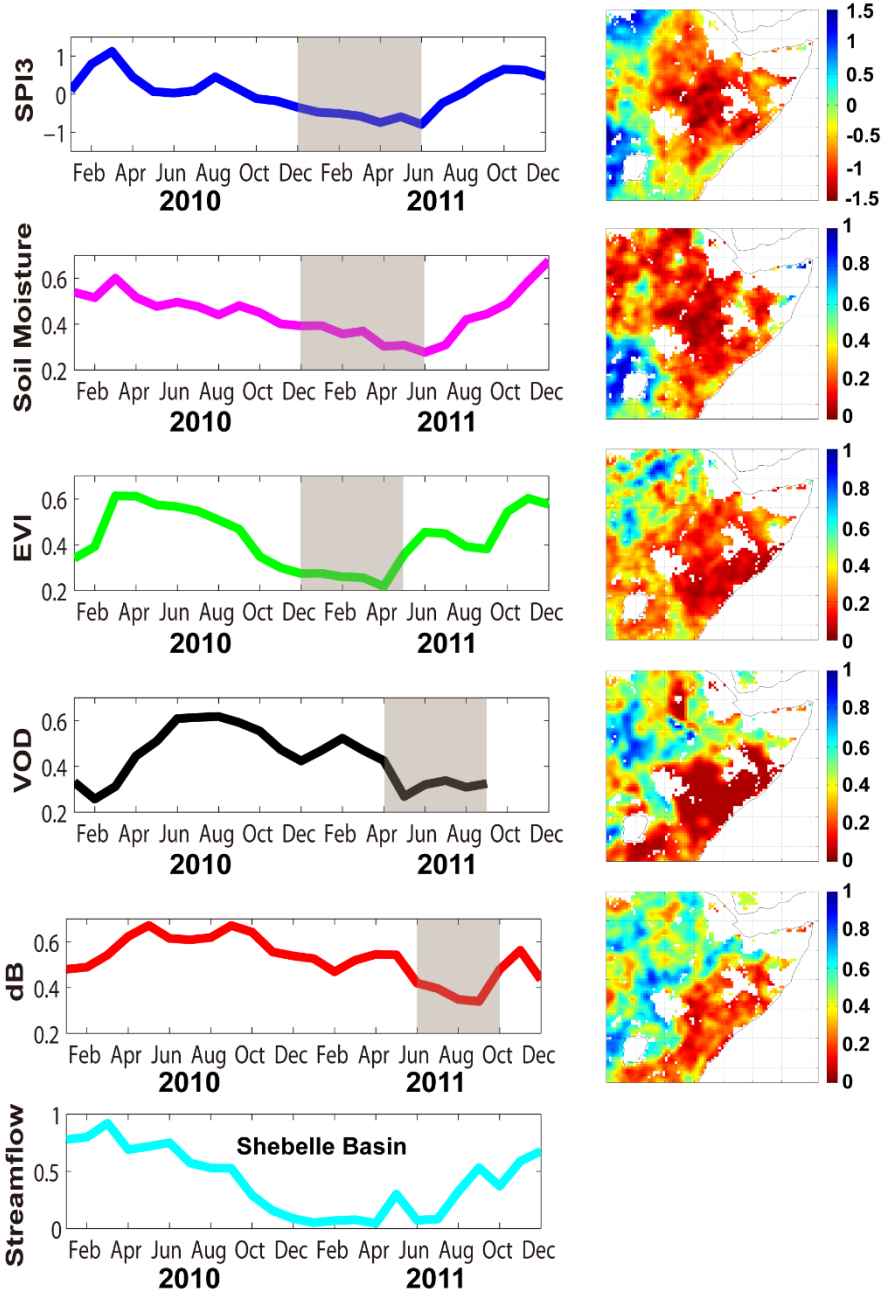
- Contribute to achieve water and food security
- Regional agro-meteorological and hydrological monitoring
- Management and dissemination of information across the region.

Information services, *including web-based services and apps*



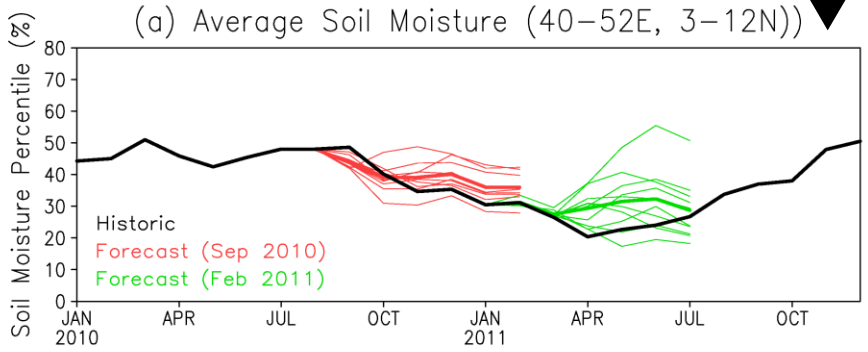
Customized products (*e.g. user specific indicators*)

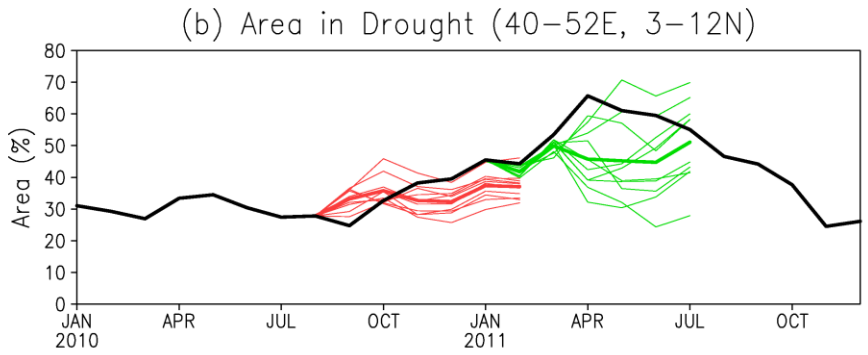
Regional Example: Horn of Africa Drought 2010-2011



Monitoring the propagation of the drought

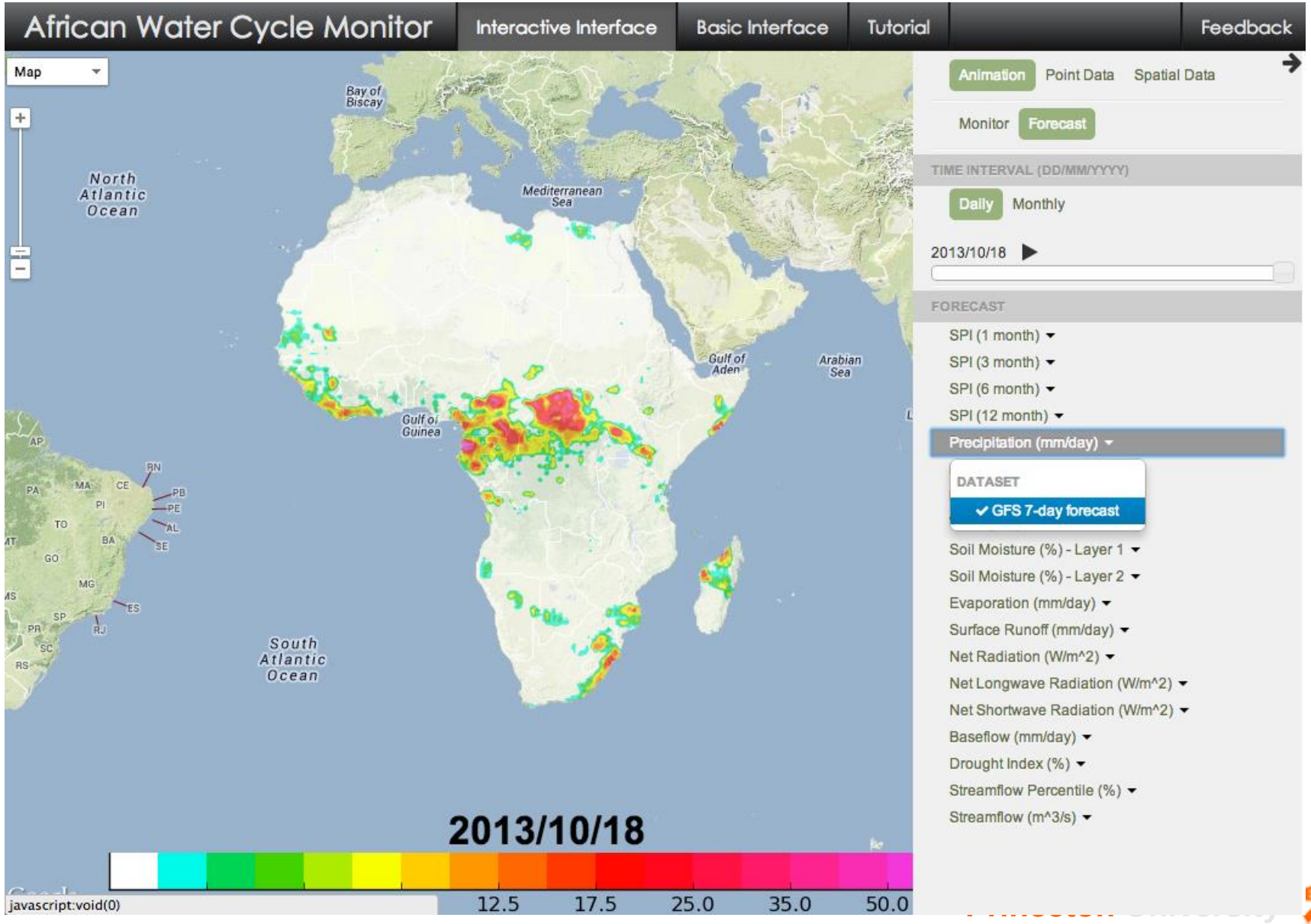
Seasonal drought forecasts (based on CFS model only)





Information services, *including web-based services and apps*

7-day forecasting based on NCEP's GFS



Forecasts from the North American Multi-Model Ensemble (NMME)

Seasonal (monthly forecasts out 12 months)

- Monthly total precipitation and mean Tair (1982-2015)
- Number of ensembles varies by model
- CanCM3, CanCM4, CFSv2, GEOS-5 (NASA), CCSM4, CM2p1 (GFDL)

Sub-seasonal forecasts (Daily resolution out 12 months)

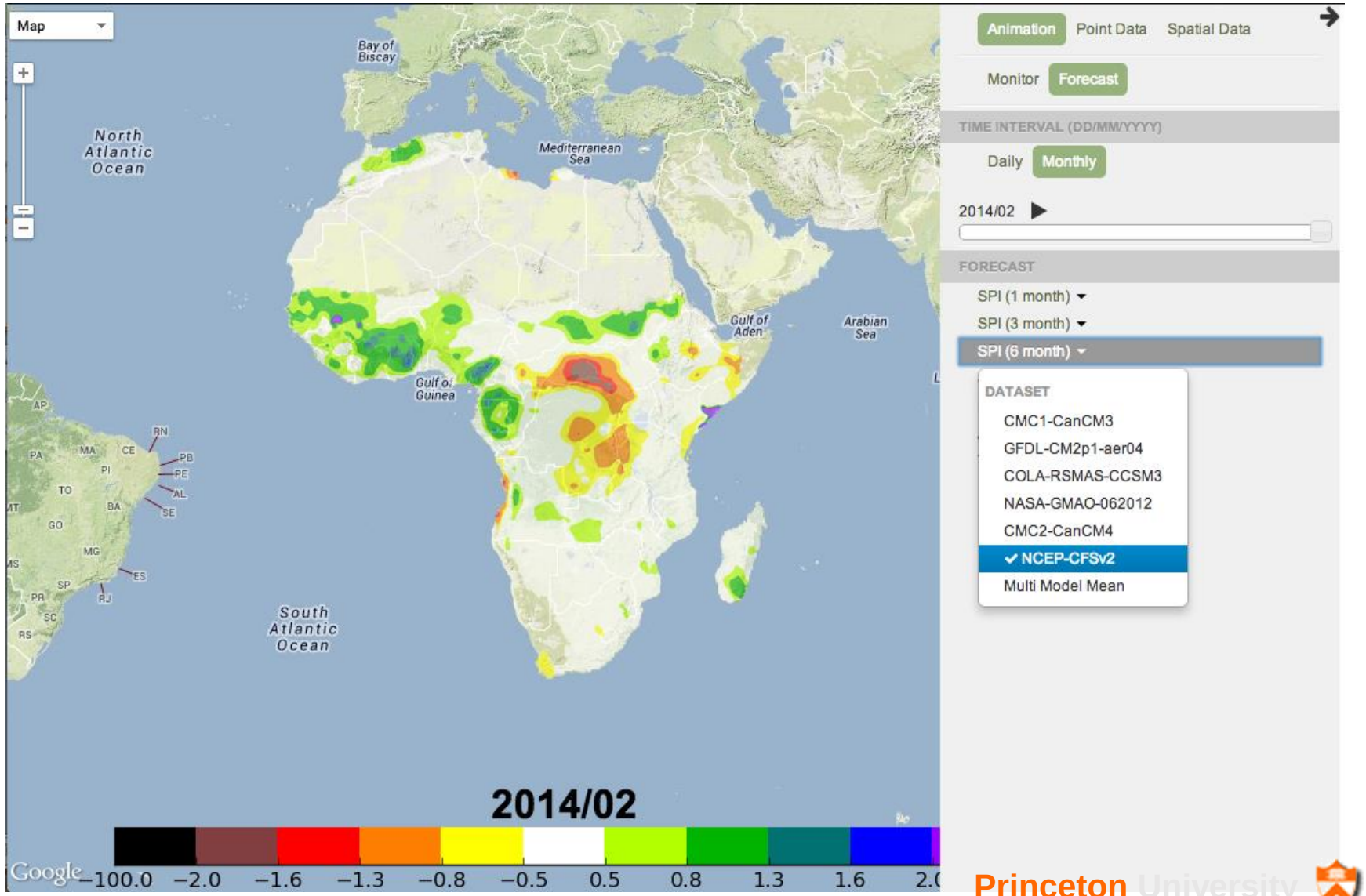
- Many meteorological and hydro. variables (surface and atmospheric)
- CCSM4, CFSV2, CanCM3, CanCM4, FLORB-01, GEOS-5

	CanCM3	CanCM4	FLOR-B01	CCSM4
Institute	Environment Canada	Environment Canada	GFDL	NCAR/University of Miami
Temperature data availability	100%	100%	100%	71.4%
Precipitation data availability	100%	100%	100%	76.5%

Models and data integration (*e.g. drought impact indicators*)

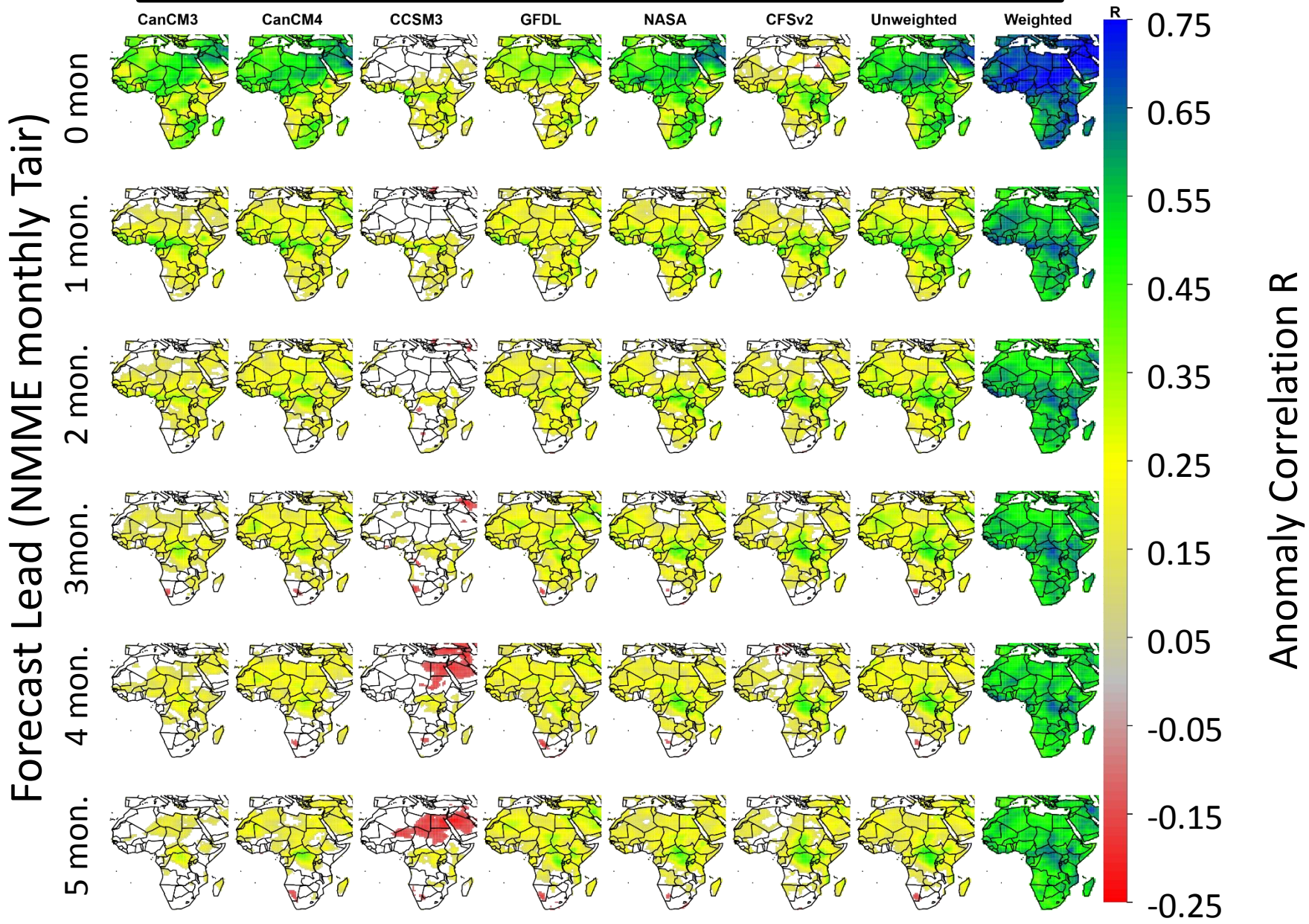
Information services, *including web-based services and apps*

Seasonal SPI-6 (6-month) forecast (e.g. for 2/14 from 9/13)



Information services, *including web-based services and apps*

Data integration and applications depend on skillful forecasts



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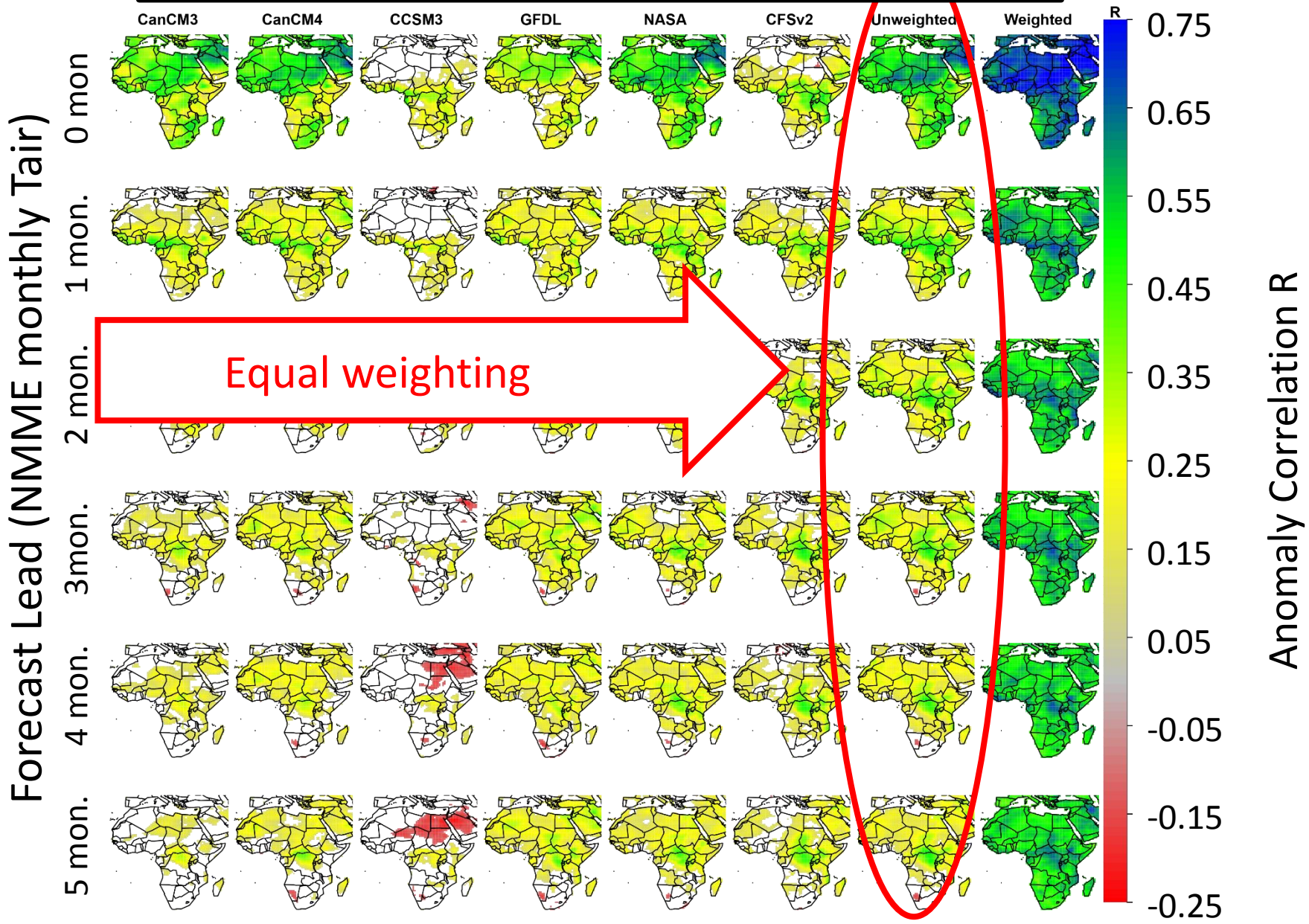

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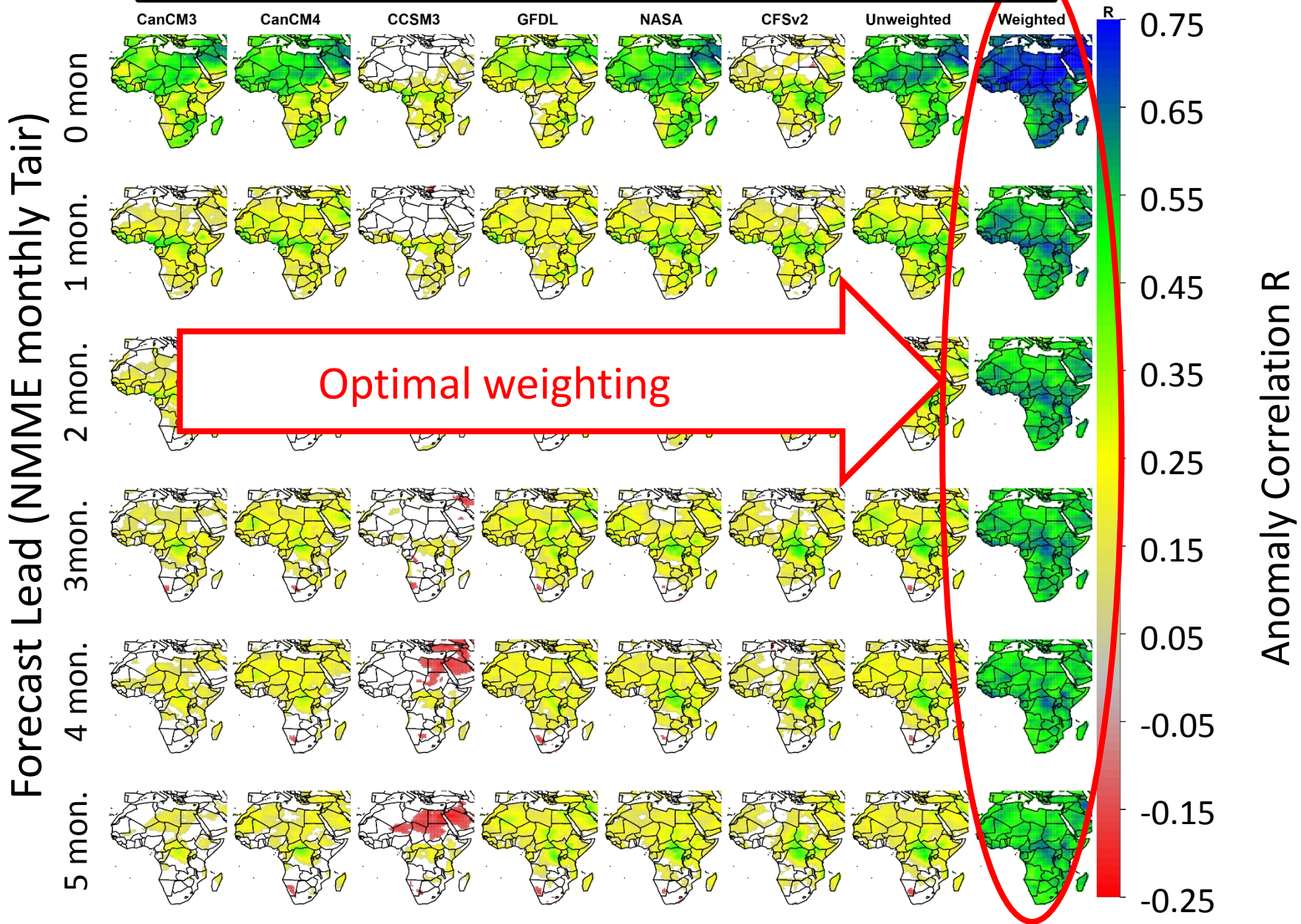

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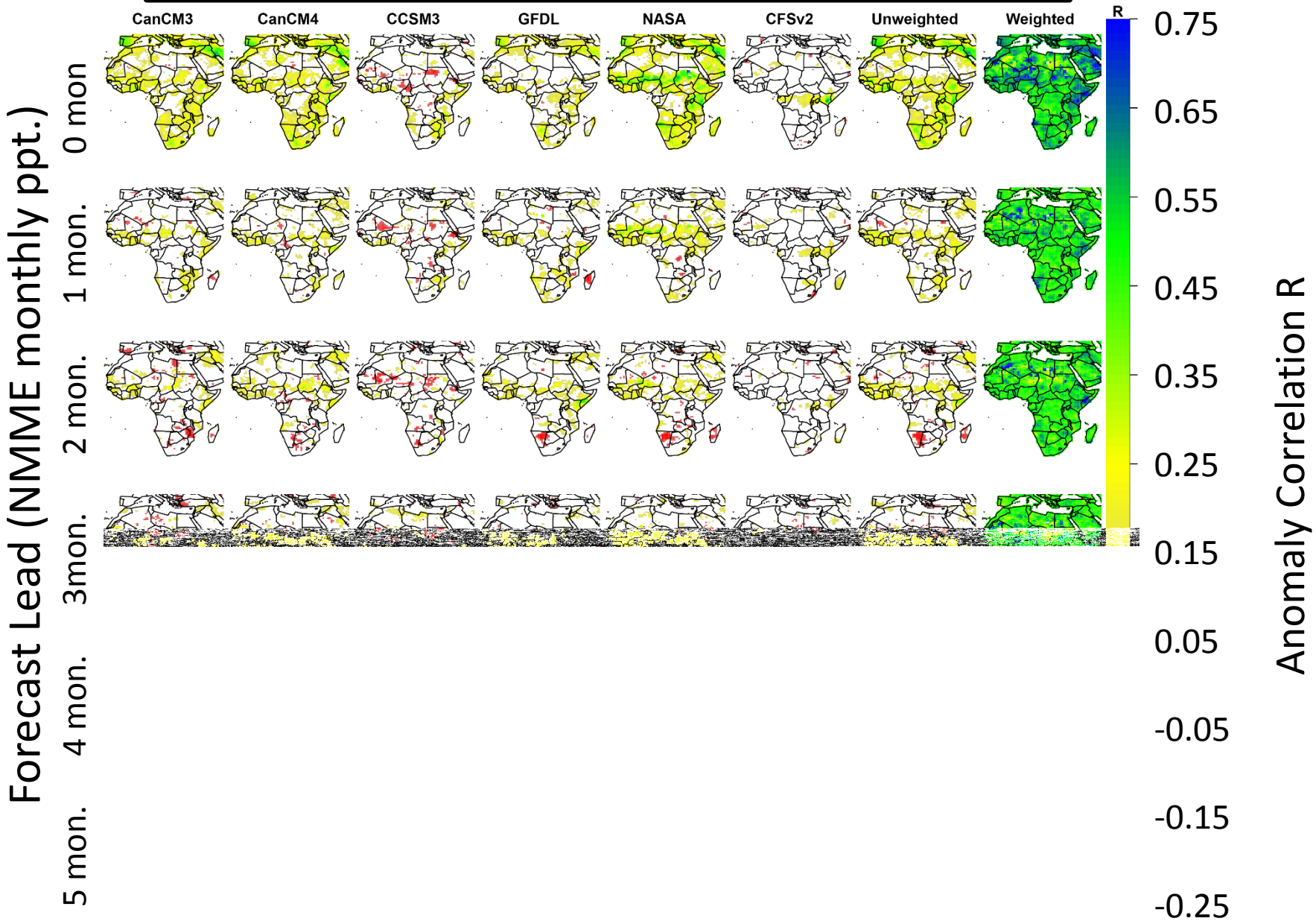

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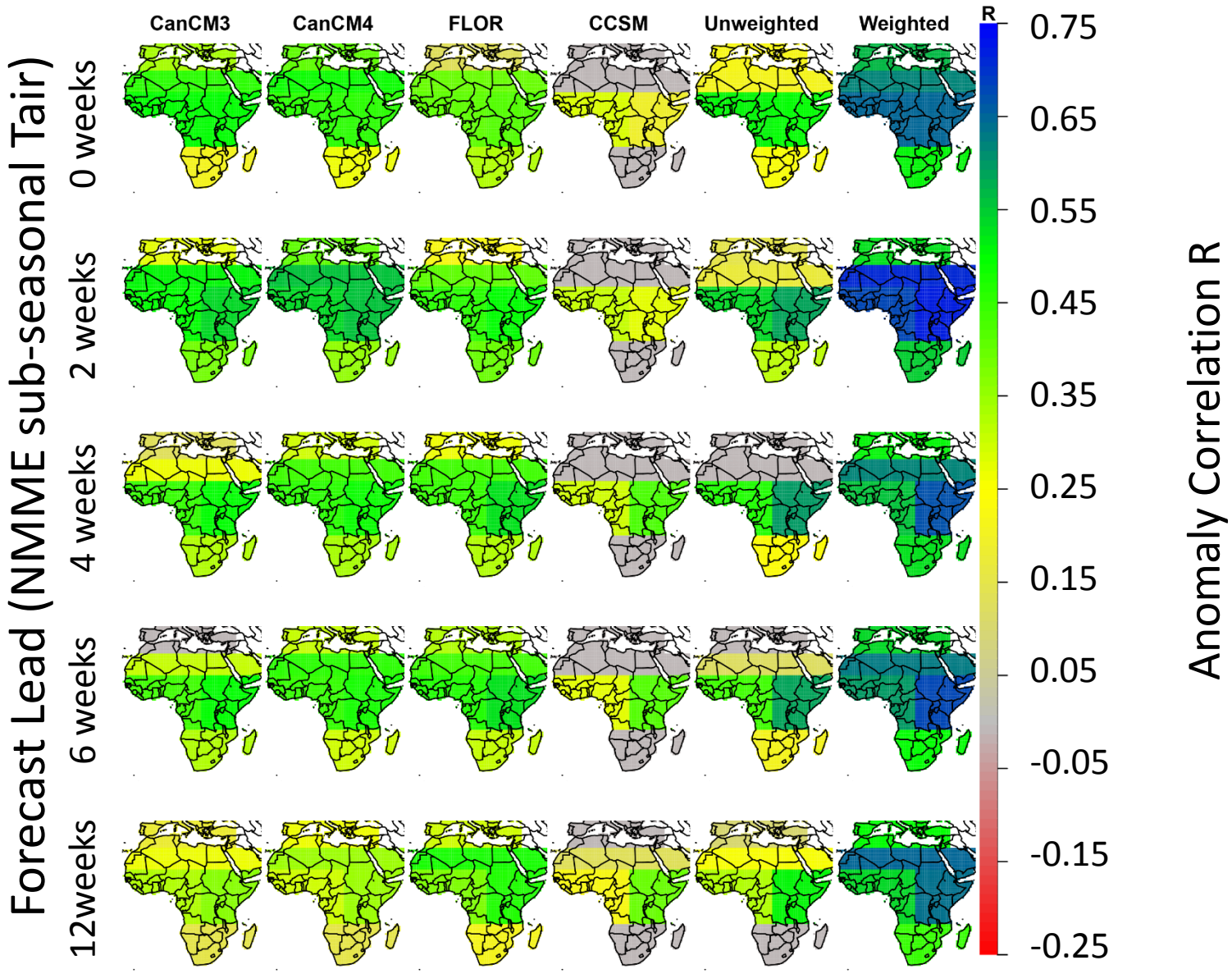

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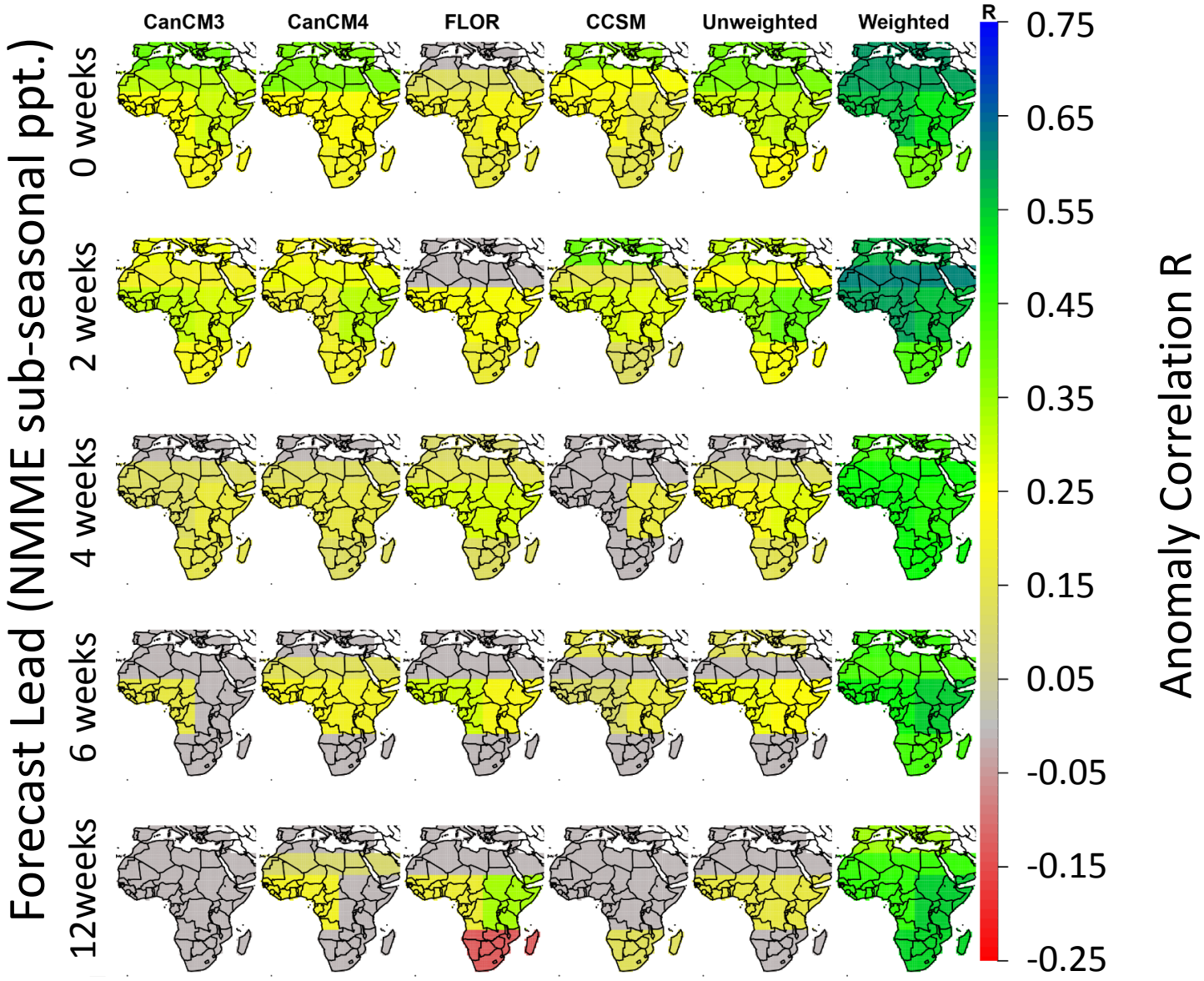
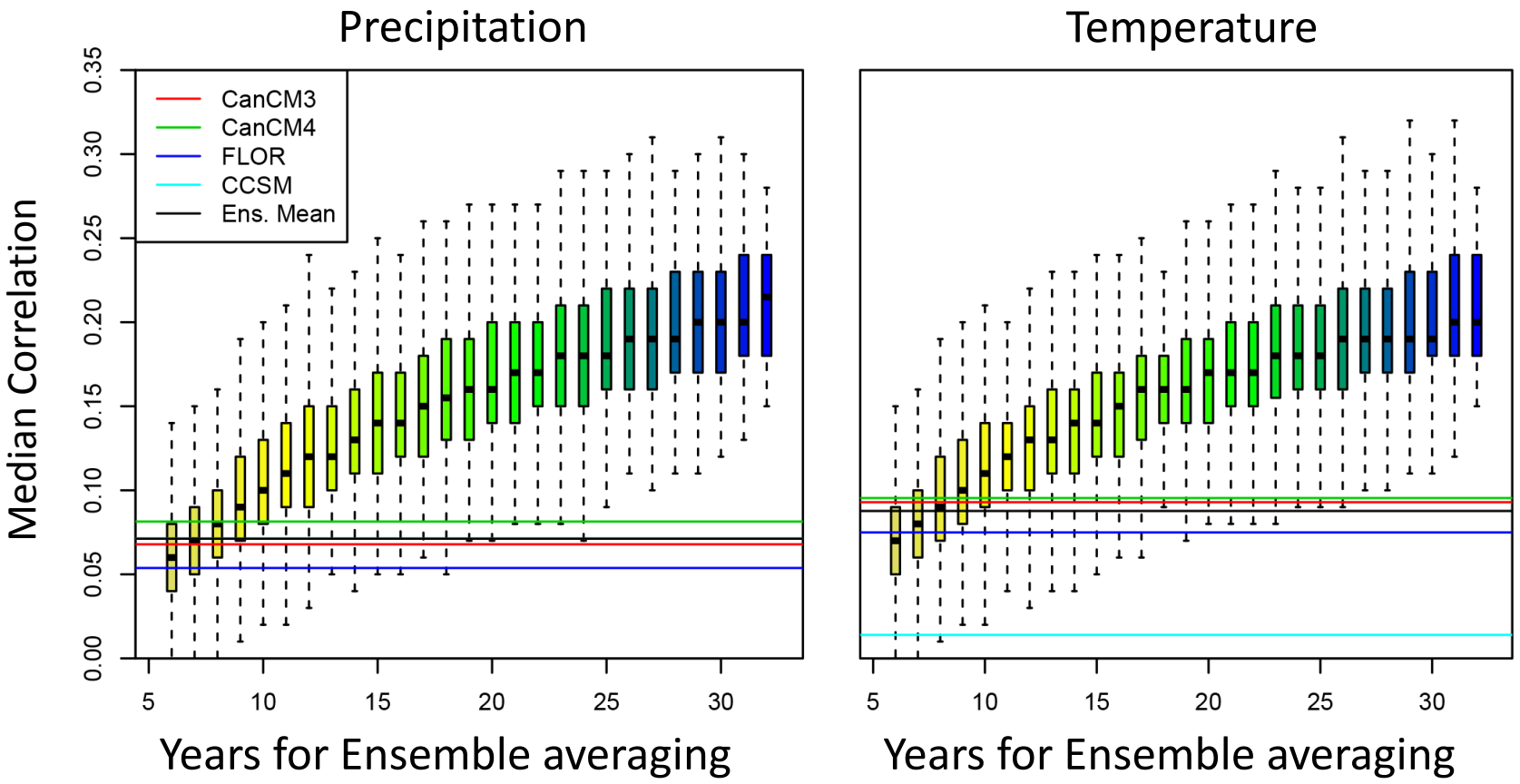


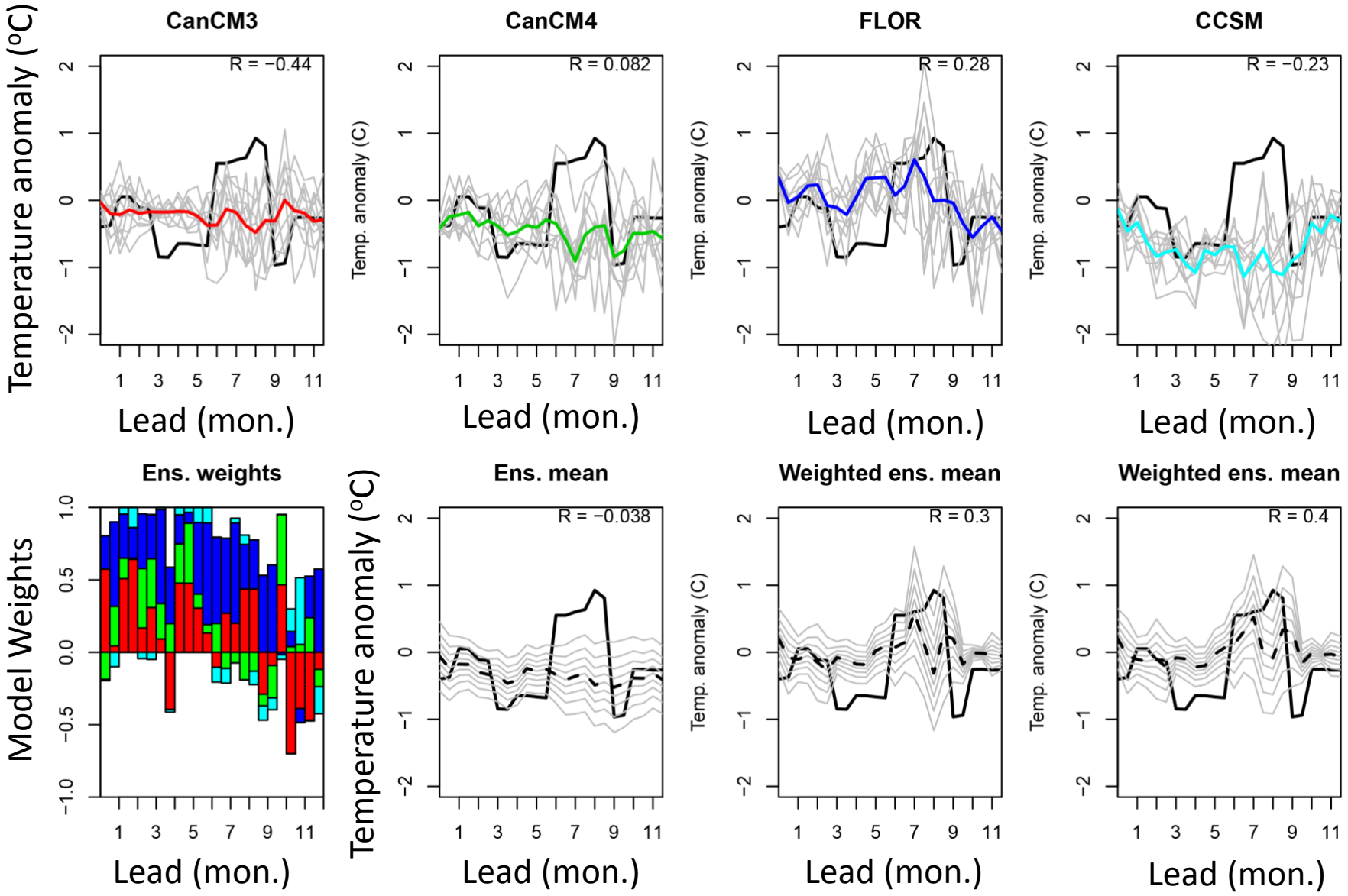
Verification of optimal weighting (using bootstrap sampling)



Performance of weighted ensemble mean superior with 10 years of data

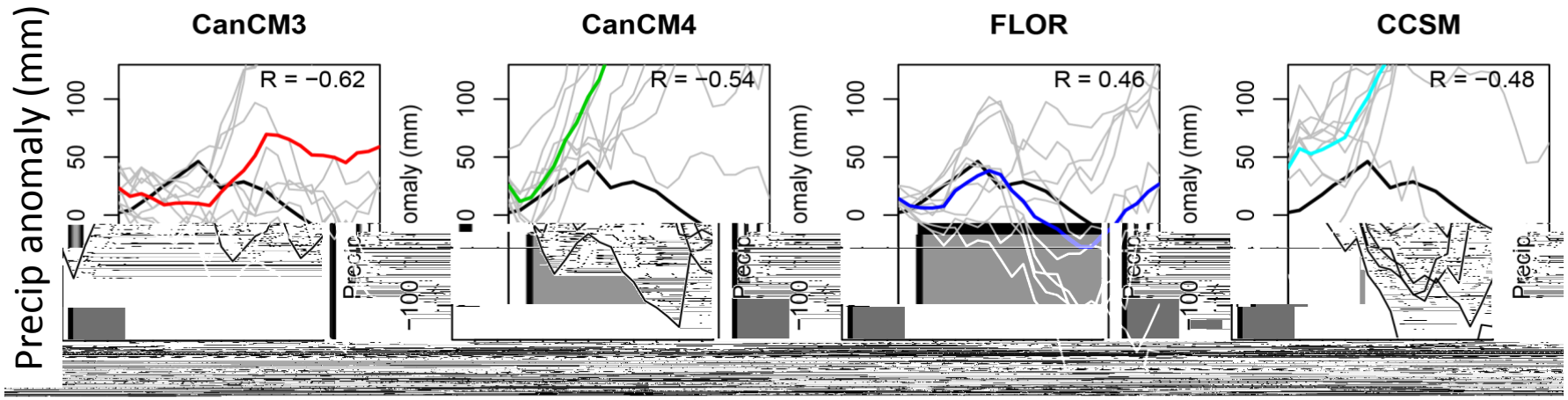
Information services, *including web-based services and apps*

West Africa drought 2000



Information services, *including web-based services and apps*

2010 East - Africa drought



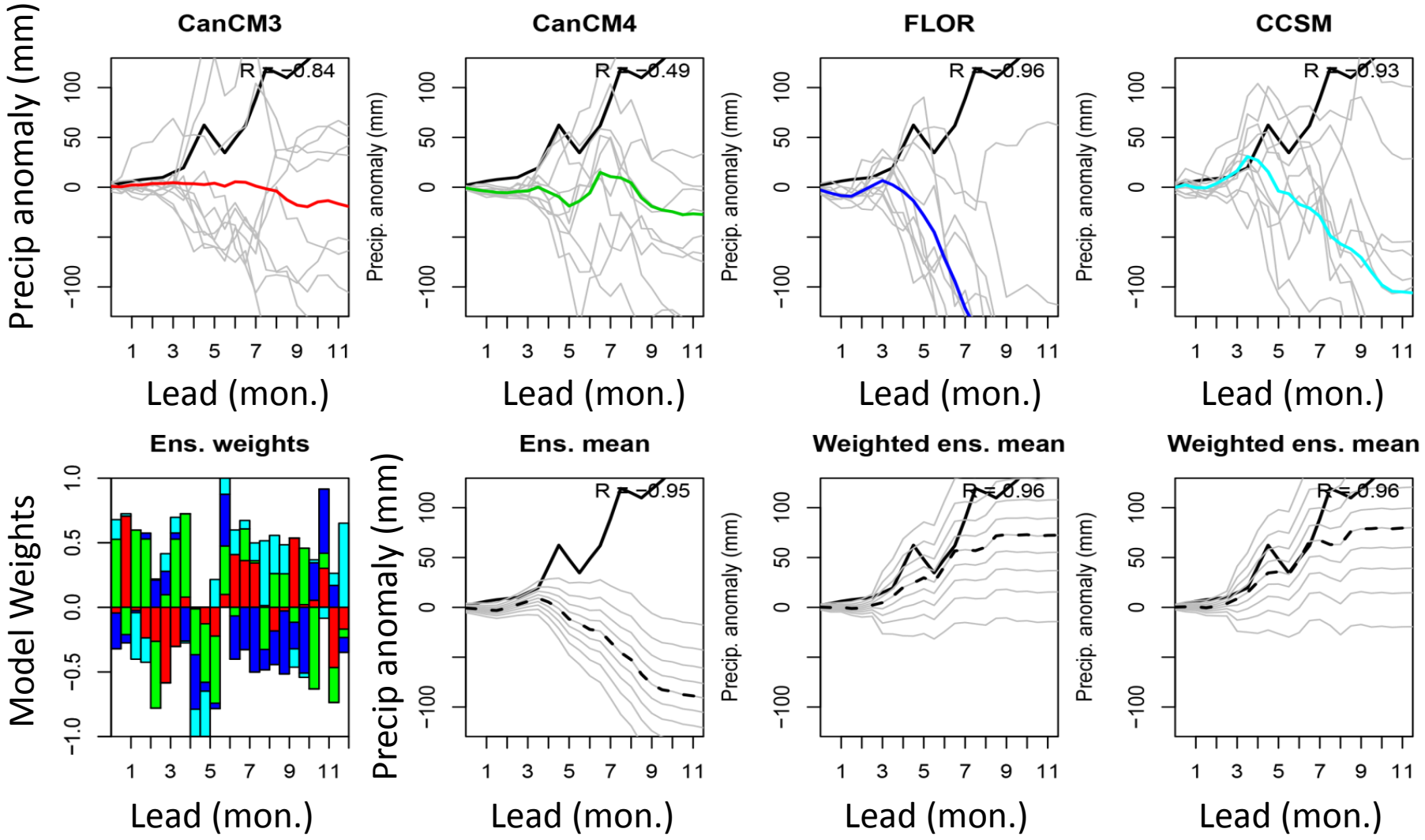
Model Weights

Precip anomaly (mm)

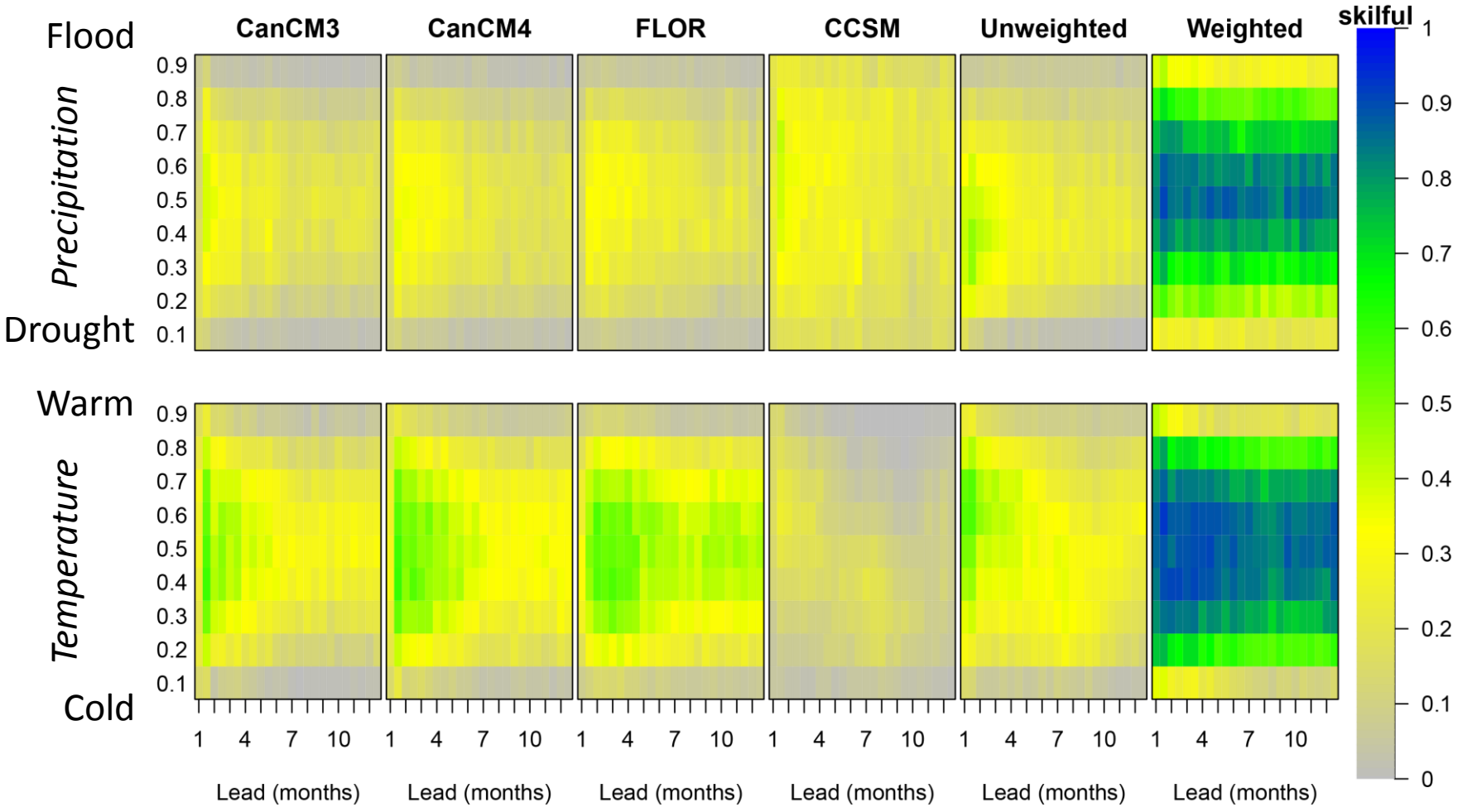
Lead (mon.) Lead (mon.) Lead (mon.) Lead (mon.)

Information services, *including web-based services and apps*

2011 Brazil floods



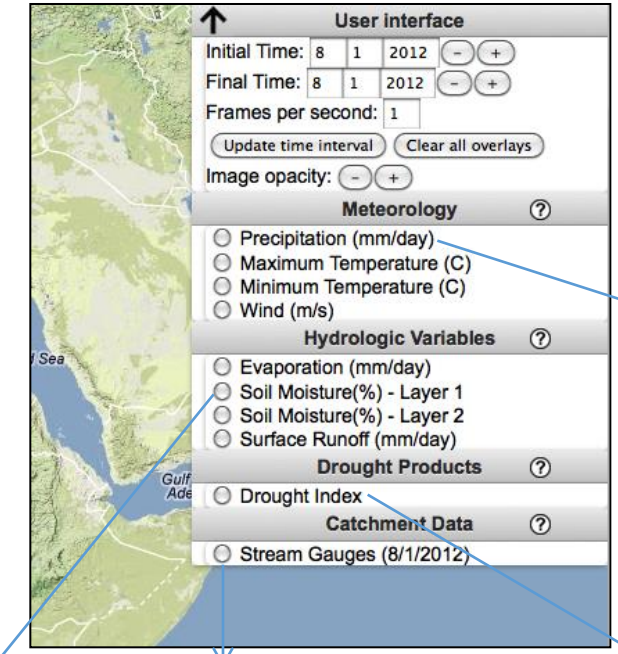
Natural hazards

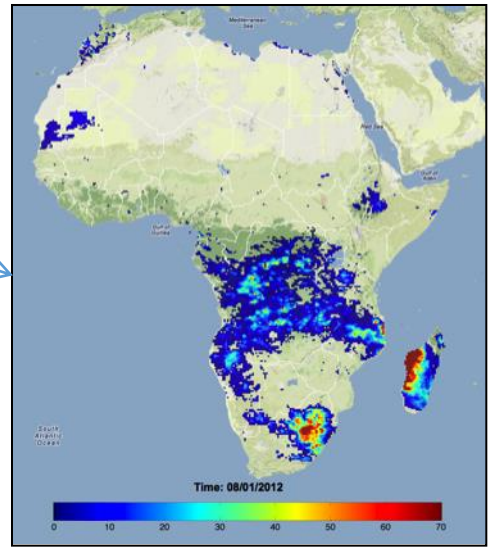


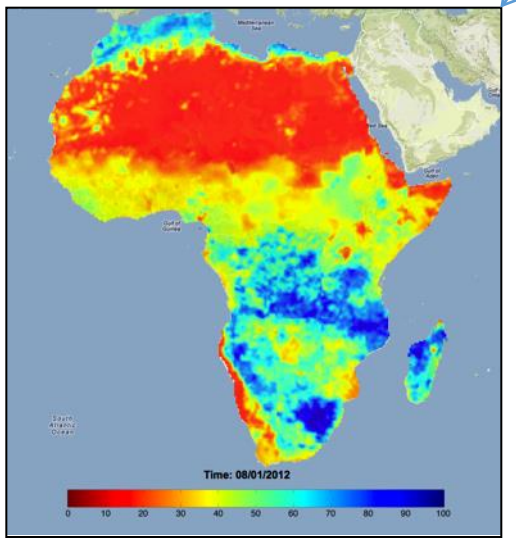
Models and data integration (*e.g. drought impact indicators*)

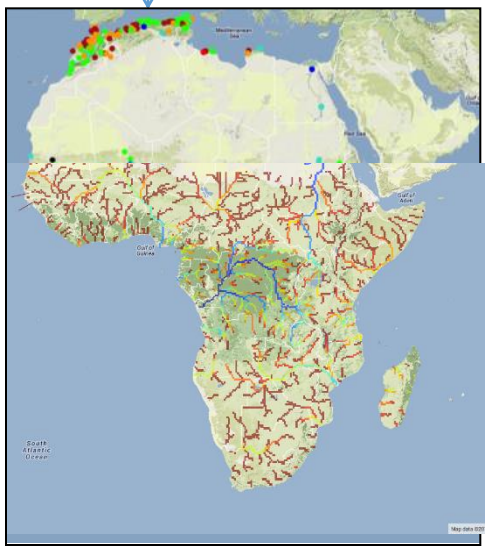
Information services, *including web-based services and apps*

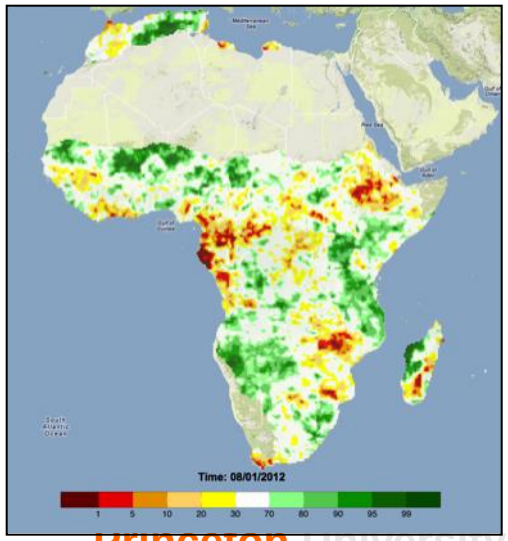
- Animation of hydrologic variables
- Catchment data
  - Over 800+ basins from the GRDC network and FAO Reservoir database.
- User control is enhanced.
- Overlay basin maps
- Zoom in to regions of interest
- Access data record from 1950 – present.





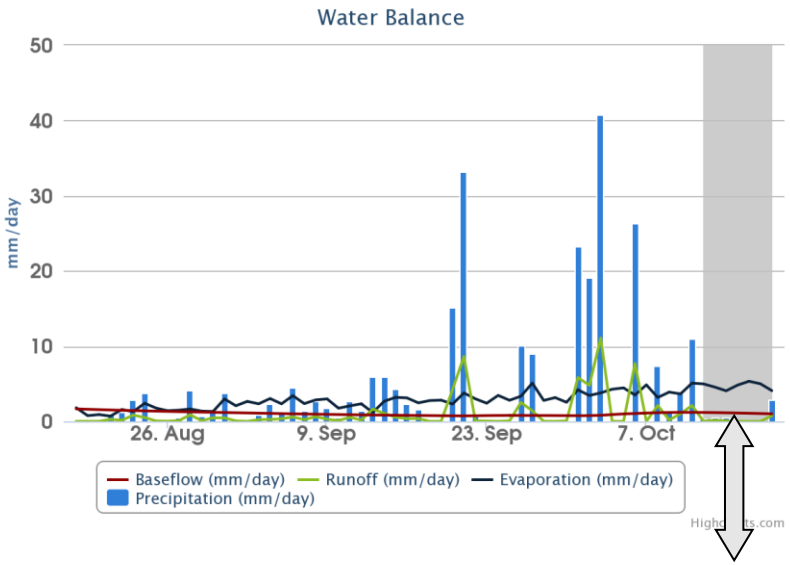


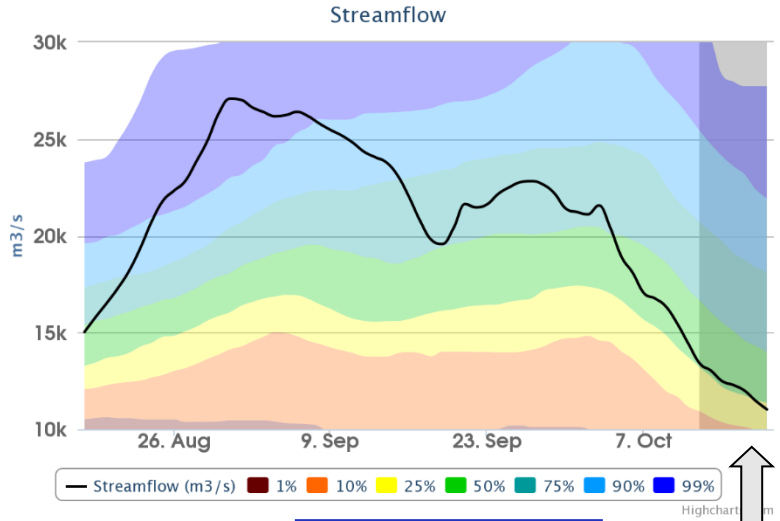




Indicators integrated with local data and tools

Models and data integration (*e.g. drought impact indicators*)





NMME sub-seasonal to seasonal forecasts

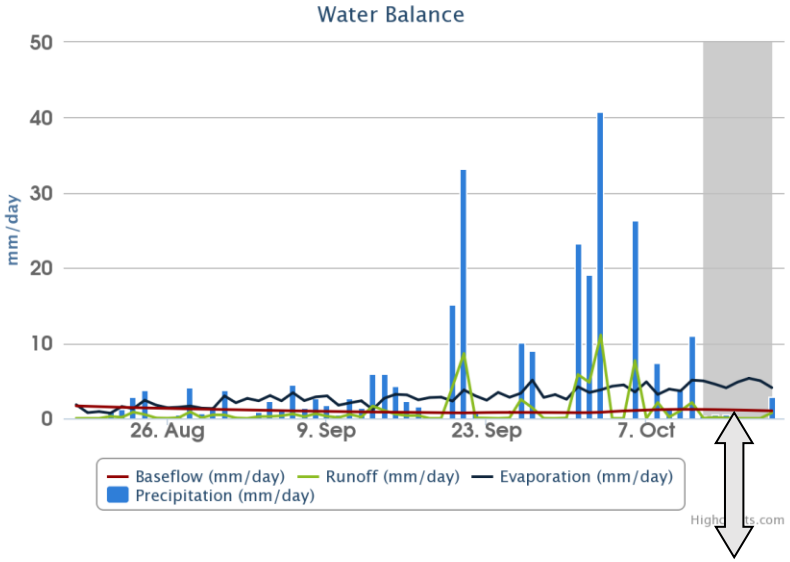
Initial Conditions

Land surface (hydrology) models

Discharge Forecast

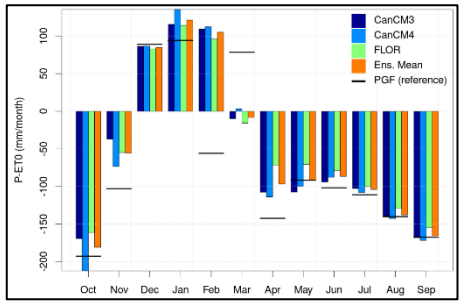
Indicators integrated with local data and tools

Models and data integration (*e.g. drought impact indicators*)

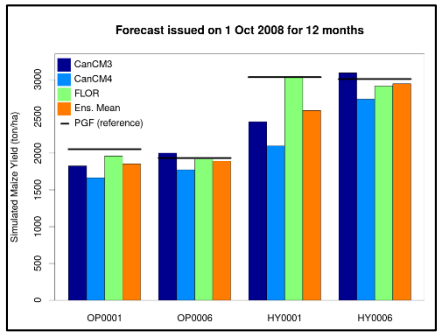


NMME sub-seasonal to seasonal forecasts

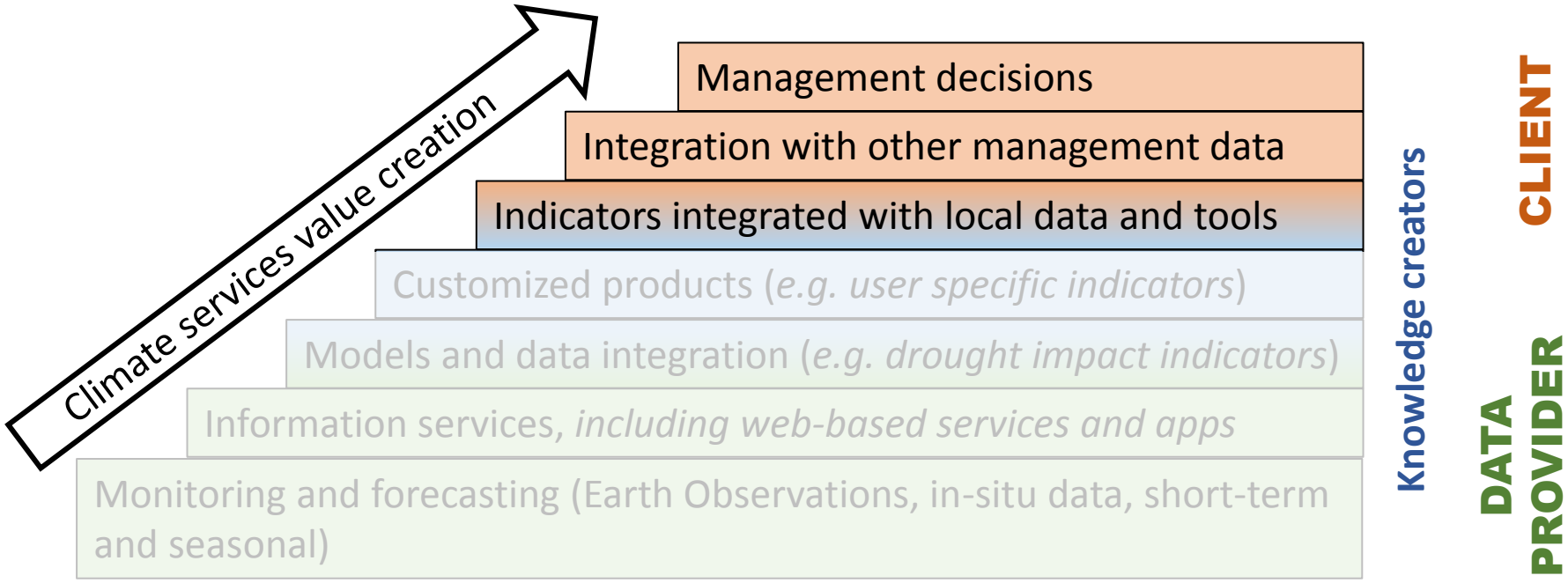
Irrigation Demand (P-Eto)



Crop forecasts



The big challenge: Can we create climate information useful for client decision making



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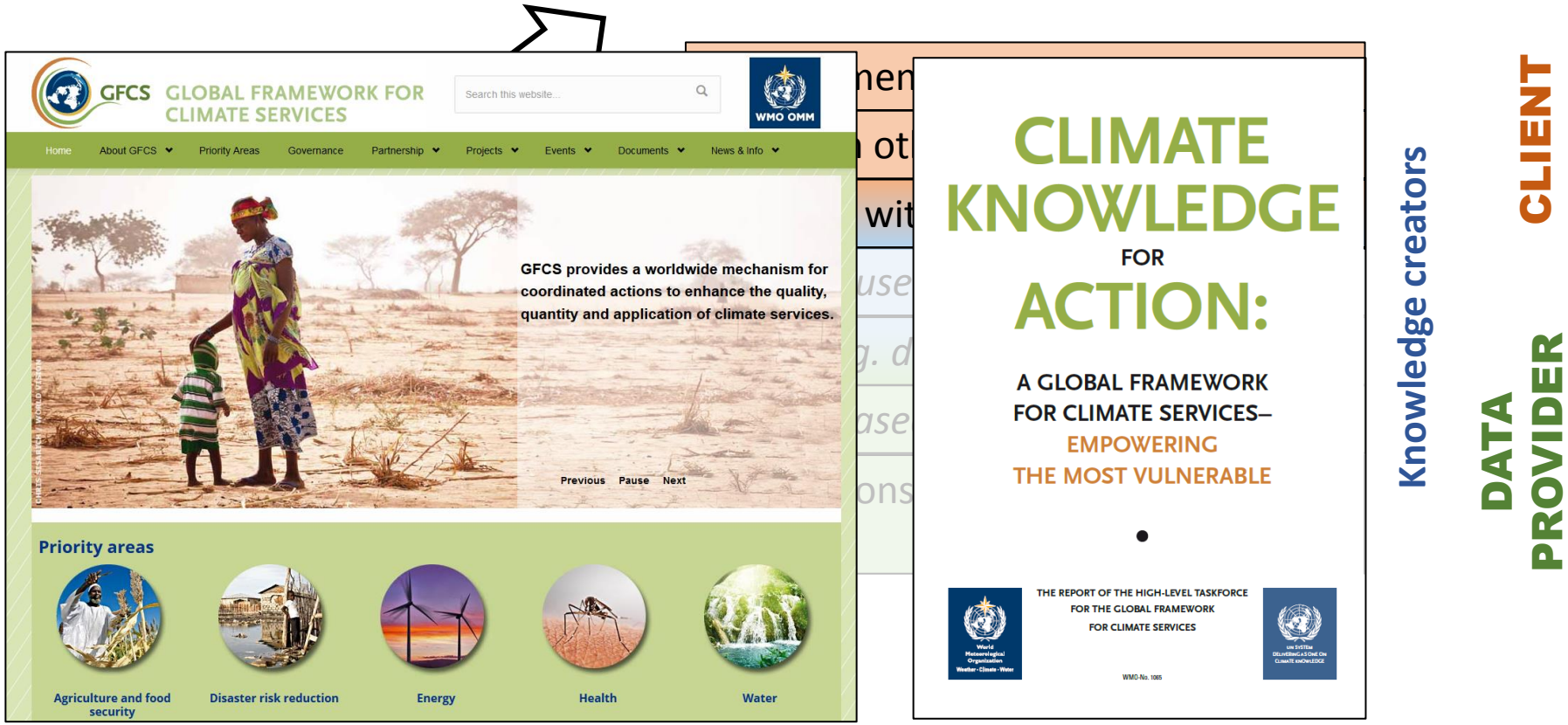
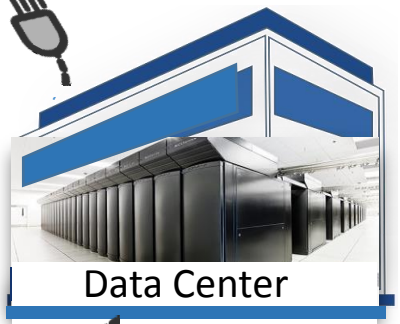


The challenges of a Global Climate Service System

1. Can the information (satellite, in-situ, forecasts) get into data centers in ways that are convenient and easy to access by climate product providers?
2. Can the “Climate Service Center” produce products useful for decision makers?
3. Can the decision makers access the products in a easy, convenient and timely manner?



Weather

Earth System Models

?

Climate Product Center

!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Discover, Access, Contribute
Earth Observations, Information and Services
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SITE AVERAGED GRAVIMETRIC SOIL MOISTURE: 1987-1989 (BETTS)
The Site Averaged Gravimetric Soil Moisture Data: 1987 - 1989 (Betts) Data Set contains the site averaged product data collected during the 19
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AMSR-E/Aqua L2B Surface Soil Moisture, Ancillary Parms, & QC EASE-Grids
The Advanced Microwave Scanning Radiometer - Earth Observing System (AMSR-E) instrument on the NASA EOS Aqua satellite provides global passive
Click to read more...
AMSR-E/Aqua level 3 global monthly Surface Soil Moisture Standard Deviation V005 (AMSRE_STDMO) at GES DISC
Global monthly AMSR-E-derived Soil Moisture The dataset contains global monthly-mean soil moisture statistics (standard deviation)
Click to read more...
SITE AVERAGED GRAVIMETRIC SOIL MOISTURE: 1987-1989 (BETTS)
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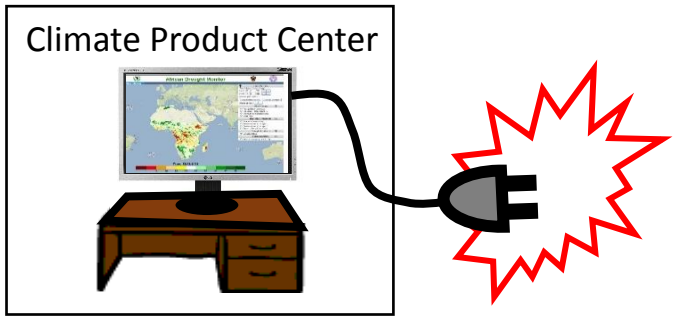
LPRM/AMSR-E/Aqua Daily L3 Ascending Surface Soil Moisture, Ancillary Params, and QC
This Level 3 (gridded) data set?s land surface parameters, surface soil moisture, land surface (skin) temperature, and vegetation water conten



Transfer ADFM to AGRHYMET (1/2012; 10/2013),
ICPAC (6/2012), and
LAFM to CAZALAC (Santiago Chile, 11/2014)

Goals:

- Adapt the monitoring system to the region.
- Improve data dissemination, knowledge exchange
- Provide training and allow for feedback at workshops (participatory exercises)
- Followed by validation plans, operational evaluations, exchange visits, …

IN SUB-SAHARAN AFRICA, LIMITED CAPACITY AND LITTLE PROGRESS;
IN LATIN AMERICA, BETTER CAPACITY AND GOOD PROGRESS.

Summary and conclusions

1. We are at the threshold of the development of climate services (e.g. IBM buying the Weather Corp. data for US$2B, EU Copernicus' climate service program);
2. We (our community) are the "data providers" and "knowledge creators", but to fulfill this role we need to continue our research to make the climate information skillful;
3. We (our community) don't understand well what climate products decision makers need (what and how good;)
4. The "data centers" have failed to provide easy access by decision makers to climate information.

Summary and conclusions

My personal assessment:

The GFCS and GEO/GEOSS are on pathways that will assure failure; but the problem is important enough that it needs to be correctly.