RCC climate products and service requirements for hydrological services

WMO Commission for Hydrology perspectives

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14 November 2018

WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

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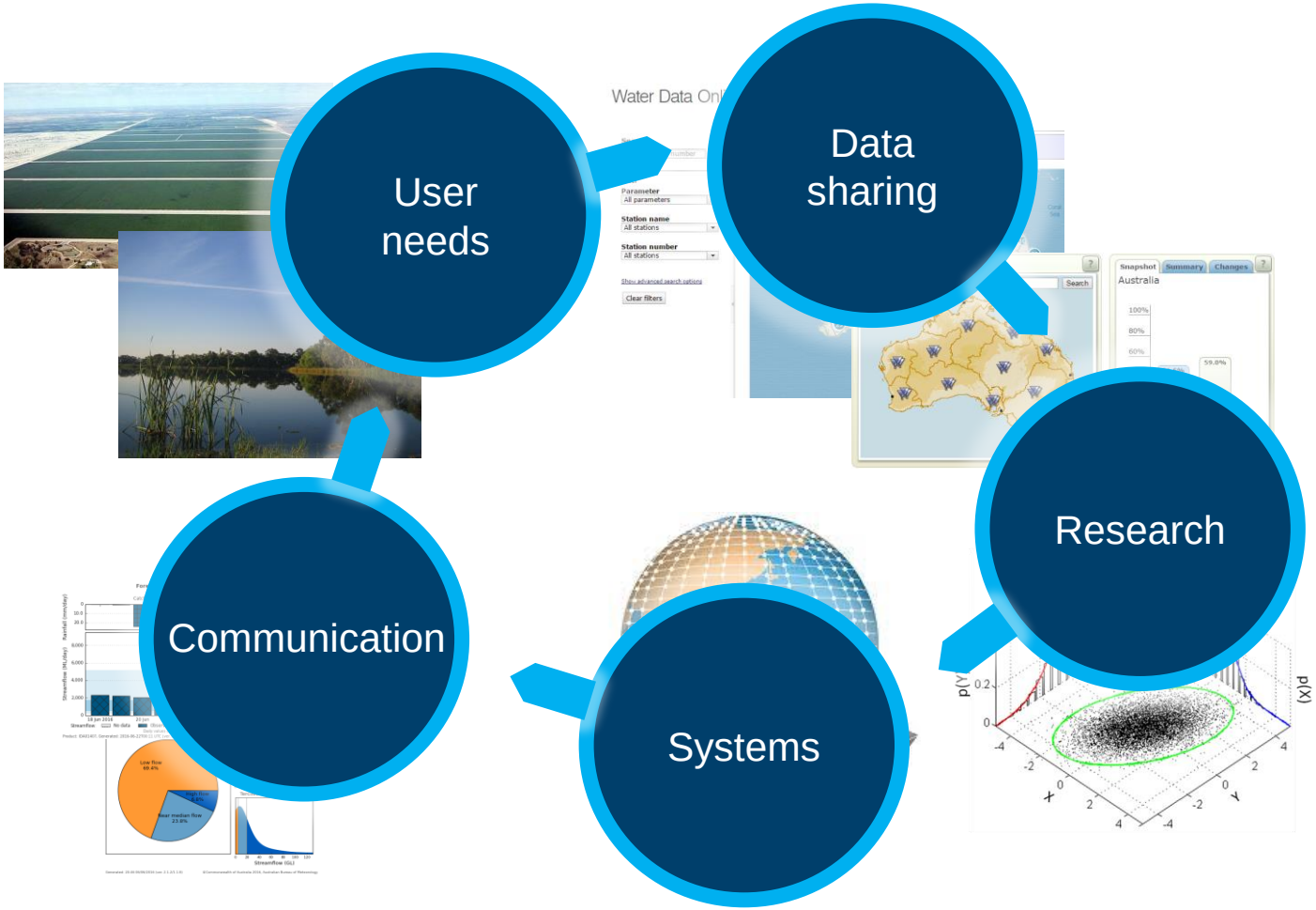
World Meteorological Organization
Organisation météorologique mondiale

Development cycle of National Hydrology Services



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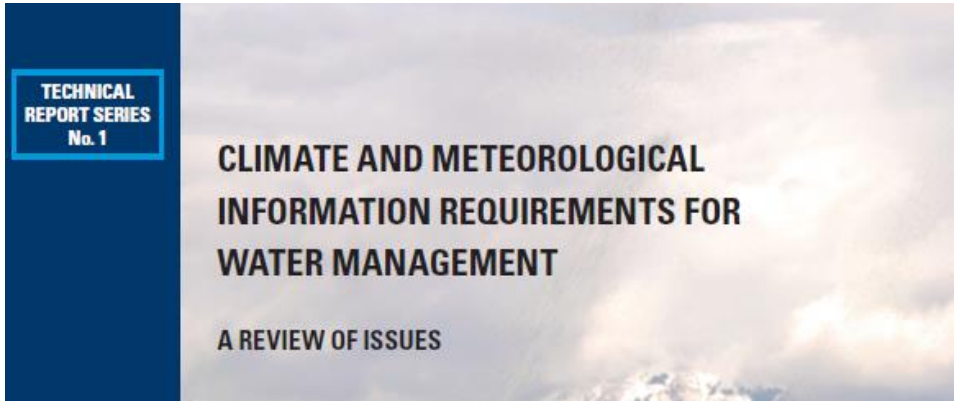
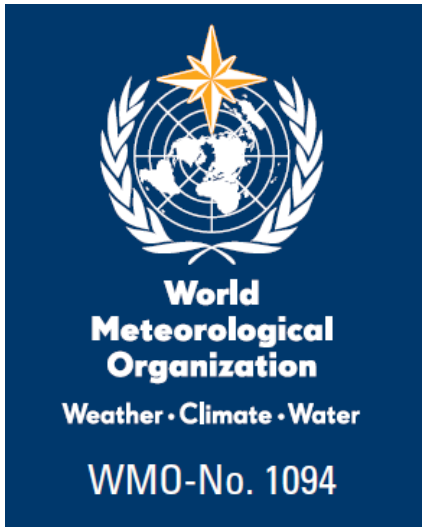
1. Climatological and meteorological data for water resources management

http://www.wmo.int/pages/prog/hwrp/publications.php





Purpose → Features → Required data

Purpose	Features	Required data
		Humidity Wind speed
Flood management and control	Structures (dams, river training)	Precipitation Temperature Humidity Wind speed and direction
	Flood forecasting and warning	Precipitation Temperature Evapotranspirtation Synoptic information Forecasts and alerts Medium- and long-term forecasts
	Flood plain zoning/Flood frequency estimation	Precipitation Evapotranspiration Temperature Synoptic information
	Coastal inundation	Wind speed Wind direction Synoptic information Forecasts and alerts
Irrigation and drainage	Supply Demand scheduling	Precipitation Temperature Humidity Wind speed Medium/long-range forecasts
Groundwater	Recharge Groundwater flooding	Precipitation Temperature Humidity Wind speed Medium/long-range forecasts
Navigation	Canal systems Dredging	Precipitation Temperature Medium/long-range forecasts
Power generation	Hydropower Cooling water	Precipitation Temperature Humidity Wind speed Medium/long-range forecasts
Water supply	Potable water Industrial processing	Precipitation Temperature Humidity Wind speed Medium/long-range forecasts
Water quality	Pollution control Dilution Salinity and sedimentation	Precipitation Temperature Humidity Wind speed Forecasts and alerts
Fisheries and conservation	Hydro-ecology Hydromorphology	Precipitation Temperature Humidity Wind speed Medium/long-range forecasts
Amenity	Public access Recreation	Precipitation Temperature Wind speed Synoptic information Forecasts and alerts

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2. A web page with a map showing coverage of all RCCs + networks + GPCs

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3. Meta data: precipitation, temperature, PET + additional data for cold regions

Table 1: Rainfall d ts we

Resolution → Time step → Latency

Name	Characteristi				Url
Automatic Weather Stations (AWS)	675 stations across India	Point	Hourly		http://www.imd.gov.in/pages/obs_network.php?id=13
Automatic Raingauge Stations (ARG)	1289 stations across India	Point	Hourly		http://www.imd.gov.in/pages/obs_network.php?id=14
Agromet stations	130 stations across India	Point	Daily		http://www.imd.gov.in/pages/obs_network.php?id=08
NMSG	Research data set generated from merged AWS and TRMM/GPM remotely sensed data	Gridded 0.25 degree resolution	Daily	6 days	ftp://ftp.ncmrwf.gov.in/pub/outgoing/akmitra
Radar composite network	radar across India				http://ddgmui.imd.gov.in/radar_gis/RDR_GIS_FINAL/Composite.html

Example of datasets available from India Meteorological Department

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4. Meta data: reanalysis, nowcasts and outlooks

Model	Horizontal Resolution/ vertical layers	Model coverage	Dynamic coupling atmosphere / ocean	Ensembles Forecast: Hindcast:	Forecast Update Frequency	Hindcast period	Max. lead time/ Product Time step/ Forecast latency	Web links / Data available freely to National Met/ Hydrology agencies (Yes/ No)
IFS HRES	9 km	Global	Yes	1 forecast:	Forecast: 00 and 12 UTC	N/A	Lead time: 1-10 days Time step: 1h 0 to 90h, 3h 93 to 144, 6h 150 to 240h Latency: ~6 hours	https://confluence.ecmwf.int/display/FUG/HRES+-+High-Resolution+Forecast Atmosphere: https://www.ecmwf.int/en/forecasts/datasets/set-i Ocean wave: https://www.ecmwf.int/en/forecasts/datasets/set-ii Free to ECMWF member and cooperating states. Only some data/parameters are public.
IFS Ensembles	18 km	Global	Yes	51-member ensemble 11-member hindcast (see below)	00 and 12 UTC	20 years (continuously updated	Lead time: 1-15 days Time step: 1h 0 to 90h, 3h 93 to 144, 6h 150 to 360h Latency: ~8 hours	https://confluence.ecmwf.int/display/FUG/ENS+-+Ensemble+Forecasts Atmosphere: https://www.ecmwf.int/en/forecasts/datasets/set-iii https://www.ecmwf.int/en/forecasts/datasets/set-iv Free to ECMWF member and cooperating states. Only some data/parameters are public.

Example of datasets available from ECMWF

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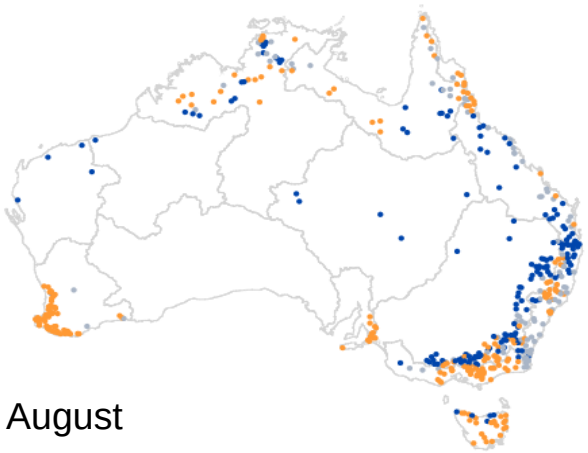
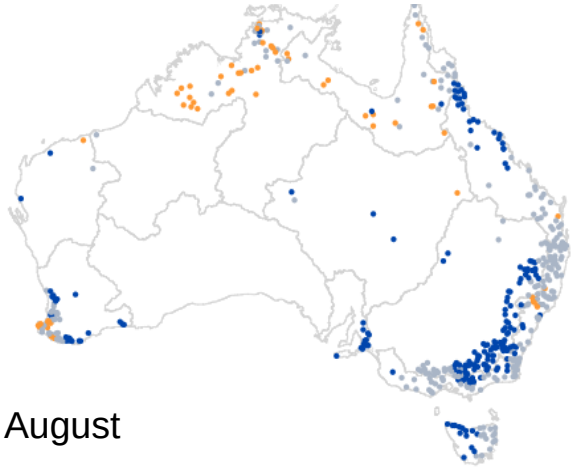
5. The value of post processing

Rainfall: raw



August

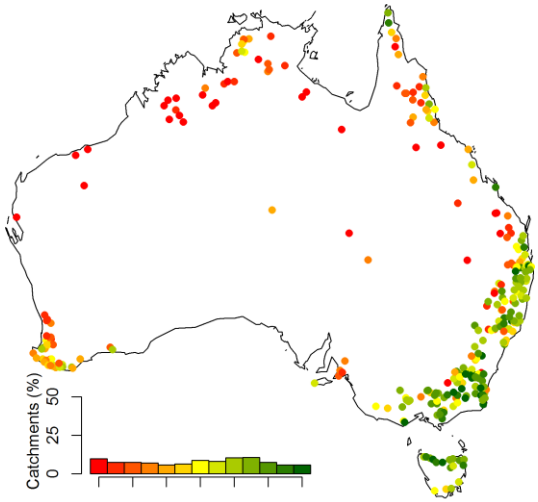
Rainfall: post processed



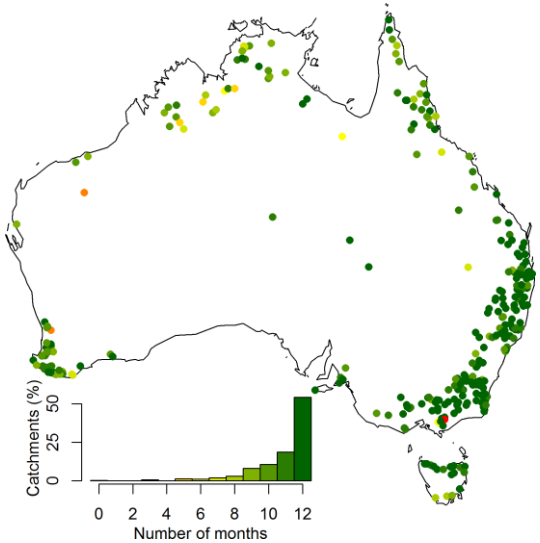
August

Over 80% sites with high forecast skill in water availability forecasts

Streamflow: raw

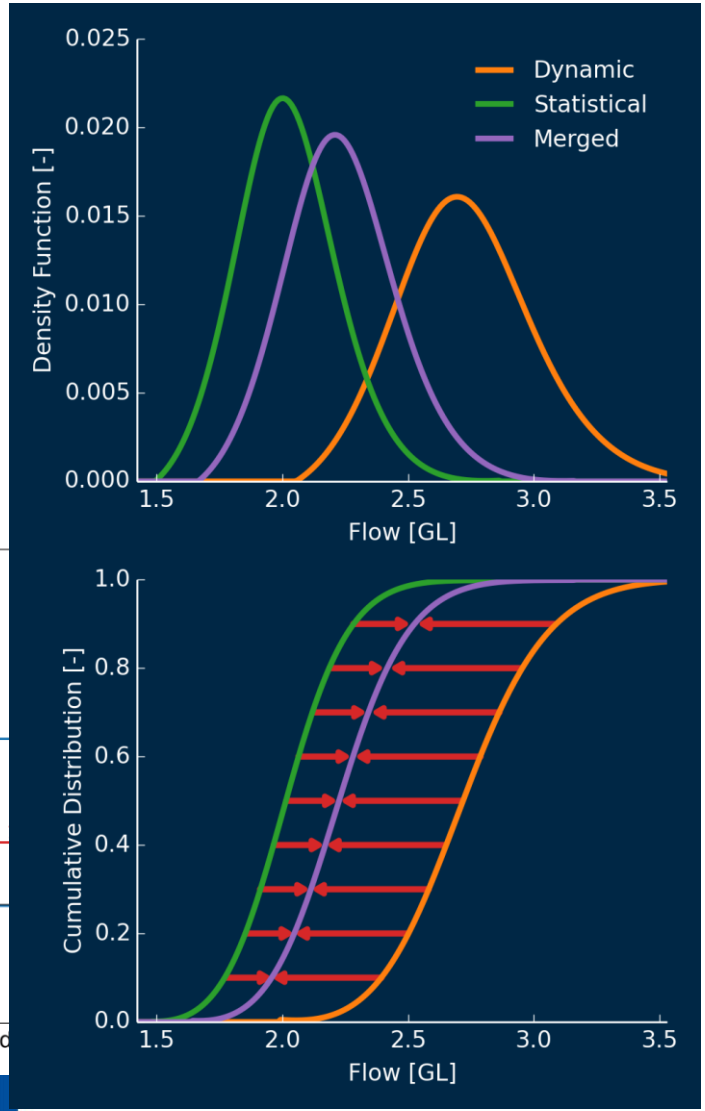


Streamflow: post processed



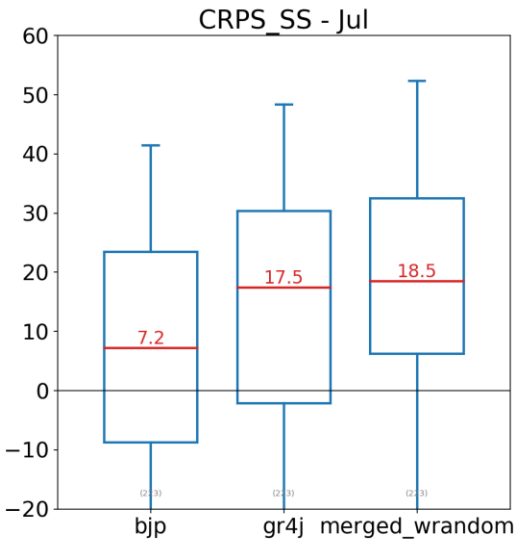
6. The value of multi-model forecasts

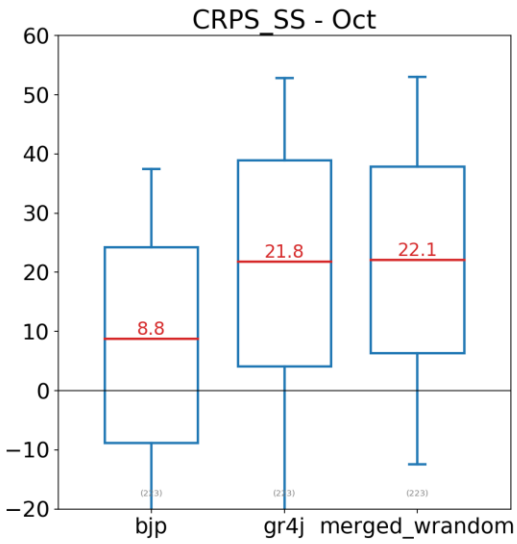
Streamflow: ensemble blending



Cross validation
results for all 233 sites
1990-2008 across Australia

- Reliability is preserved (PIT)
- Accuracy shows significant improvements (CRPSS)





7. Support to National Hydrology Services Agencies (via NMS)

- Knowledge sharing
- Capacity building in hydro-meteorology
- Hands-on collaborative work
- Operational delivery of climate outlooks:
  - Data and graphic products
  - Insights and interpretations
- Observation versus re-analysis datasets
- Recognise that:
  - Some common principles apply in methods
  - Also appreciate the need for differences based on end user needs
  - Standardisation

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WORLD METEOROLOGICAL ORGANIZATION

Monitoring and Predicting Global Hydrological Variability

HydroSOS – the pilot World Meteorological Organization global hydrological status and outlook system

AT A GLANCE

20 million
people at risk from flooding

$80 billion
in associated damage from flooding

$8 billion
in losses from drought

9.7 billion
population by 2050

HydroSOS

- What is the hydrological status?
- Is it different from normal?
- Will it get better or worse over coming weeks and months?

The current global hydrological status including groundwater, river flow and soil moisture

An appraisal of where the current status is significantly different from 'normal,' for example indicating drought and flood situations

An assessment of whether this is likely to get better or worse over coming weeks and months

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HydroSOS Task Team

WP1: Coordination

WP2a: Data Sources and Exchange Methods

WP2b: Current Status and Modelling Methods

WP2c: Hydrologic Forecasting and Modelling Methods

WP3a: South Asia Pilot

WP3b: Lake Victoria Pilot

WP4: Global Pilot

WP5: Product Communication and Dissemination

WP6: Capacity Building

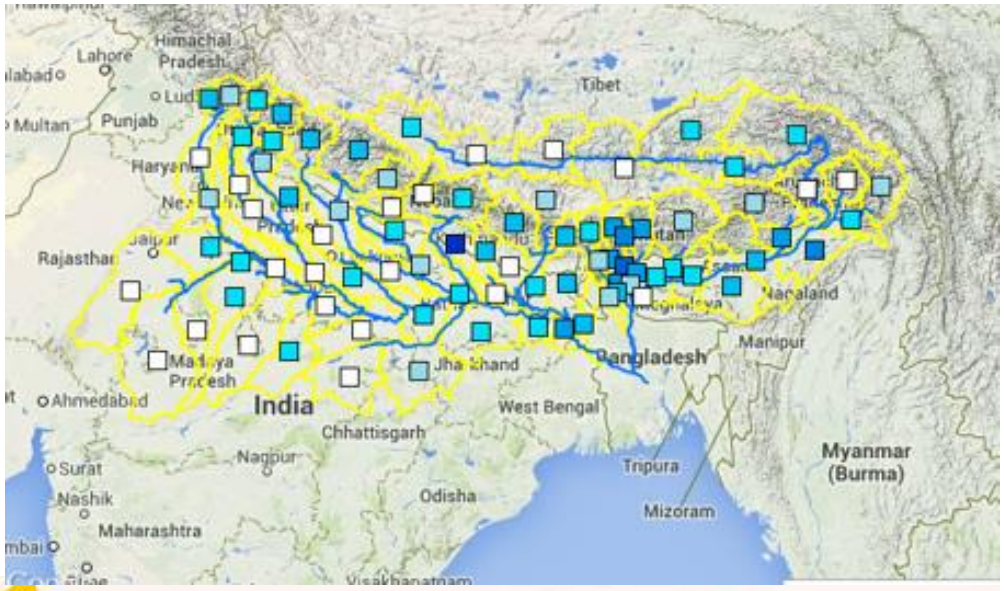
WP3a: Regional Pilot: South Asia

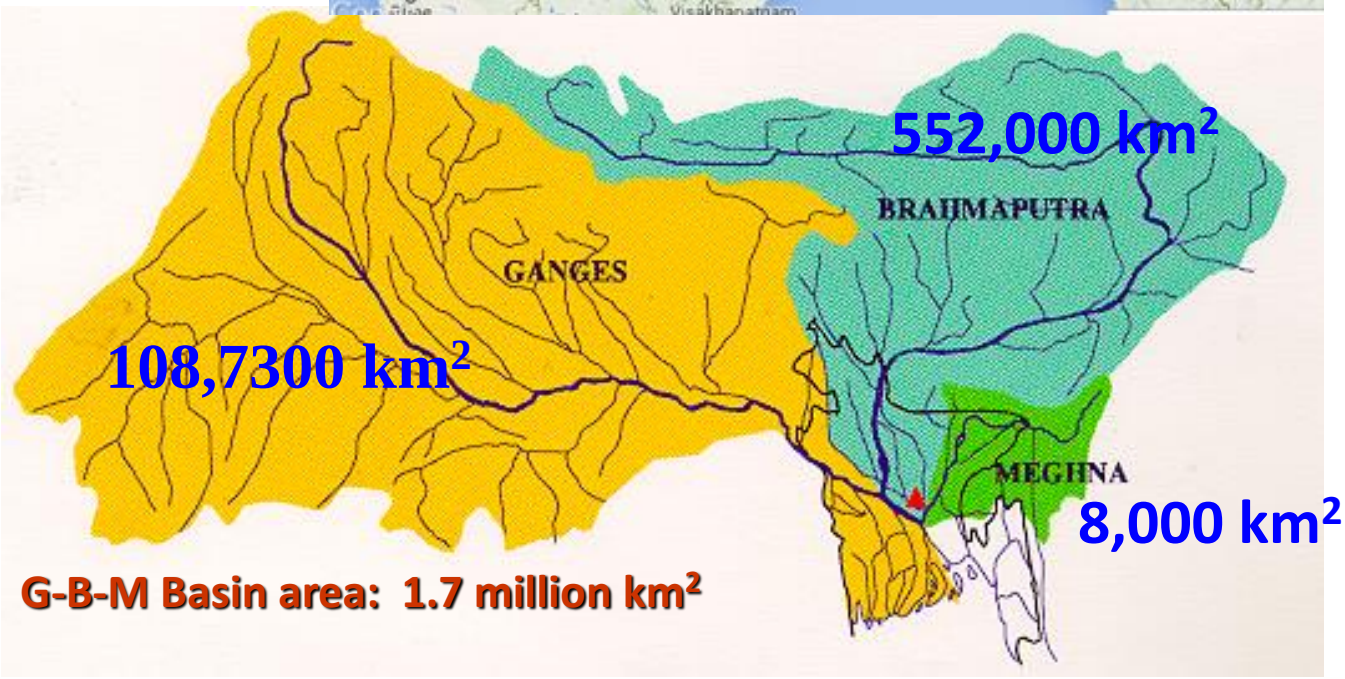
Objective: To develop a "proof-of-concept" pilot in the South Asia region

South Asia Pilot to include the Ganges, Brahmaputra and Meghna (G-B-M) basin

HKH-HYCOS G-B Basin flood outlook will serve as the basis of this Pilot, Meghna basin to be added

Provide data and information on water resources to Global pilot





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Outlooks for the Godavari River Basin

India – Australia bilateral engagement

Expected commencement wef Jan'19 (3 years)

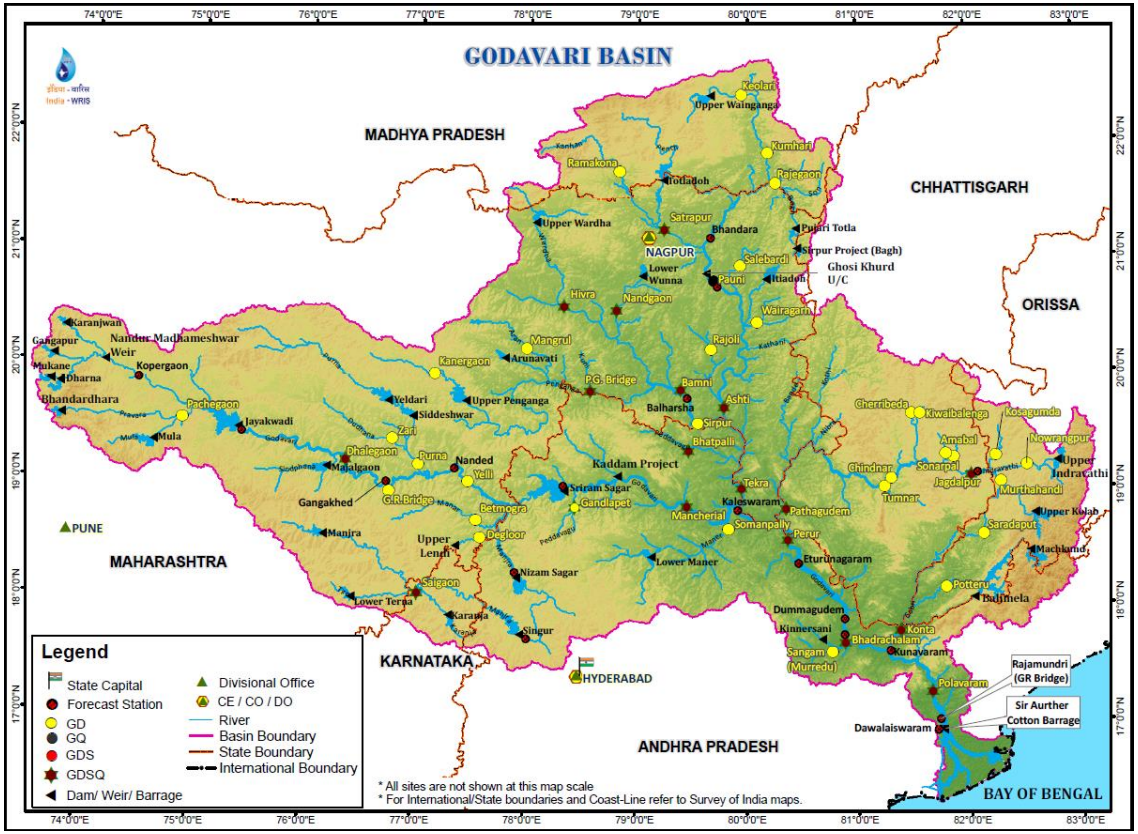
0 – 7 days hydrologic forecasts:

- Hydrologic models for the Godavari basin
- Forecasting system capable of daily updates

0 – 30 days water availability forecasts:

- Evaluation of the forecasting capability

Linkages to Decision Support System



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WP2c: Hydrological Forecasting and Modelling Methods

HydroSOS is not about flood forecasting

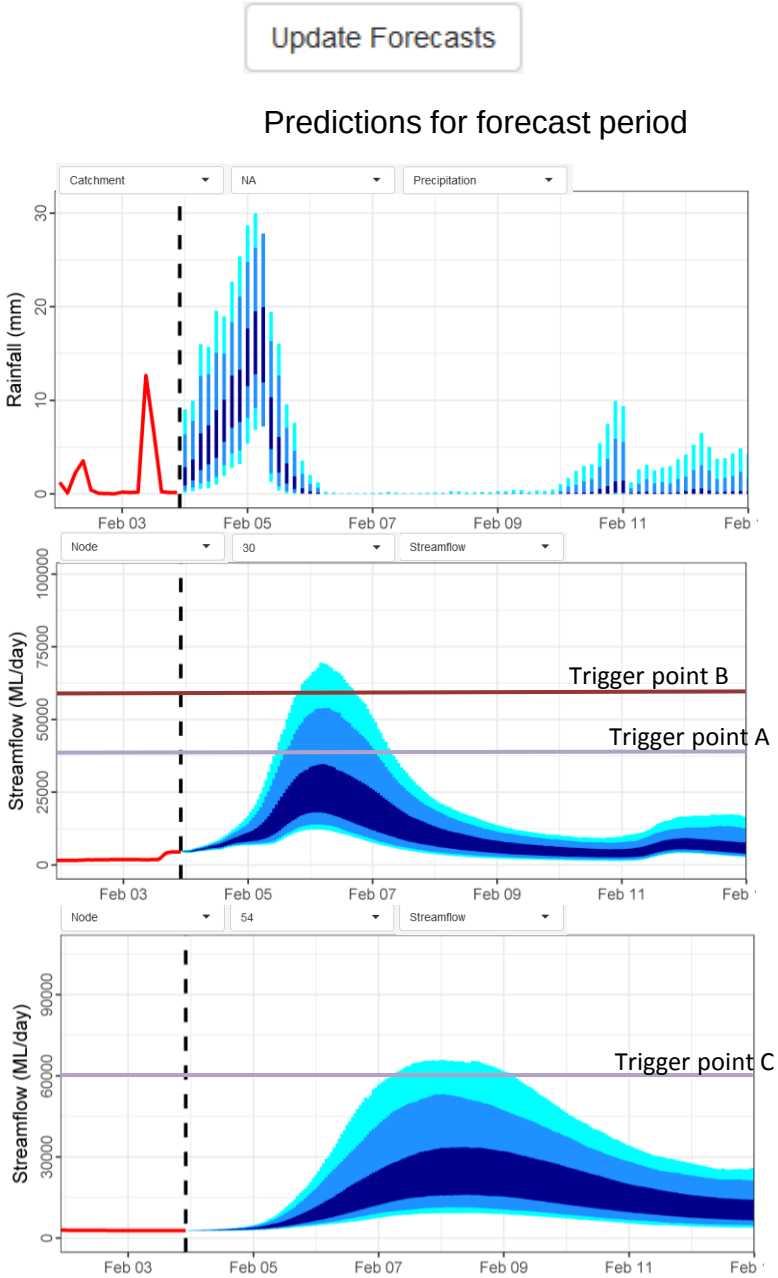
It is intended for water resource planning and operations

Forecast lead time:

- 0-7 days (weather time scale)
- 0-30 days (sub-seasonal)
- 0-90 days (seasonal)

Forecasts blend with climatology at long lead times

Focus on South Asia and Lake Victoria basins



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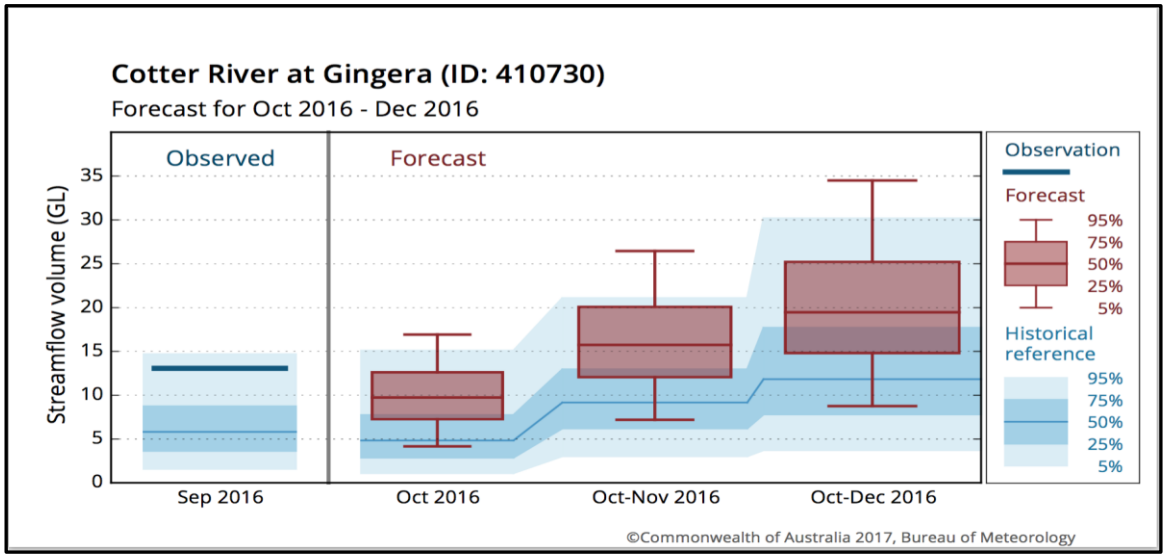
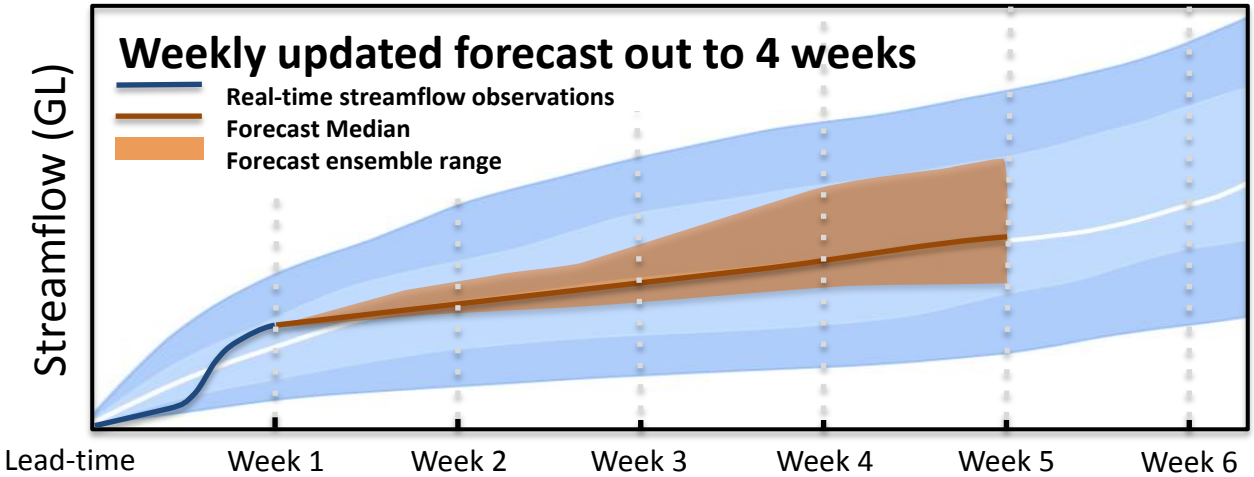
Focus on South Asia and Lake Victoria basins

Monthly updated forecast out to 3 months





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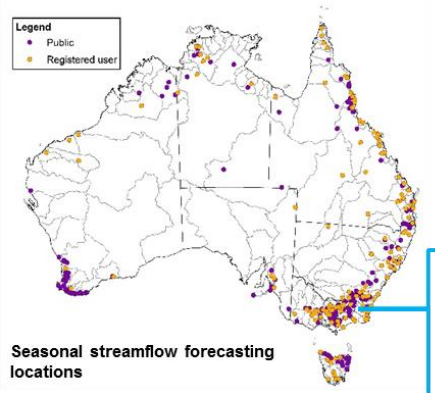
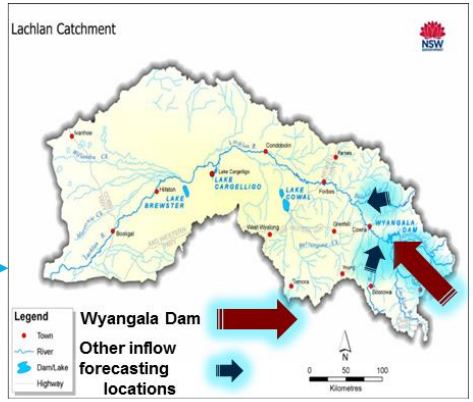
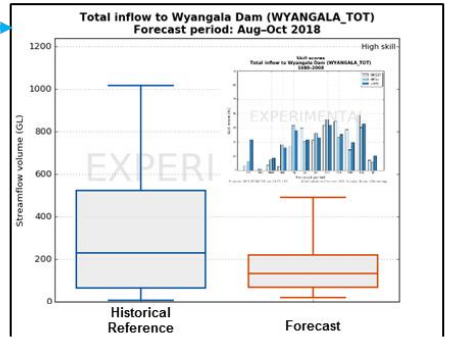
Operational example (Australia)



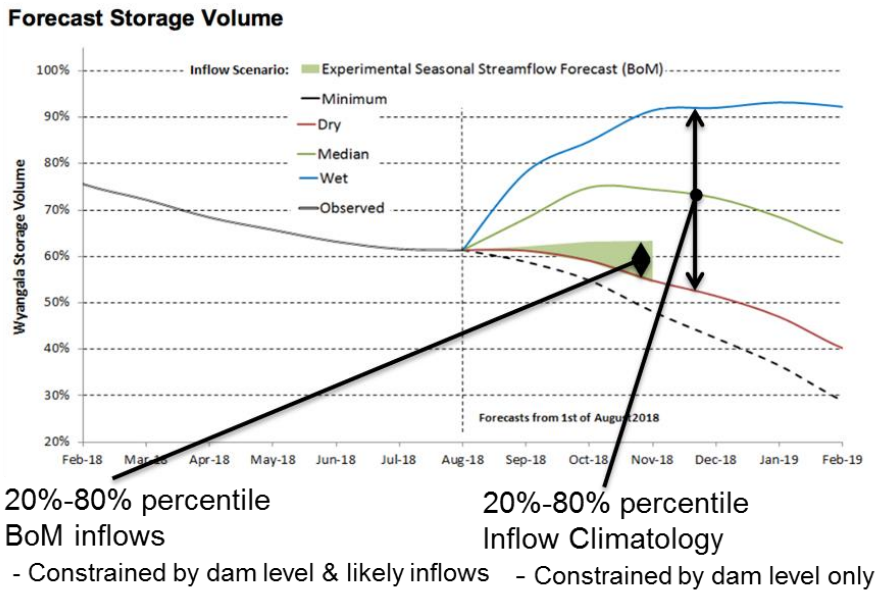
Seasonal streamflow forecasting locations





Streamflow 3-month forecast

- Likely change in dam volume in 3 months
- Informed by likely dam inflows, current dam level, and likely water demand



20%-80% percentile BoM inflows
- Constrained by dam level & likely inflows

20%-80% percentile Inflow Climatology
- Constrained by dam level only

http://www.bom.gov.au/water

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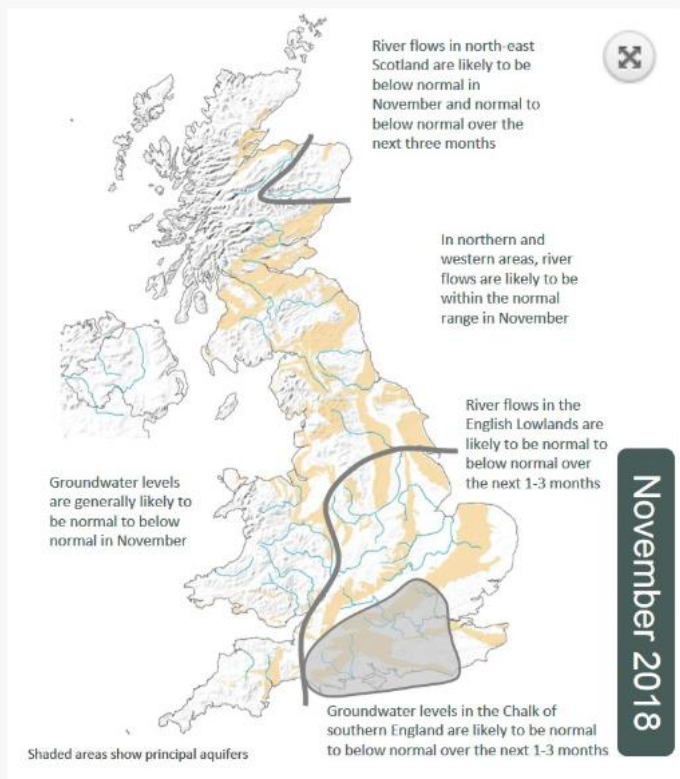
Period: From November 2018 **Issued on 08.11.2018 using data to the end of November 2018**

Summary

The outlook for November is for normal to below normal river flows across the English Lowlands and normal to below normal groundwater levels in the Chalk of southern England, with some notably low levels especially in the south-western part of the aquifer. Elsewhere, river flows are generally likely to be within the normal range and groundwater levels are mostly likely to be normal to below normal. The three-month outlook for river flows and groundwater levels is predominantly similar to the one-month outlook, with river flows and groundwater levels likely to be normal to below normal in parts of the south-east and within the normal range elsewhere.

https://www.hydoutuk.net/latest-outlook/



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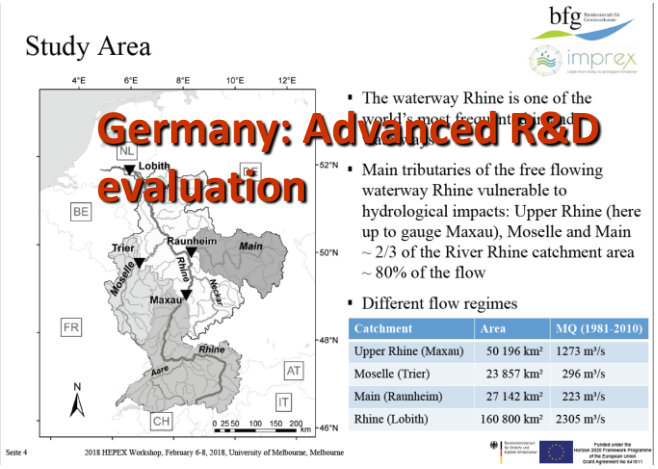
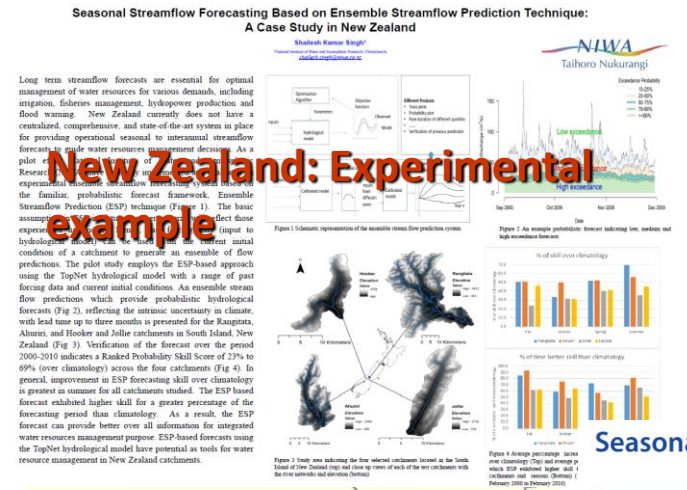
USA: Operational services deeply integrated with water resource management

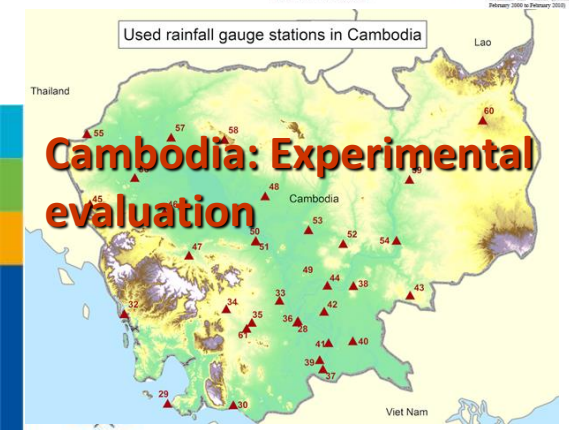


Germany: Advanced R&D evaluation

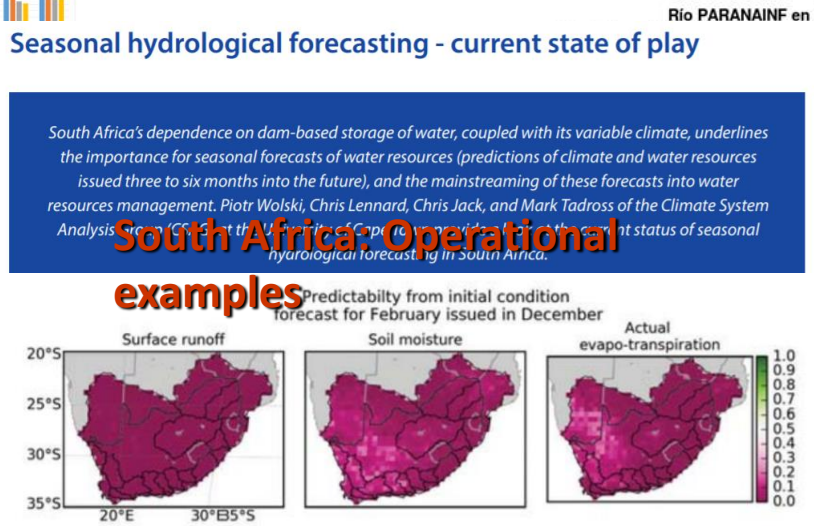


New Zealand: Experimental example

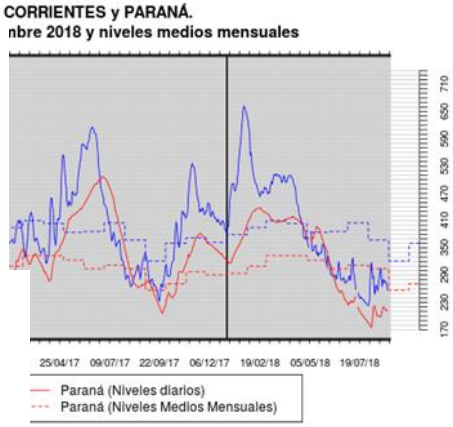
South America: Operational examples



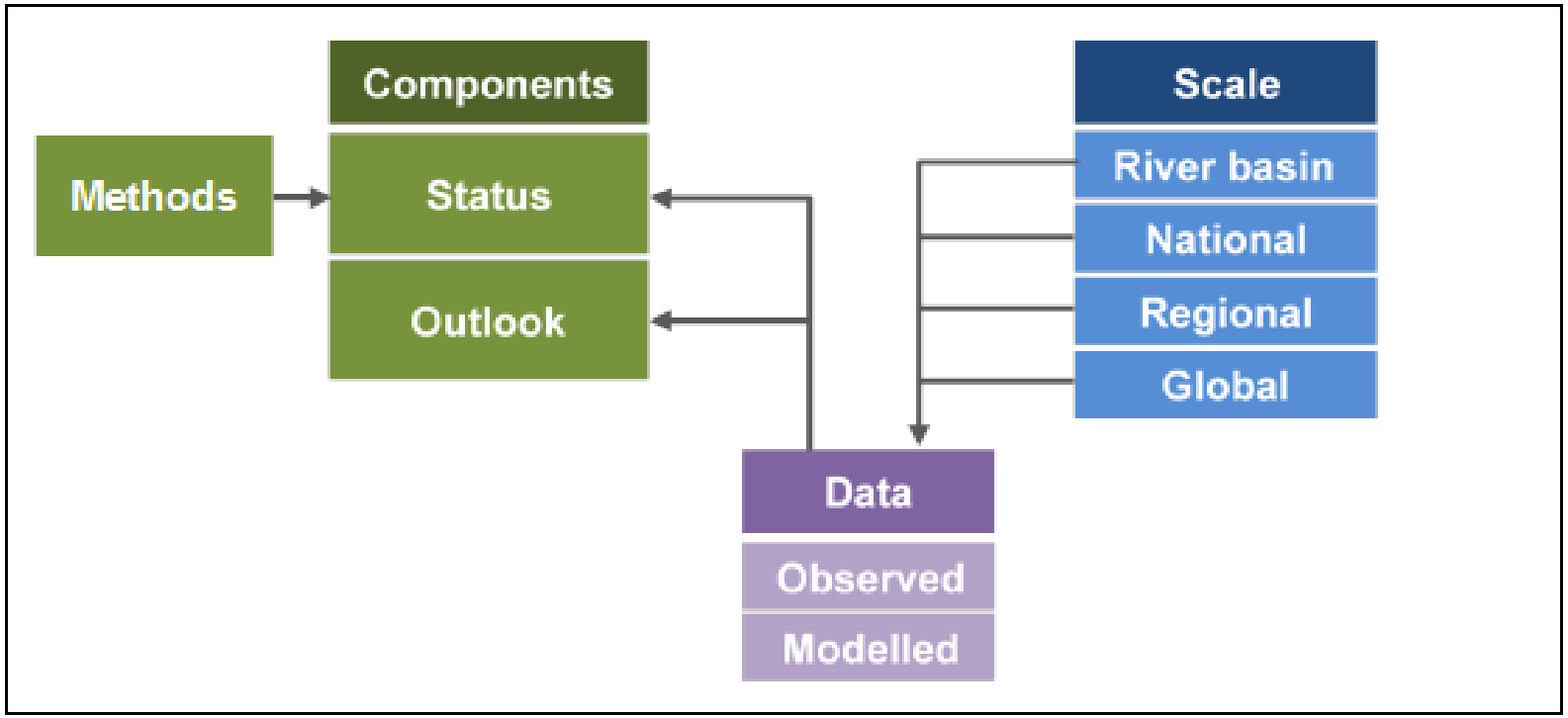
Cambodia: Experimental evaluation



South Africa: Operational examples



What does HydroSOS intend to deliver in the current phase



- Intended for National Hydrology Agencies
- Collate driving data for the pilot regions
- Trial methods to describe status and outlooks
- Different spatial and temporal scales
- Develop plan for post 2020 implementation

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Thank you

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