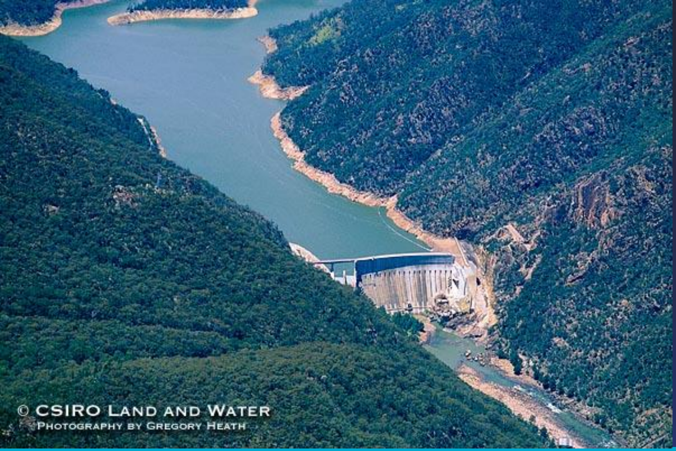


Ground and satellite based observations in water resource management

OzEWEK 28-29 October 2014

Geoff Podger

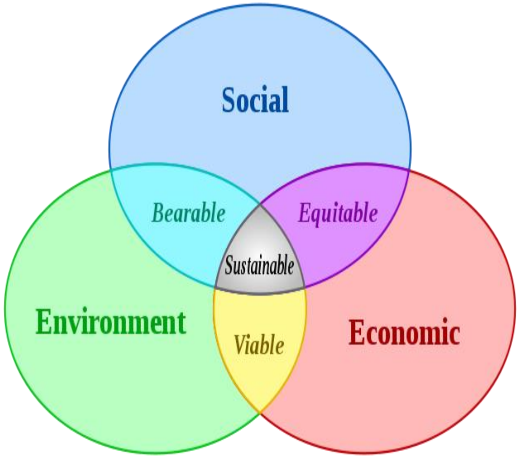
Session 2a 13:30-15:00 Tuesday, 28 October 2014

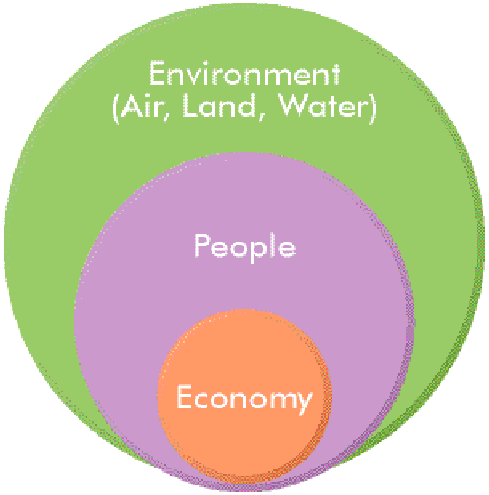
So what is water resource management

“**Integrated Water Resource Management (IWRM)** is a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems". GWP-TAC, 2000.

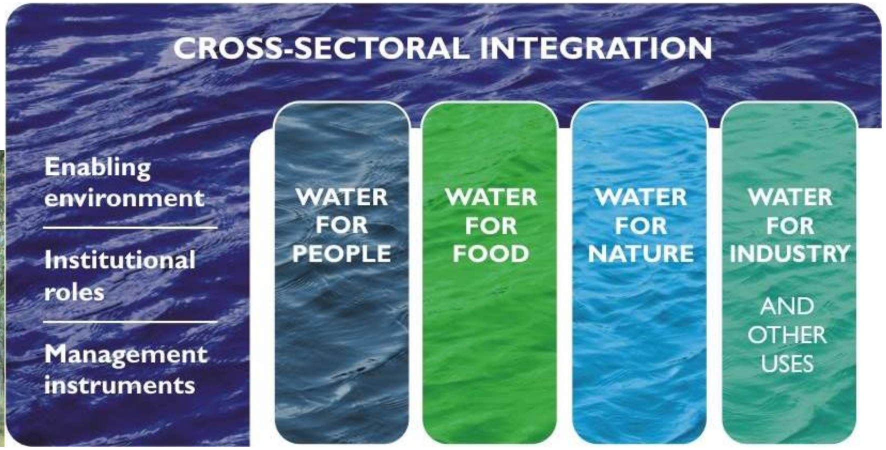
Triple bottom line:

1. Social equity
2. Economic efficiency
3. Ecological sustainability





Key elements of IWRM



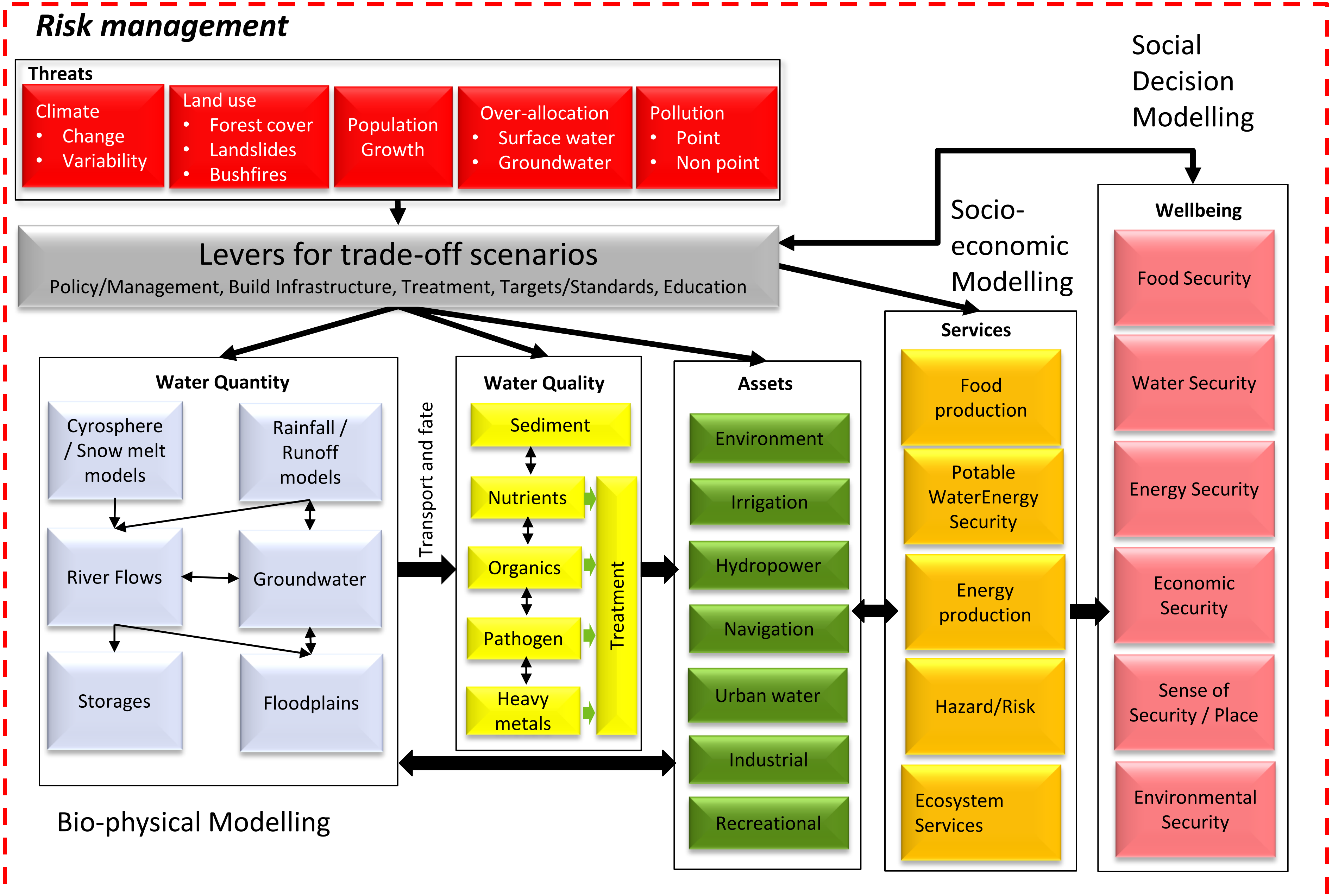
- An enabling environment: Political stability, will and commitment, adequate investment and stakeholder engagement.
- Institution development: Having the right institutions and building the skills, knowledge and understanding within these institutions to support the water resource management journey.
- Management instruments: Tools and methods that support decision makers and inform stakeholders on the impacts of choices on alternative actions.

The focus of this talk is on the tools that support water resource management in particular the bio-physical aspects with some thoughts on socio-economic aspects.

Data and models to support IWRM

- Climate
- Rainfall/Snow/Ice
- Surface water/groundwater
- Water quality
- River system models
- Biophysical models
  - Ecosystems
- Socio-economic models
  - Potable water
  - Hydropower
  - Agriculture
  - Ecosystem services
  - Social benefits

Conceptual IWRM Modelling Framework



So where can satellite and ground based observations help?

Climate
- Change
- Variability

Land use
- Forest cover
- Landslides
- Bushfires

Population Growth

Cyrosphere / Snow melt models

Rainfall / Runoff models

Sediment

Environment

Food production

Irrigation

River Flows

Groundwater

Organics

Storages

Floodplains

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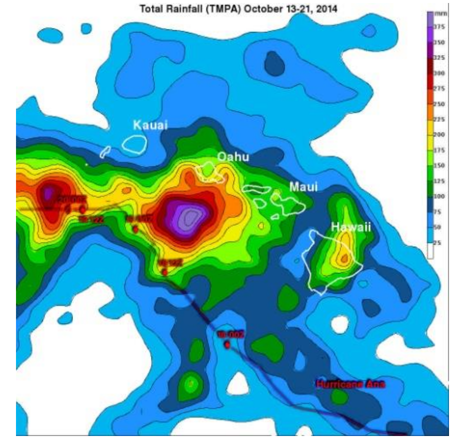
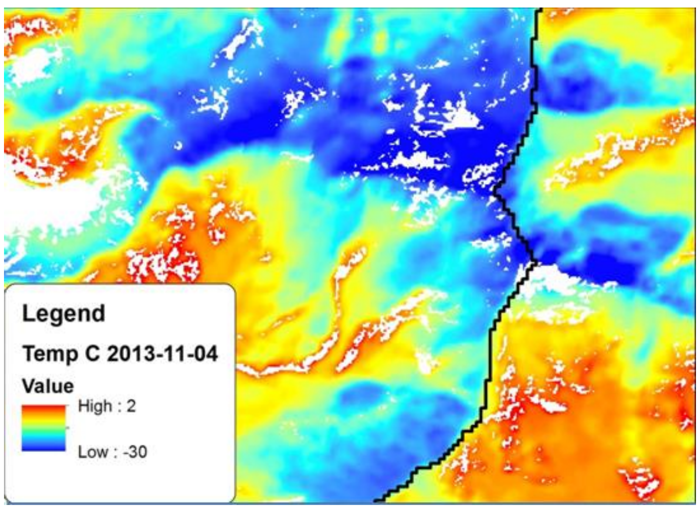
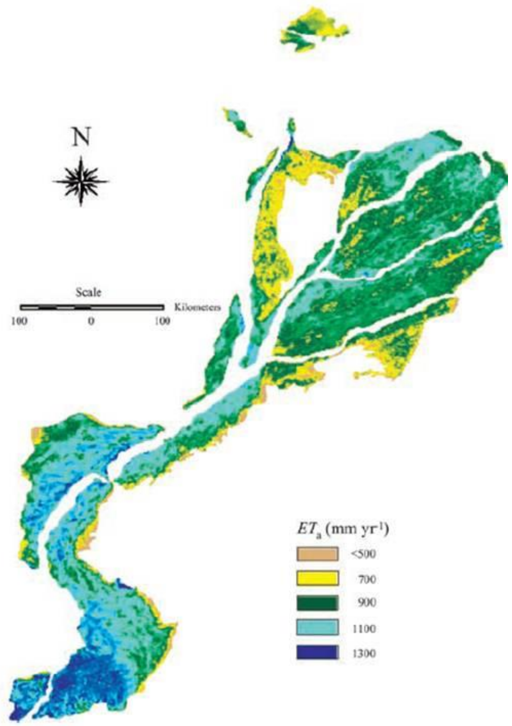
Climate

- Rainfall: TRMM, Radar
- Evapotranspiration
- Temperature

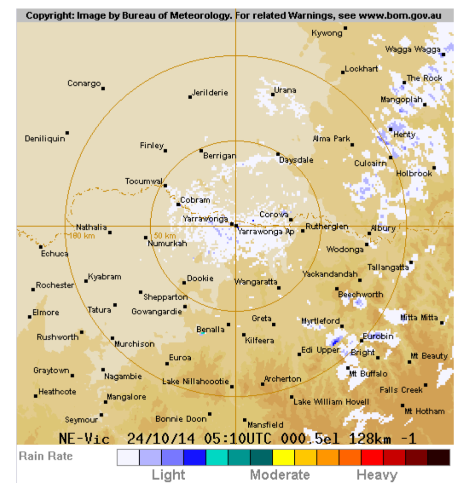


NASA TRMM



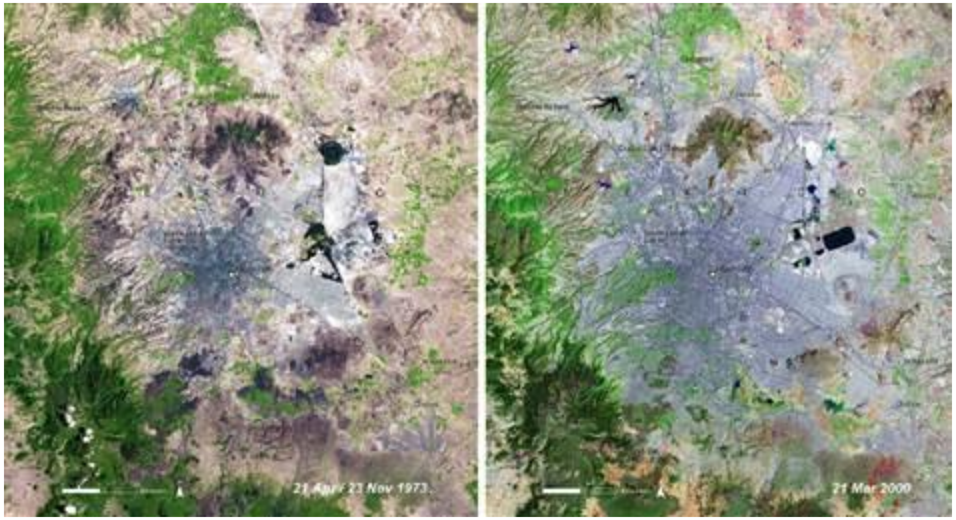


Mobin Ahmad ET Indus



BoM Radar

LULC and Population



UN Atlas: Mexico 1973 and 2000

NASA: Population from night lights

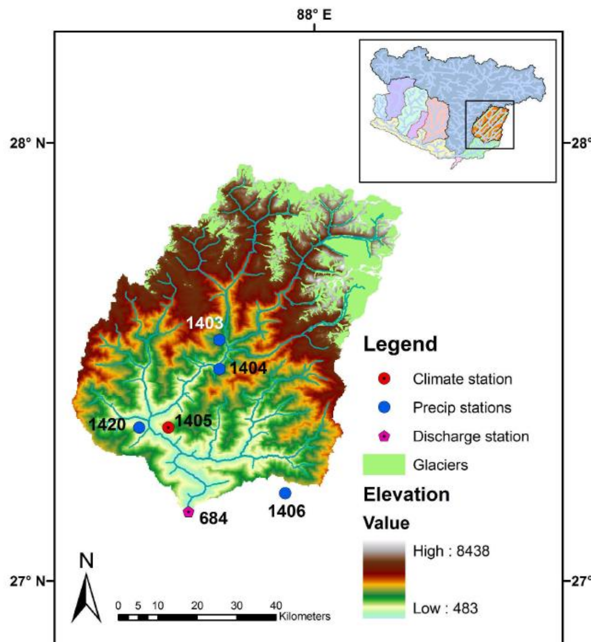
Forest Cover

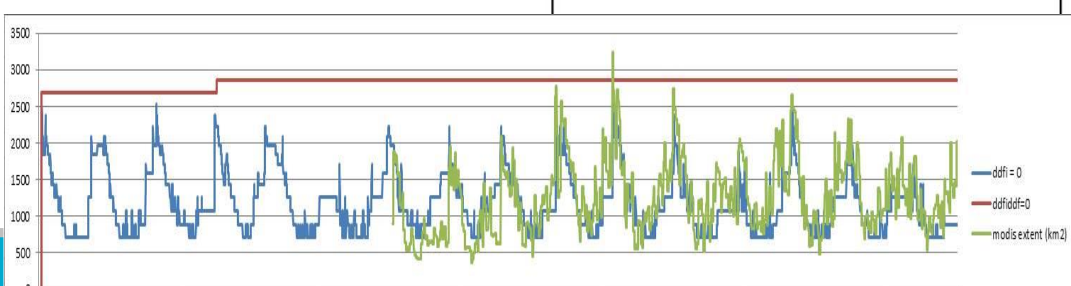
Farm dams

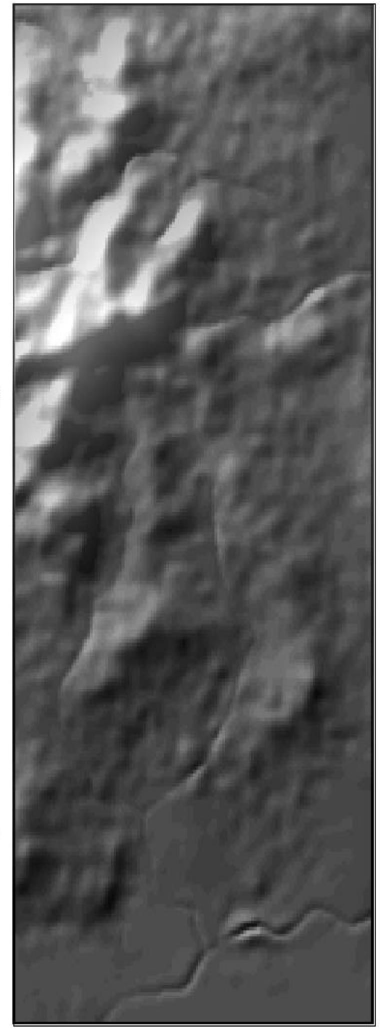
Rainfall runoff models

- DEM
  - Catchment boundary
  - Elevation
- Snow cove

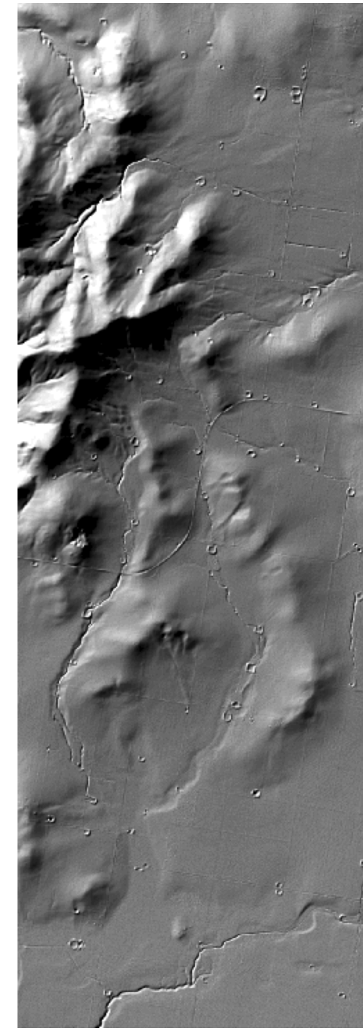
Tamor daily rainfall runoff model





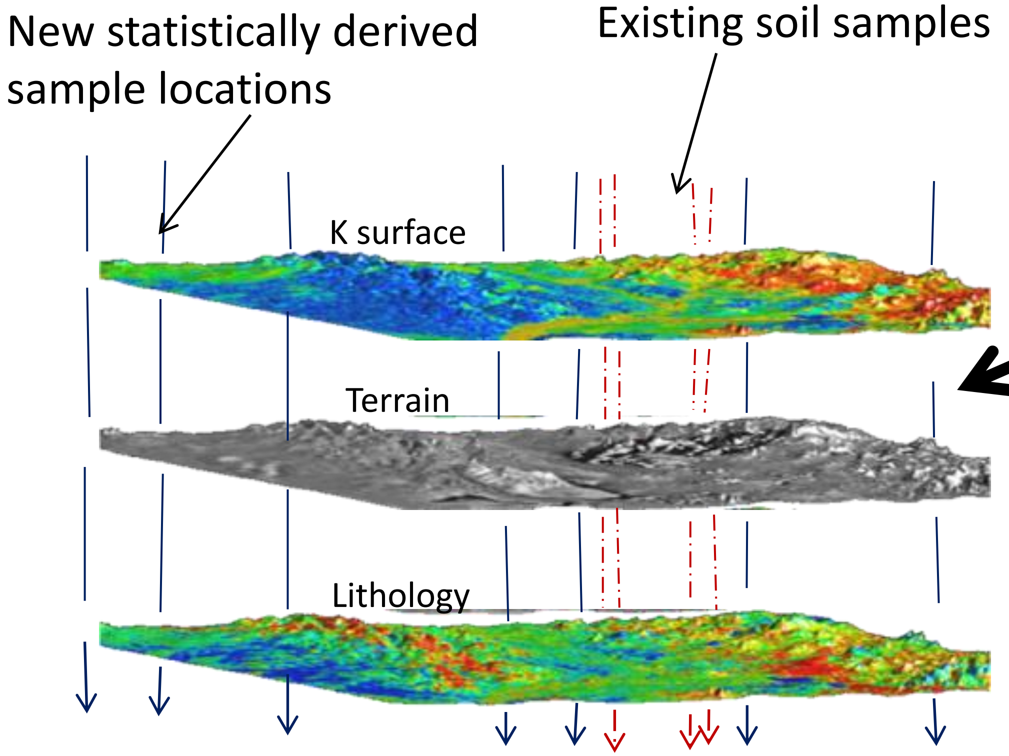


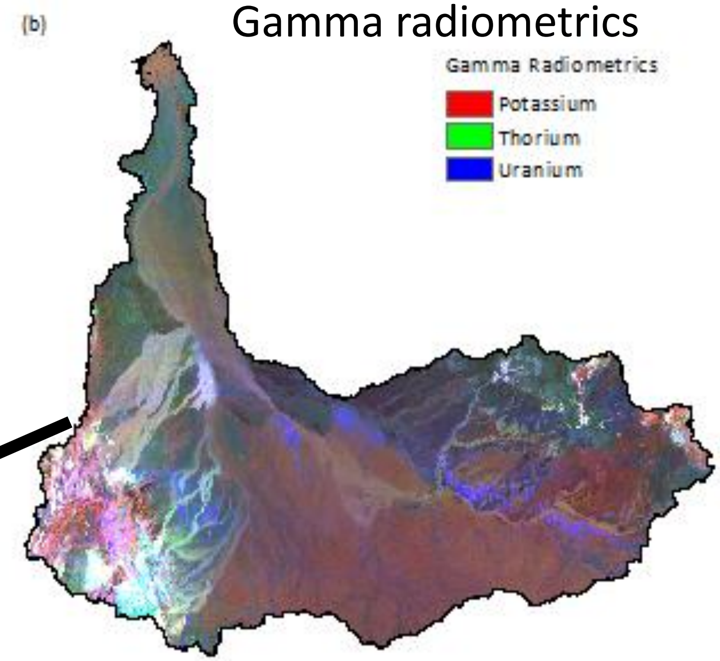
DEM-H 1 second



Lidar 5 m

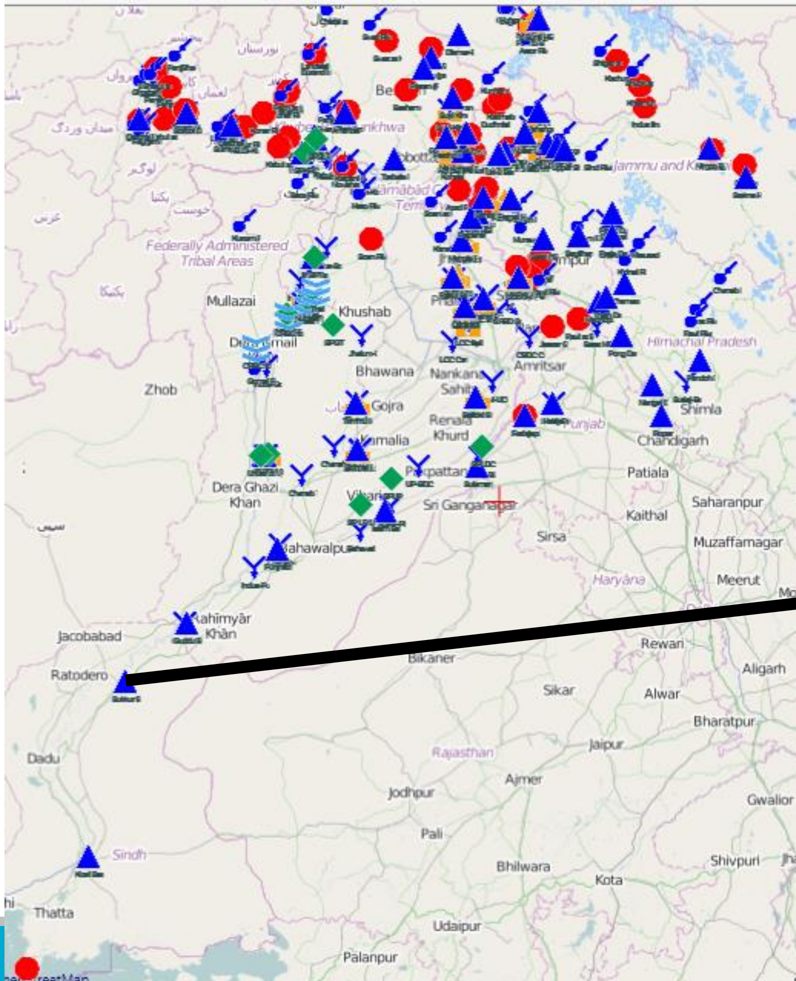
Soils


New statistically derived sample locations
Existing soil samples
K surface
Terrain
Lithology


(b)
Gamma radiometrics
Gamma Radiometrics
Potassium
Thorium
Uranium

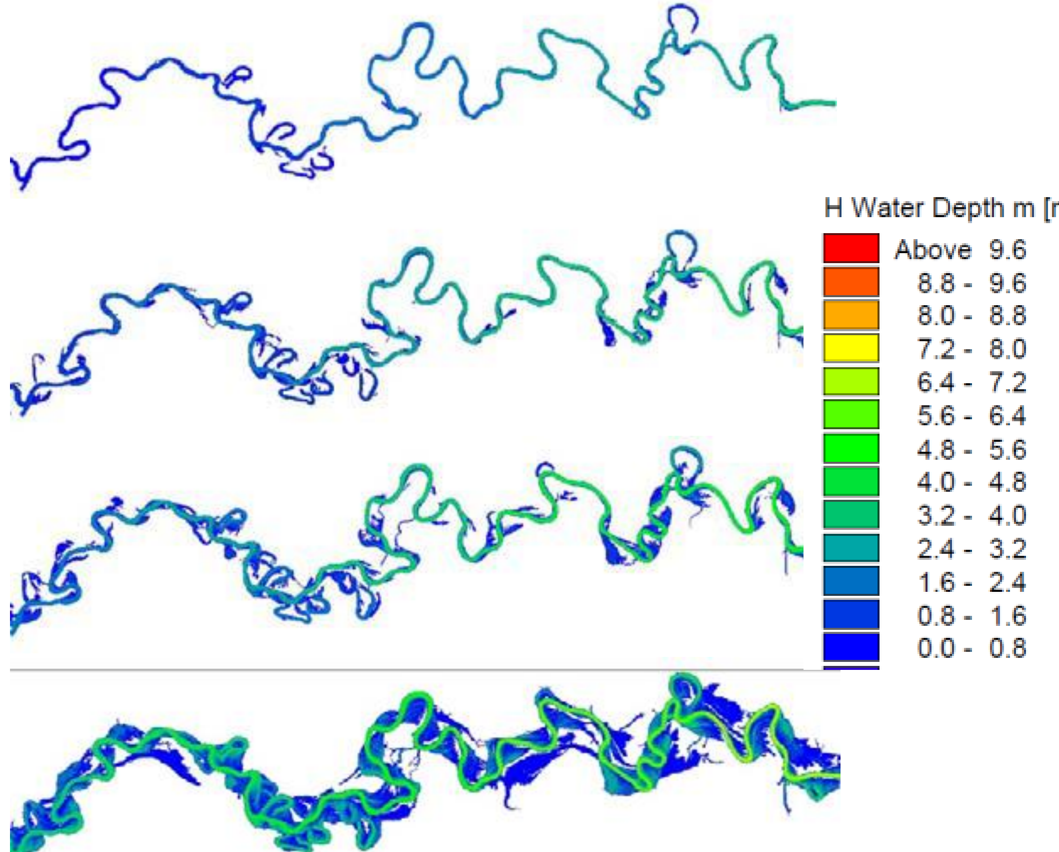
River system model conceptualisation

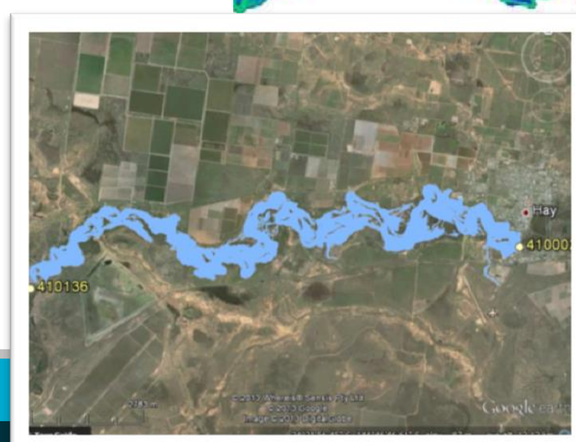
- Location of gauges, rivers and infrastructure



Floodplains

- Flood extent
- Vegetation response

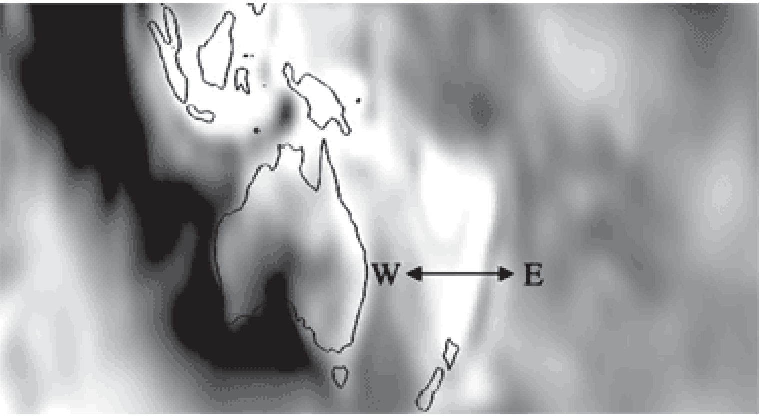


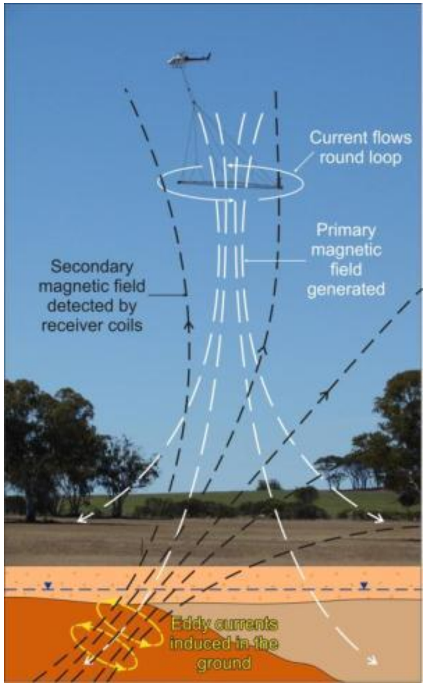


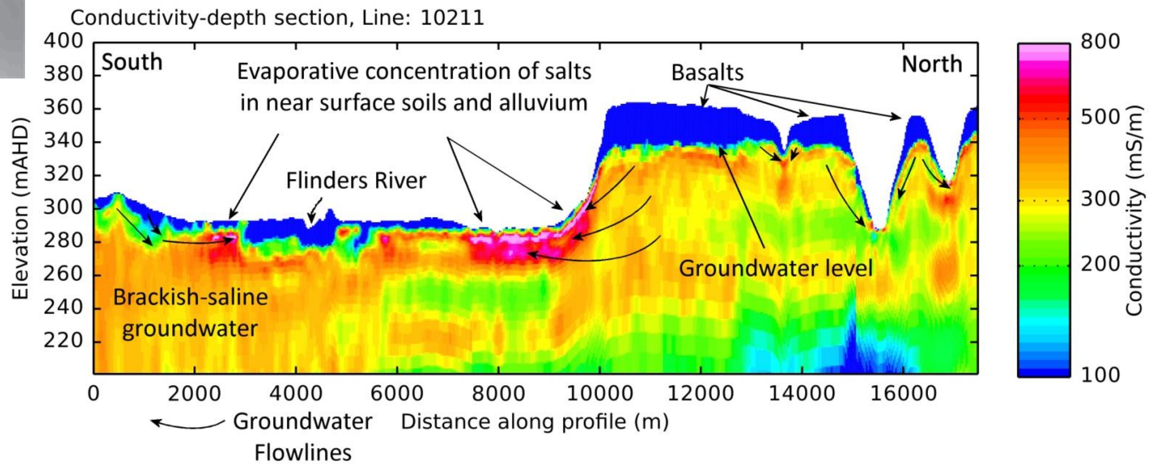
Simulated inundation by LiDAR based approach Dutta et al

Groundwater

- GRACE
- Airborne geophysics

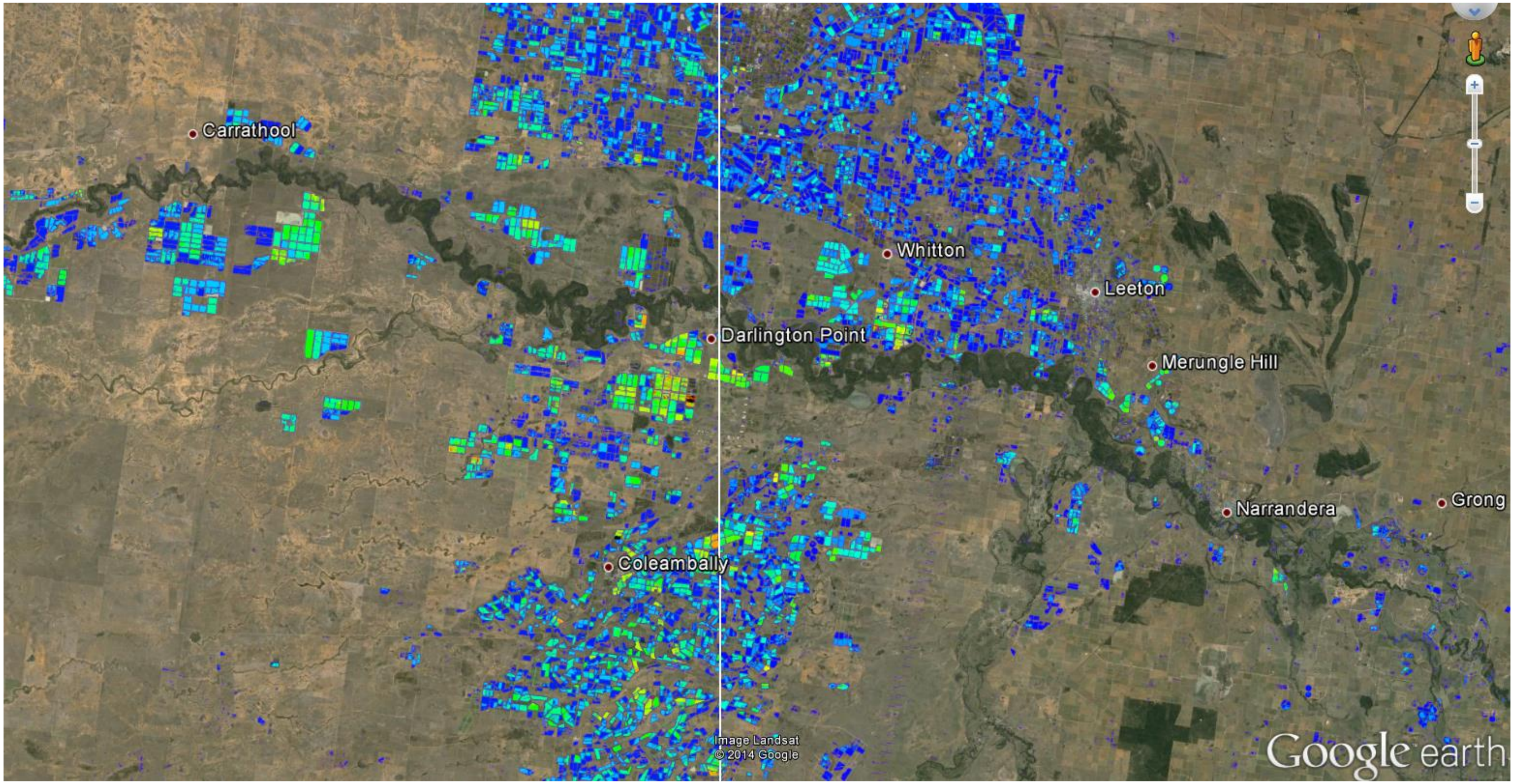






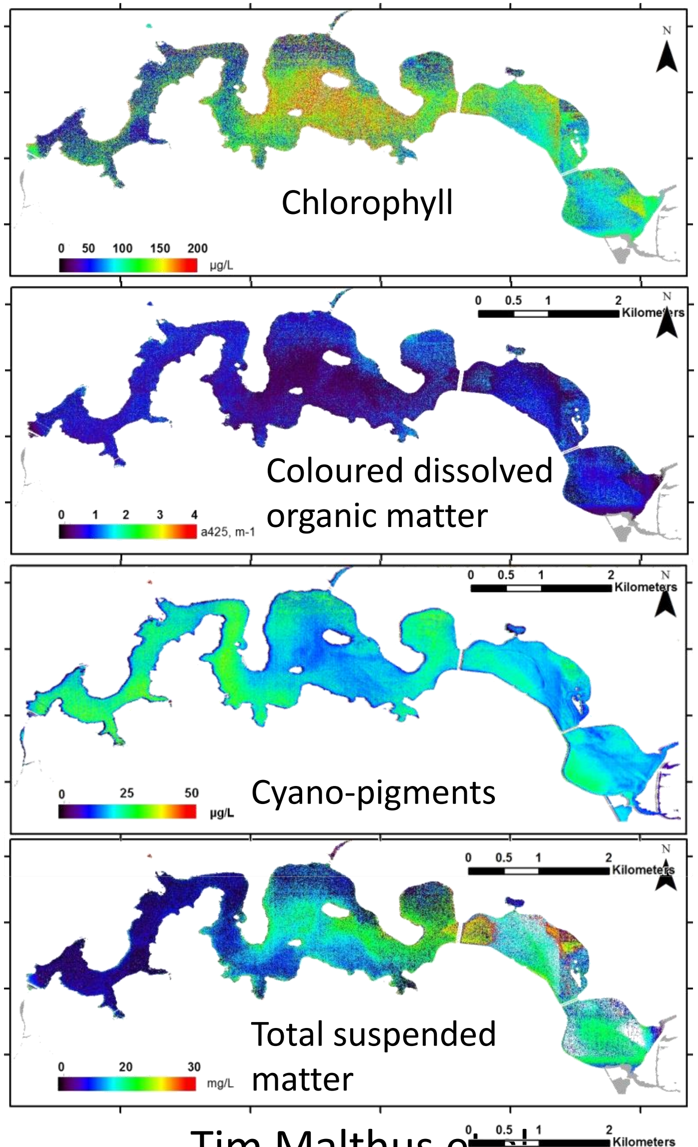
Irrigation

- Monthly time series of vegetation greenness (crop type and yield)
- Monthly evapotranspiration estimates (irrigation areas)



Jorge Peña-Arancibia

Sediment and algae

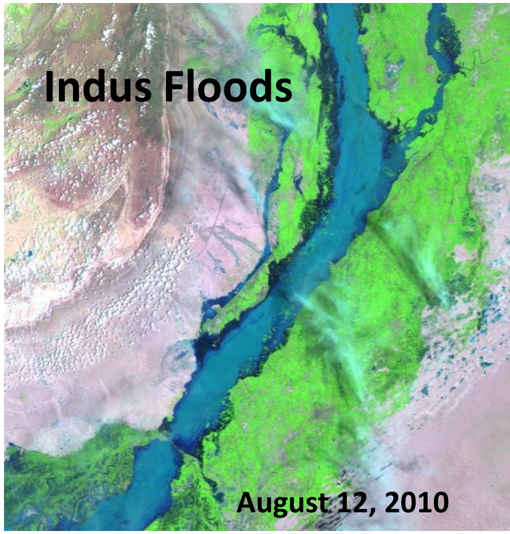


Tim Malthus et al

River fluxes: relative contributions and errors

Flux	Type	Significance	Flow	Error	Comment
Gauge flows	Inflow	Typically largest flux	Average	10%	For stable gauge
	Outflow		Low	>200%	
Extractions	Irrigation	Can be large in regulated systems (50% average, 80% in dry)	Average	10-20%	If gauged
	Environment	Floodplain storage can introduce significant losses (20-50%)	High		Typically not gauged
	Urban	Small: Large demands are typically from dams not rivers (<1%)	Average	10%	Usually well metered
Ungauged inflow		Area dependent can be large in rainfall events (10-20%)	High	10-30%	Typical rainfall runoff model error
Groundwater		Small significant during low flows (<10%) Can be large part of water balance	Low		Not measured
Net evaporation	River	Small (<10%)	Average	10-20%	Surface area may be the largest source of error

So where are the big gains in WRM



- Rainfall
  - Primary driver of models
  - Poor spatial coverage
- Floodplains
  - Large part of water balance
  - Important for vegetation response and environmental flows
- Irrigation
  - Large water user
  - Crop type and production directly links to economic and social impacts
- Groundwater
  - Not well understood
  - In some cases can be a primary water source for both urban and irrigation
- Water quality
  - Limited data
  - Spatial extent is important

Words of caution

- We still need ground based observations
  - To calibrate and verify models
- Satellite and airborne observations can help to understand the spatial extent but we need to remember there are errors in this process.
- We need to be aware of the uncertainties and how these propagates through models and how this impacts on the results from our models
- Satellite records are becoming long but often we need to go back in time (1900s-1960s) to understand the variability, so we need to rely on different data sources.
- The IWRM story is much more that bio-physical and we need to understand the impacts on livelihoods and wellbeing and remote sensing is of limited help here.

CSIRO

Summary

- Water resource management is concerned with environmental, social and economic impacts of sharing water resources.
- There is never enough data but the combination of ground based, air borne and satellite date is helping our understanding and reducing the uncertainty in our models.
- There are a broad range of products that can help in a lot of areas.
- There are some clear areas where we can make significant gains in reducing the uncertainty in our water balances.
- Ground based data is still required to calibrate both physical and remotely sensed models.
- The story is much bigger that bio-physical and we need to think about how we better tell the story about what this means for people, particularly the poor and vulnerable.

Thank you

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