GROUP ON EARTH OBSERVATIONS

The GEOSS Water Cycle Integrator

An Innovative Tool for Effective Collaboration

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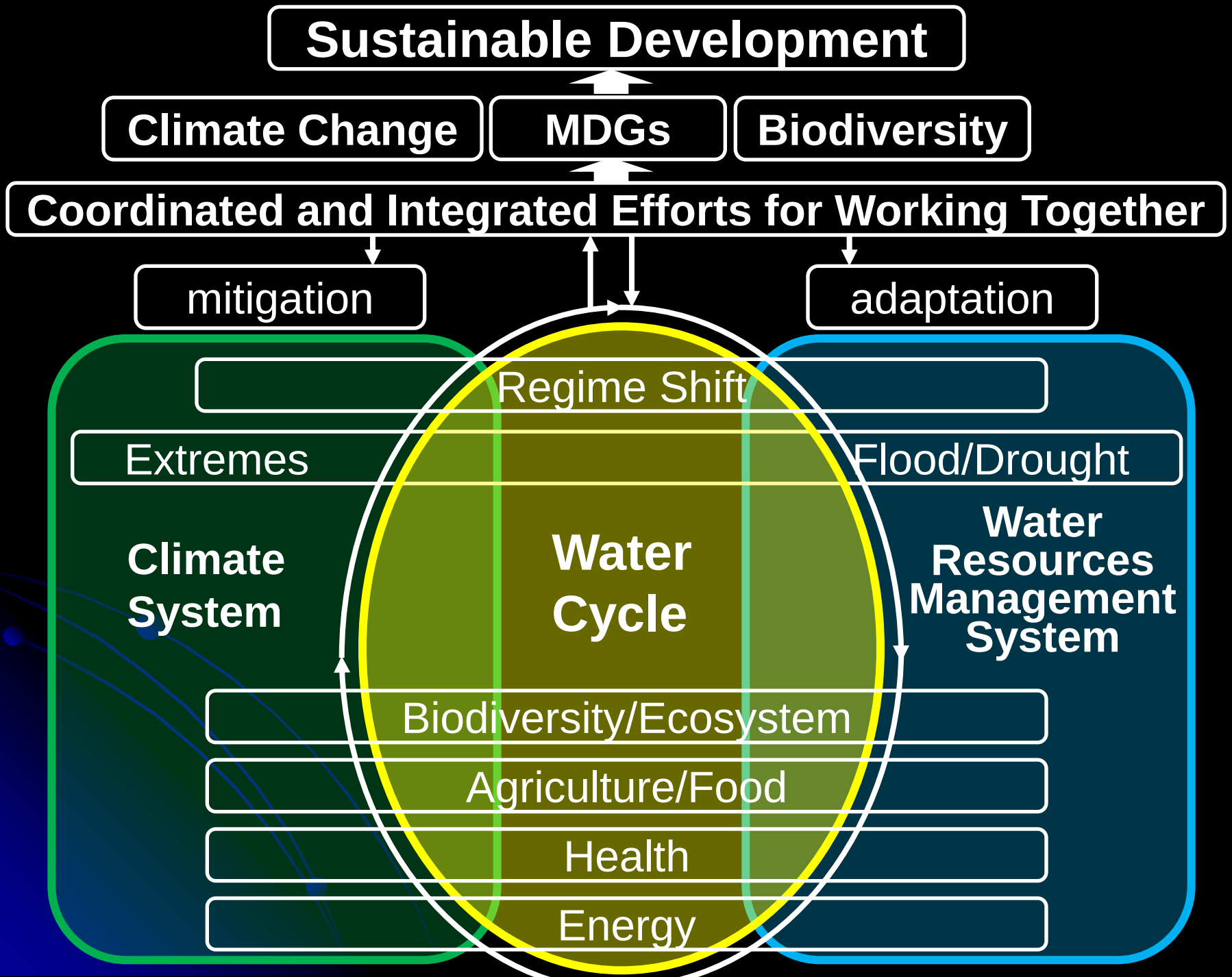
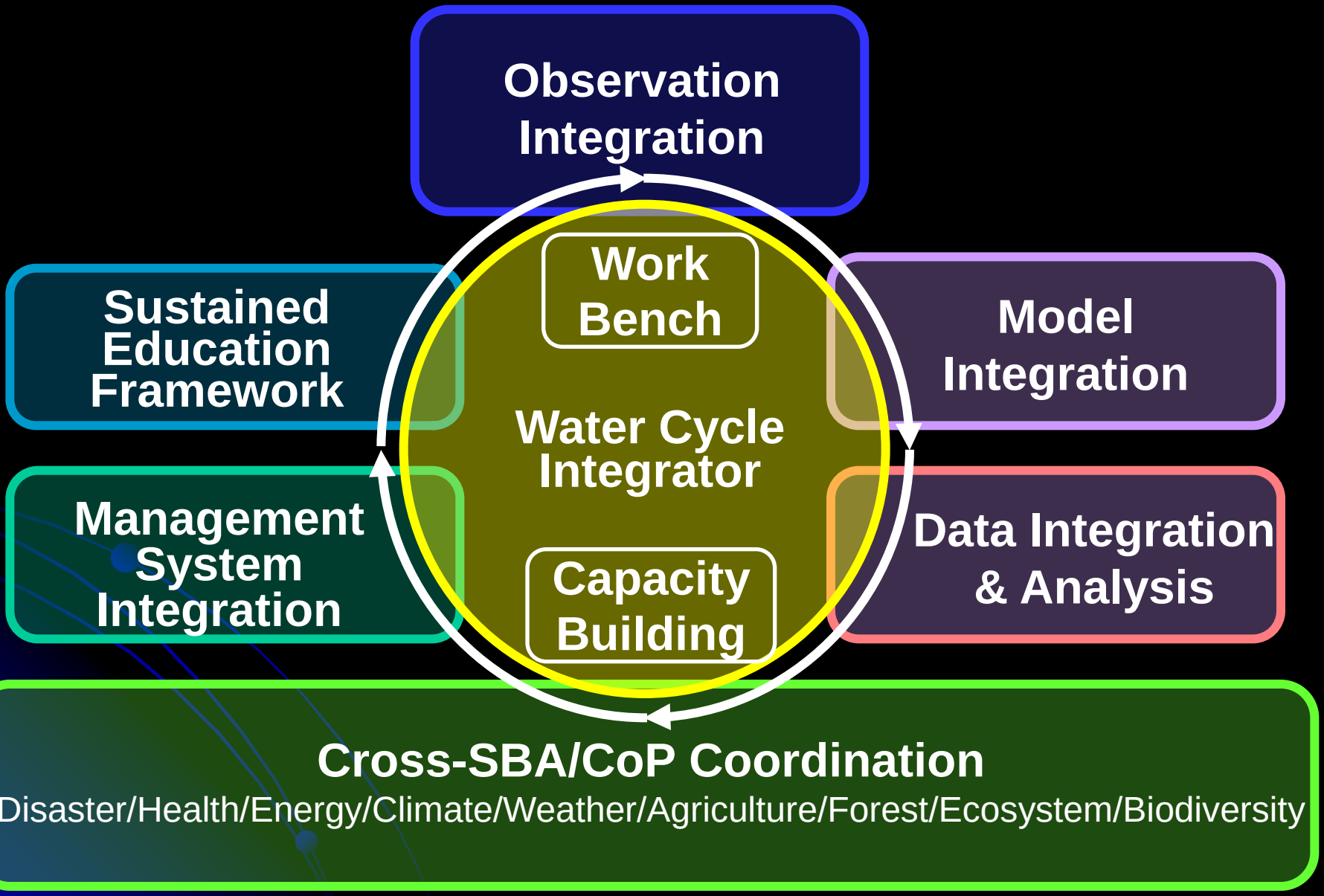
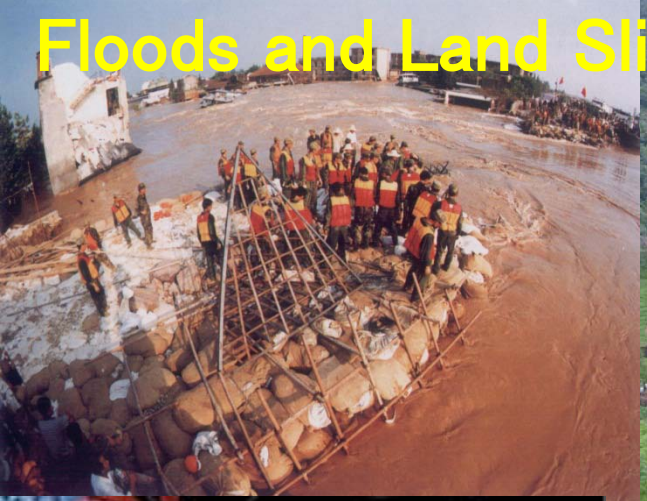
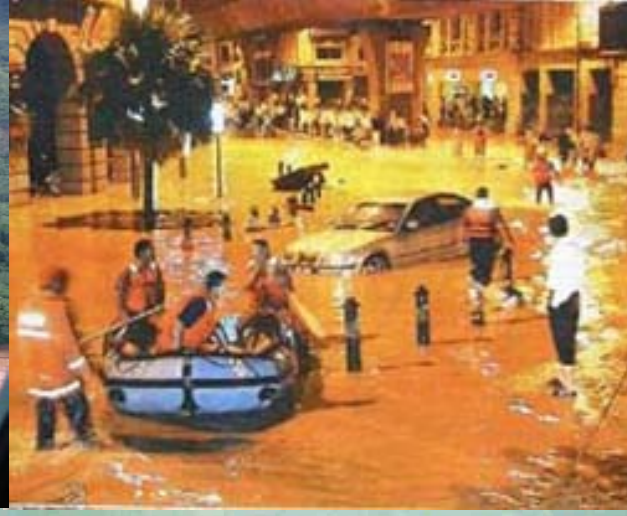

Sustainable Development
Climate Change
MDGs
Biodiversity
Coordinated and Integrated Efforts for Working Together
mitigation
adaptation
Regime Shift
Extremes
Flood/Drought
Climate System
Water Cycle
Water Resources Management System
Biodiversity/Ecosystem
Agriculture/Food
Health
Energy

Integrated & Coordinated Approach

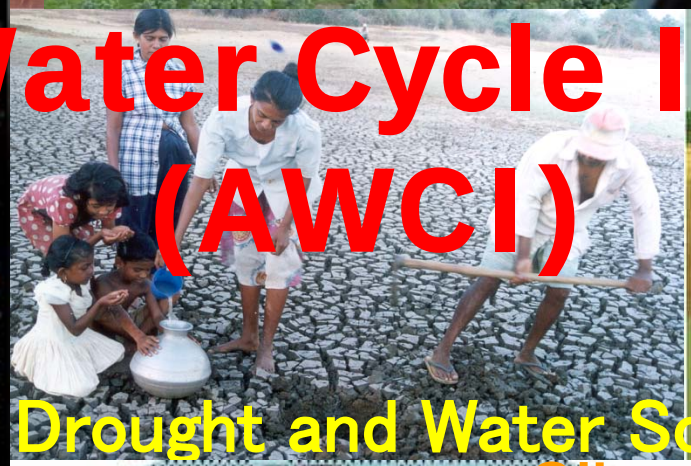


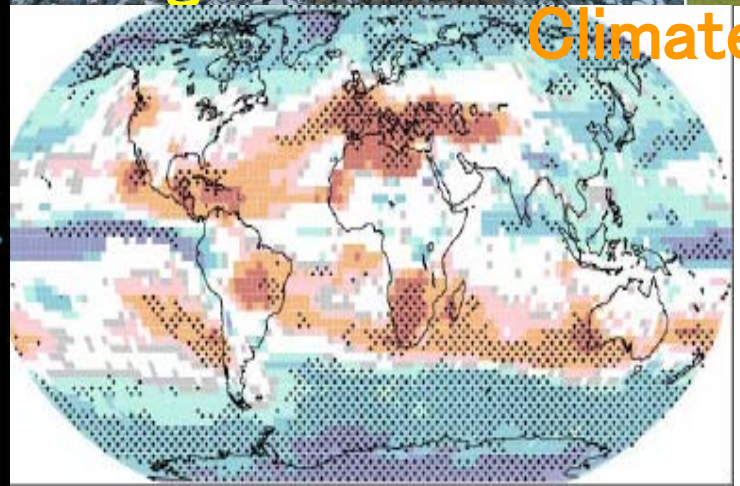


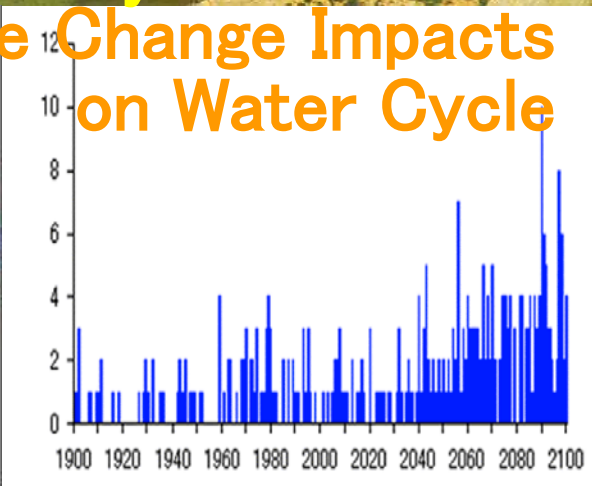


GEOSS

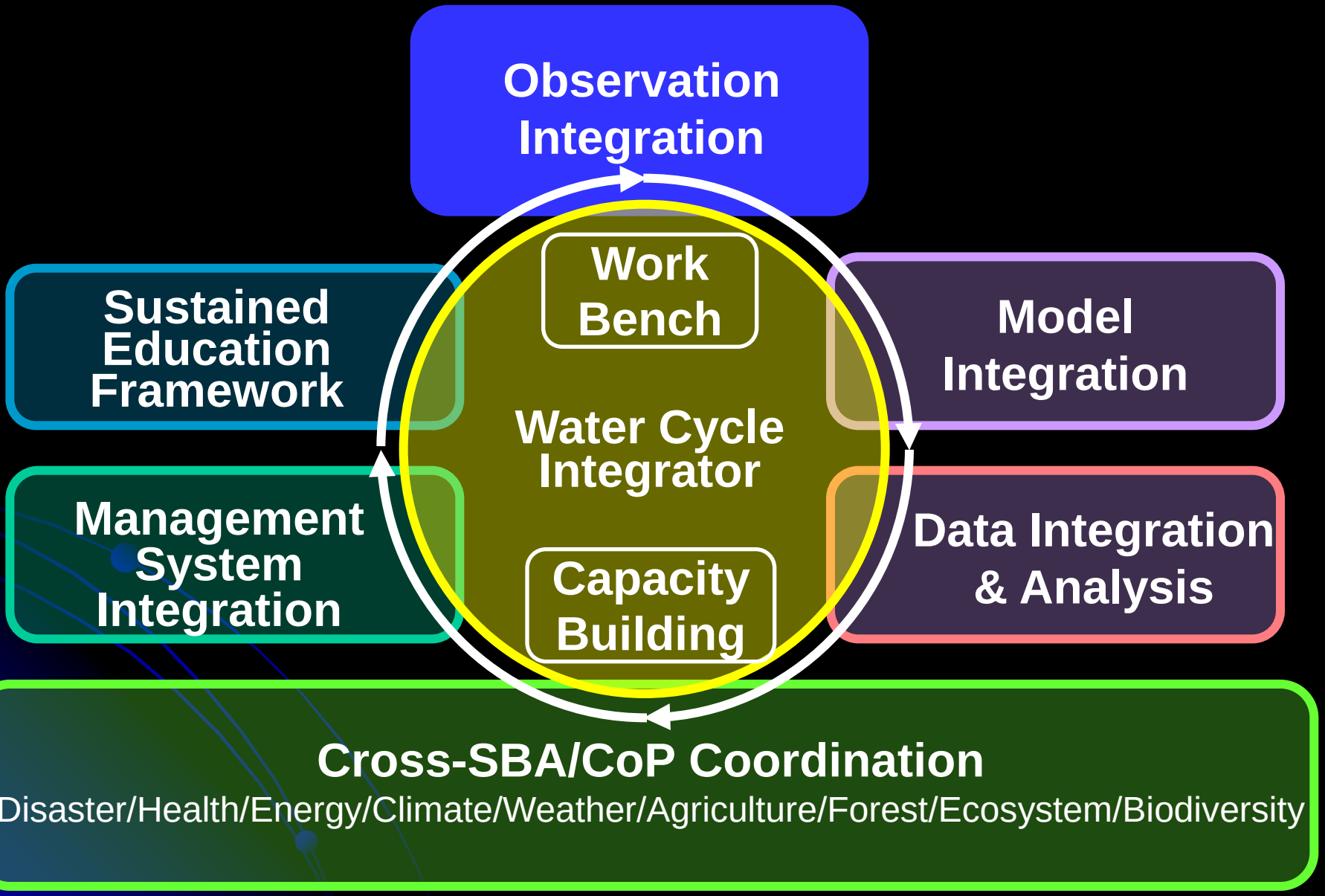
Asian Water Cycle Initiative (AWCI)



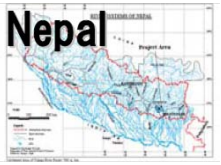


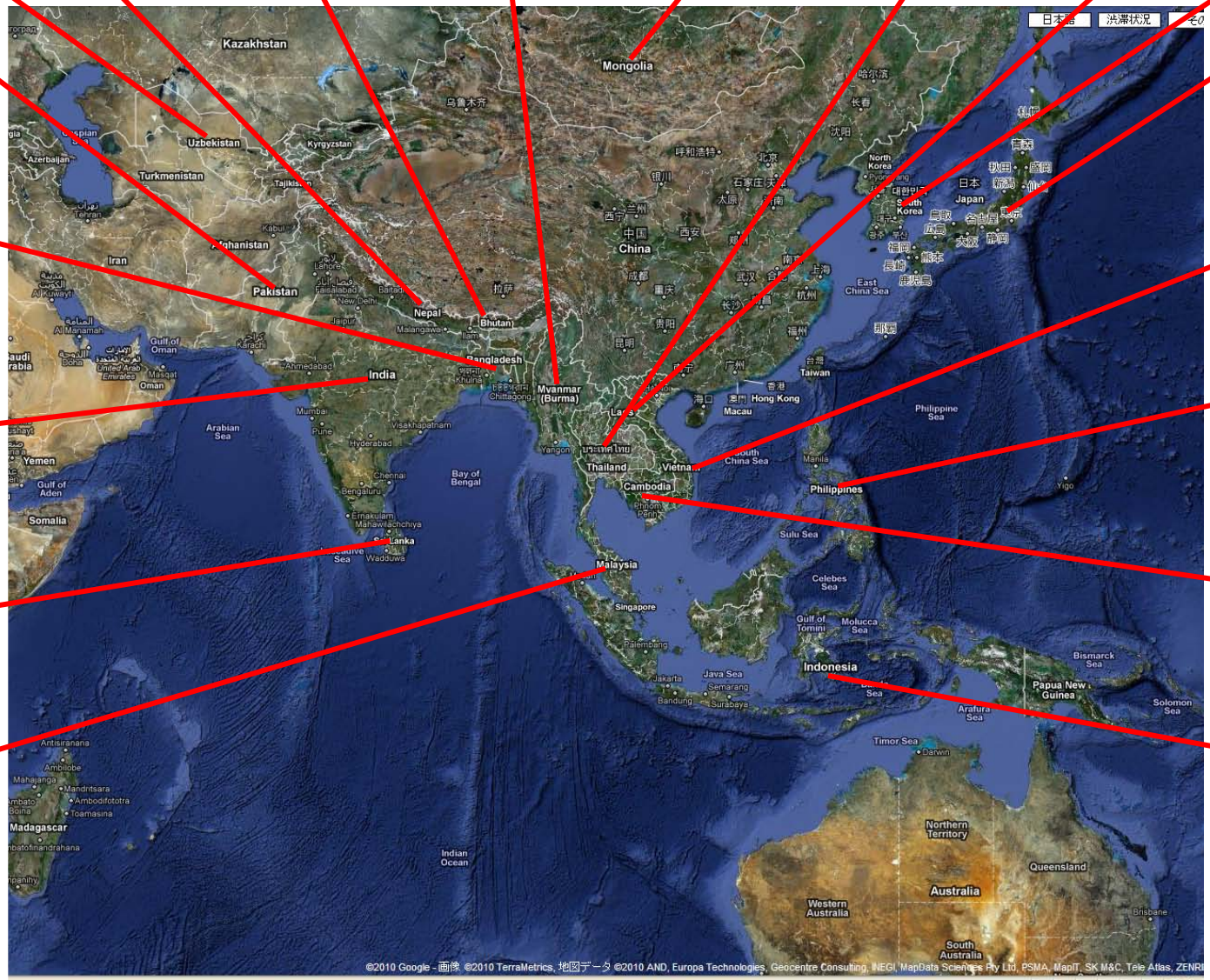


Integrated & Coordinated Approach

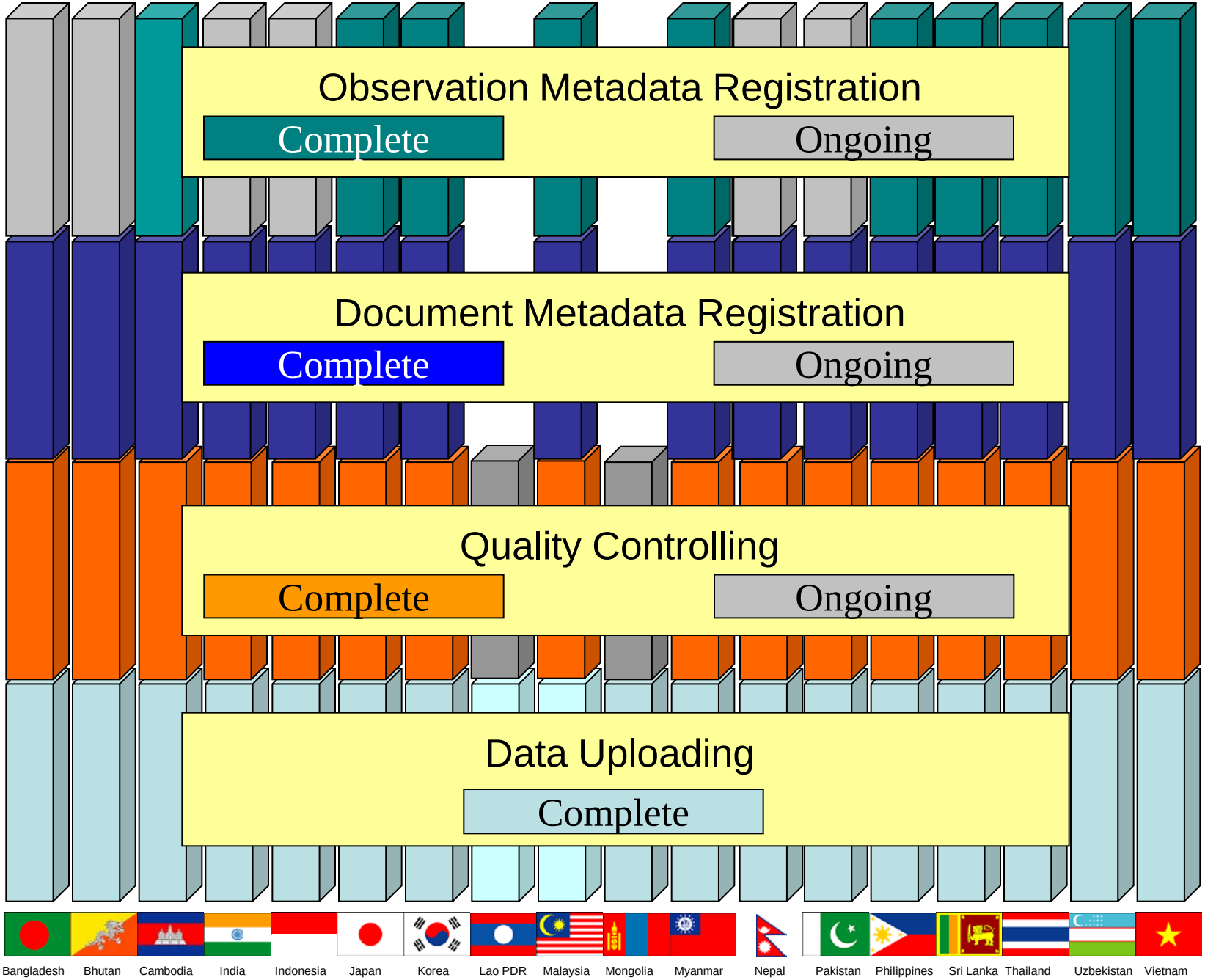


Demonstration River Basins



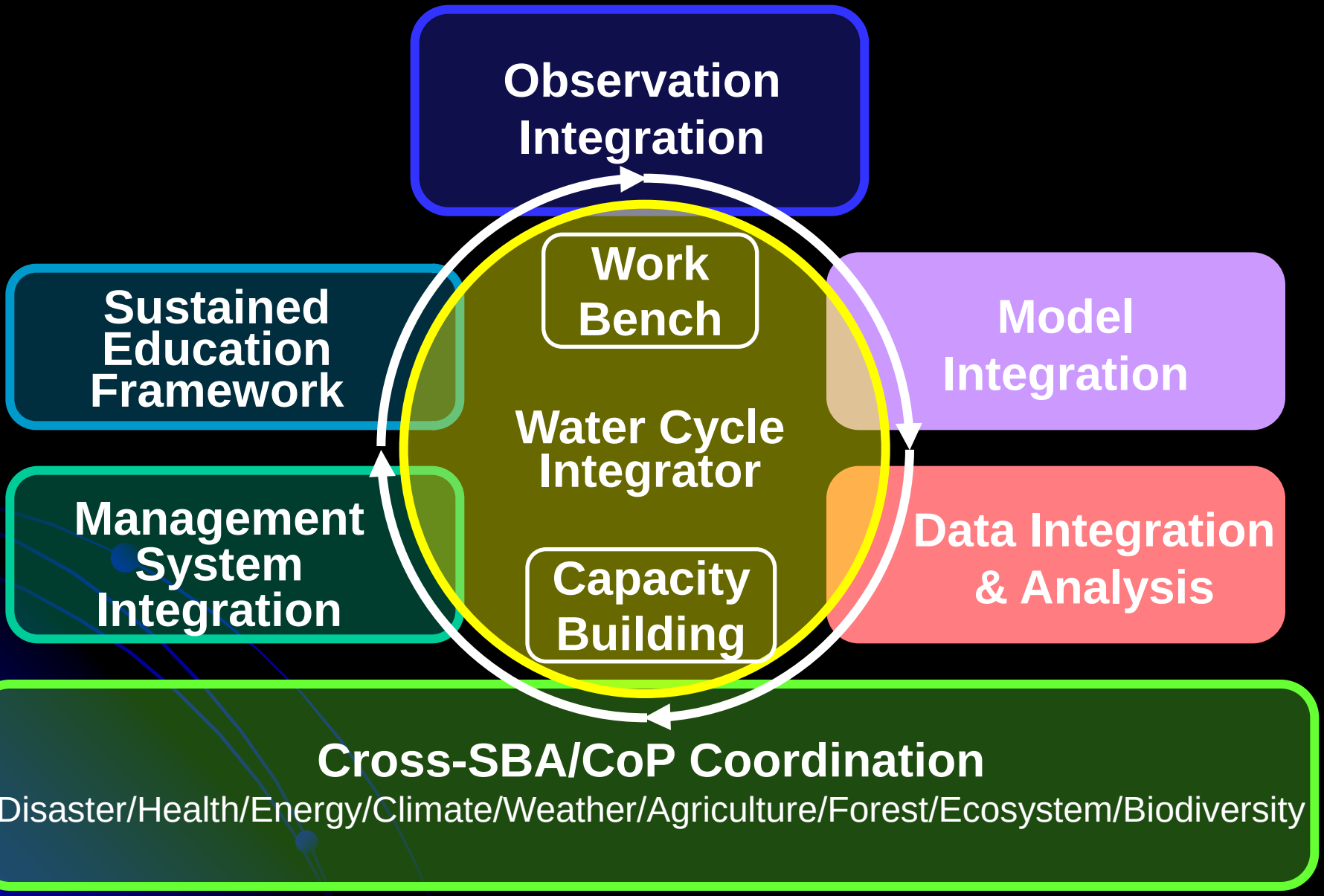


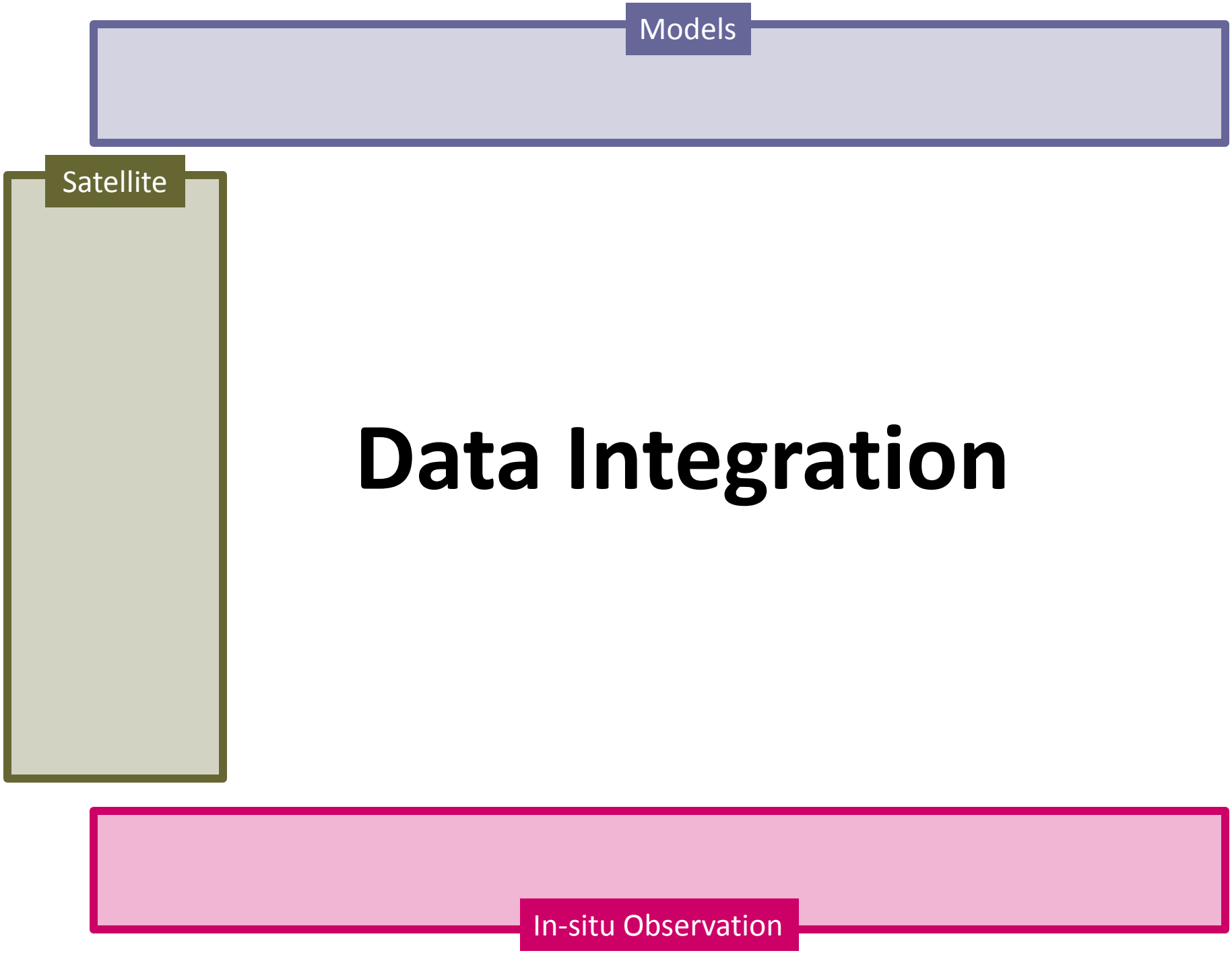
Asian Water Cycle Initiative

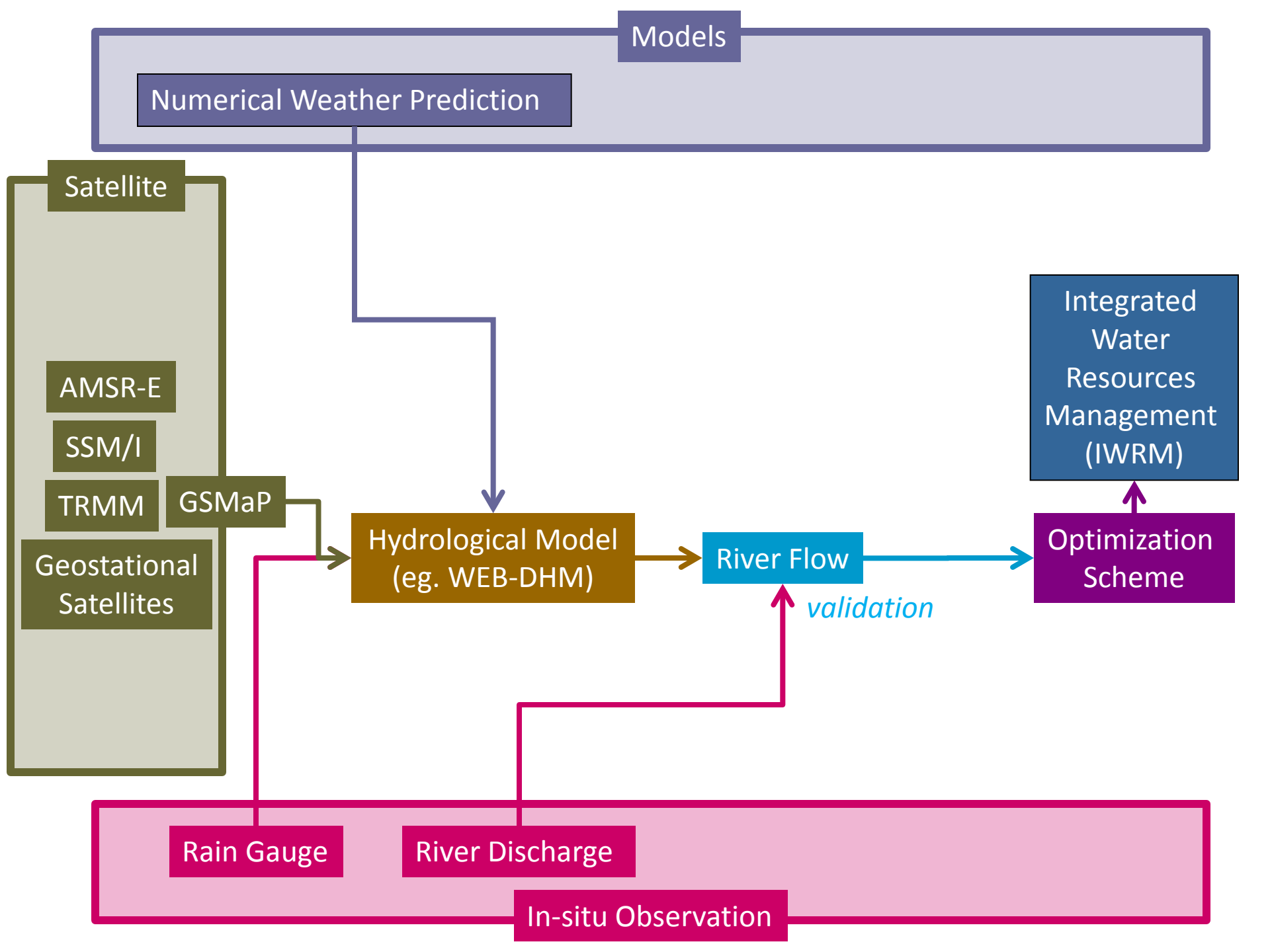

Observation Metadata Registration
Complete
Ongoing
Document Metadata Registration
Complete
Ongoing
Quality Controlling
Complete
Ongoing
Data Uploading
Complete
Bangladesh
Bhutan
Cambodia
India
Indonesia
Japan
Korea
Lao PDR
Malaysia
Mongolia
Myanmar
Nepal
Pakistan
Philippines
Sri Lanka
Thailand
Uzbekistan
Vietnam

Satellite Observation Integration

Integrated & Coordinated Approach




Models
Satellite
Data Integration
In-situ Observation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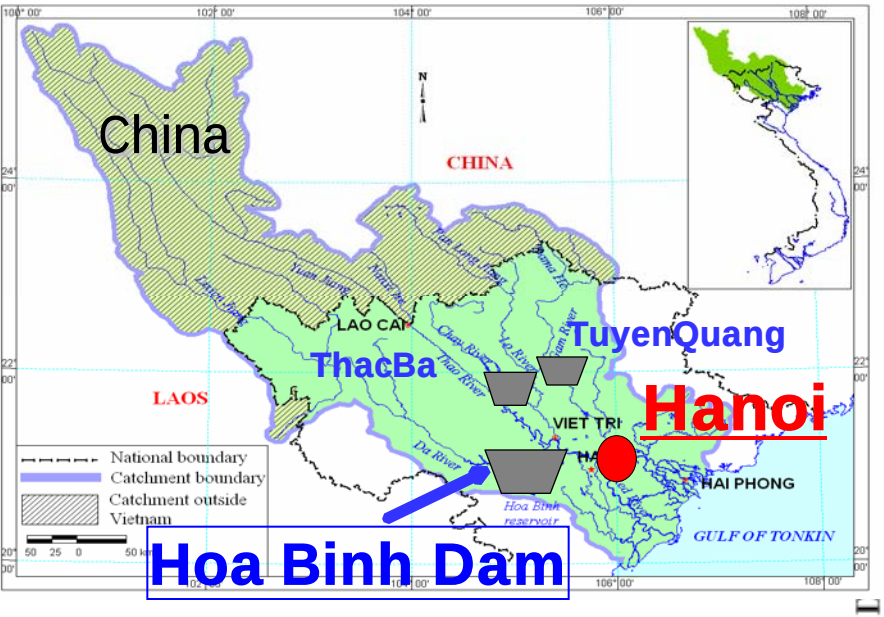
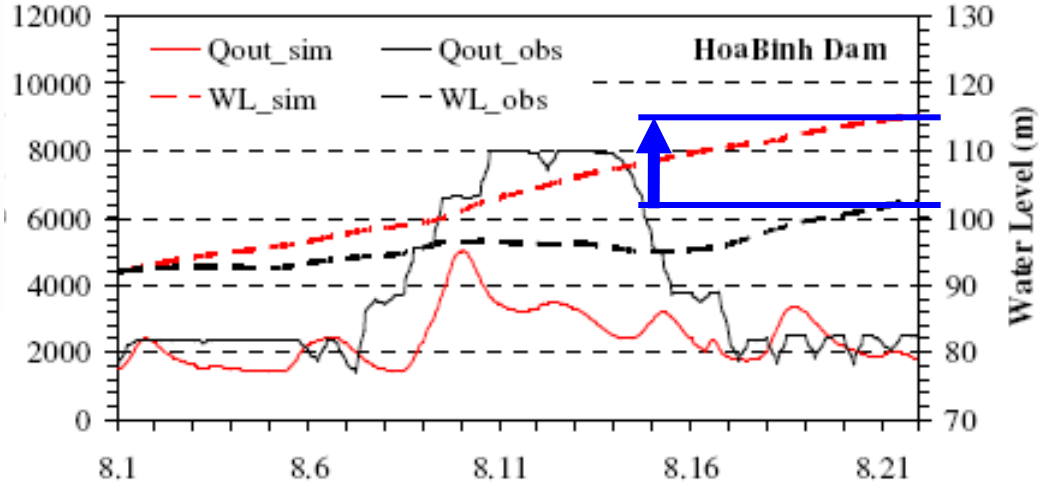
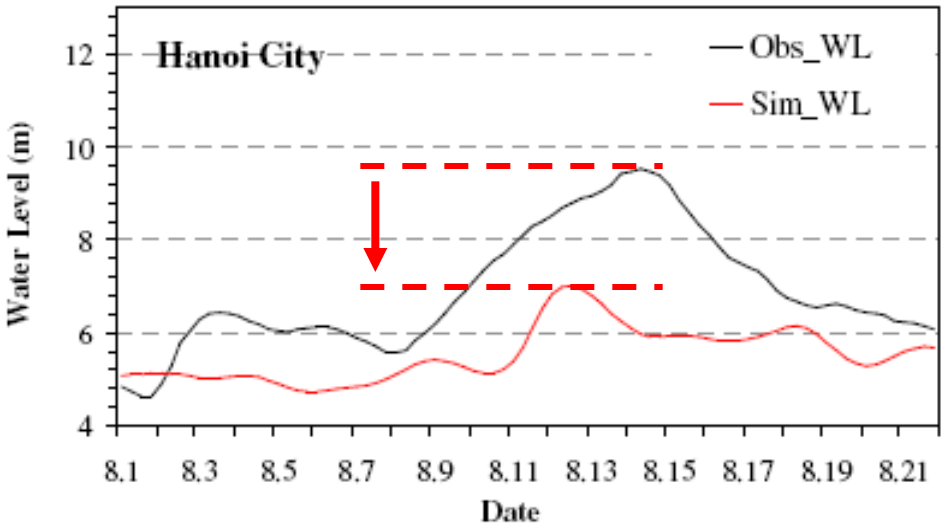
The Red River Basin:
160,000 km²





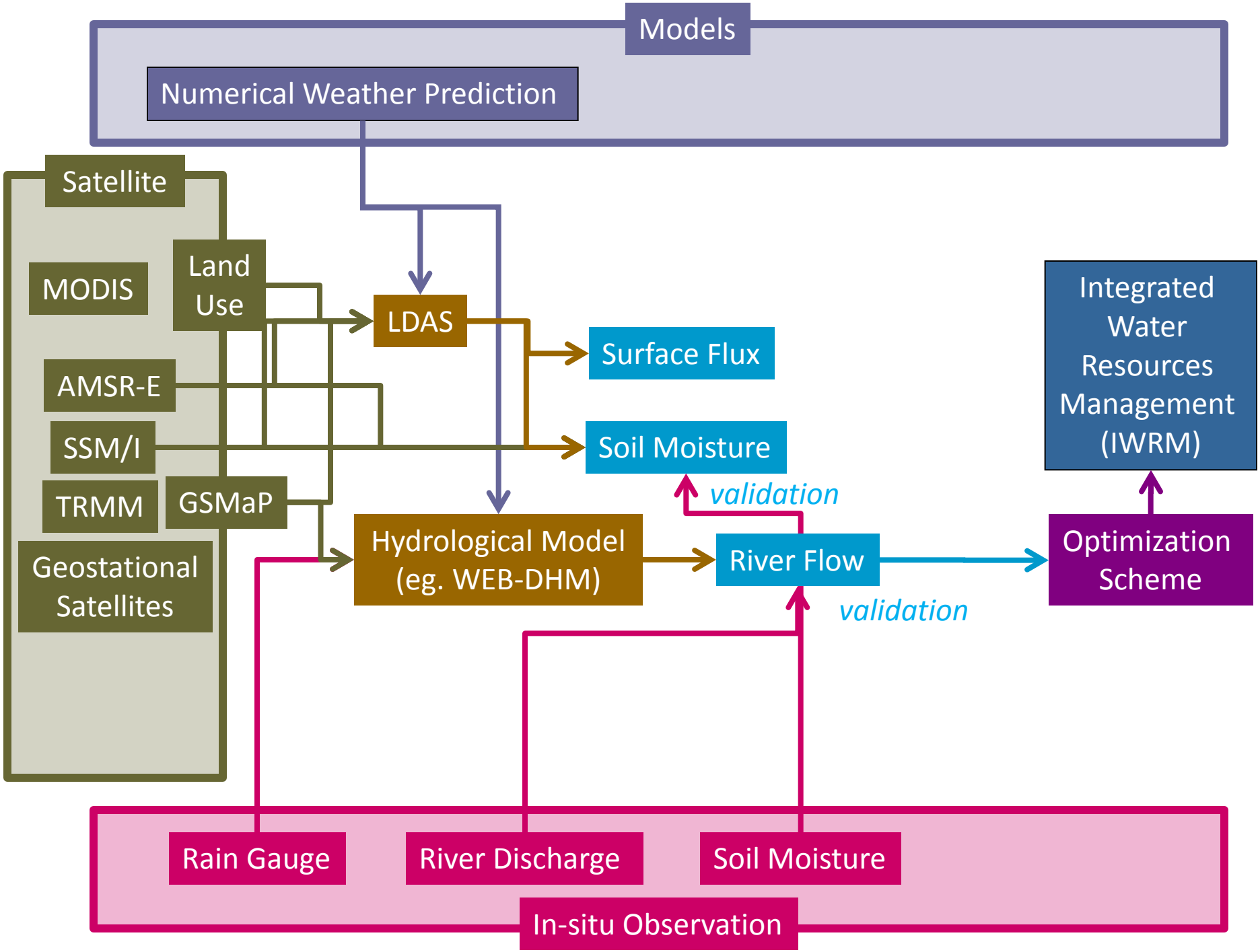
Flood disaster in Hanoi

- Tropical cyclones
- Historical flood events with damages
- Death toll: around 100psn/year
  Economic loss: $1.2 billion (2006)



Increasing demand for hydropower generation

- Increasing by 15%in each year (due to economic growth & urbanization)
- Hydropower: 60% of total electricity
- Unstable water supply (70% of annual rainfall accumulates in Jul-Sep)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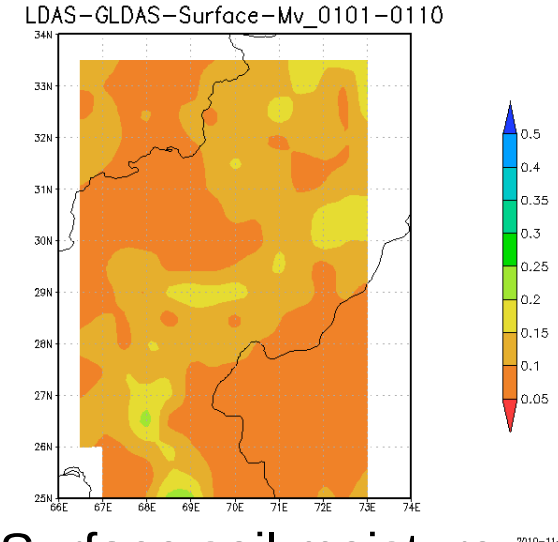
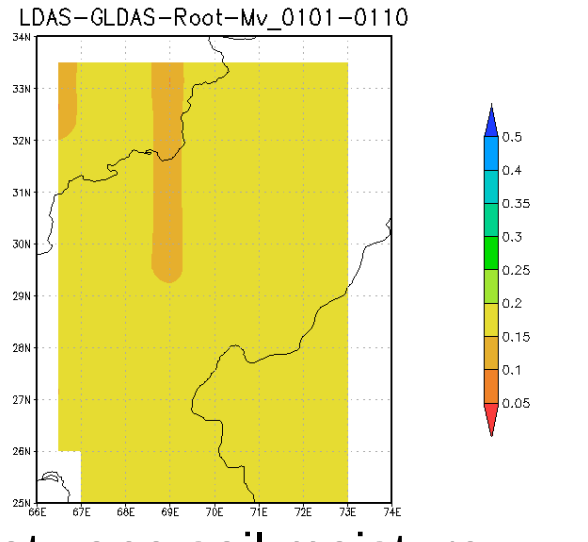
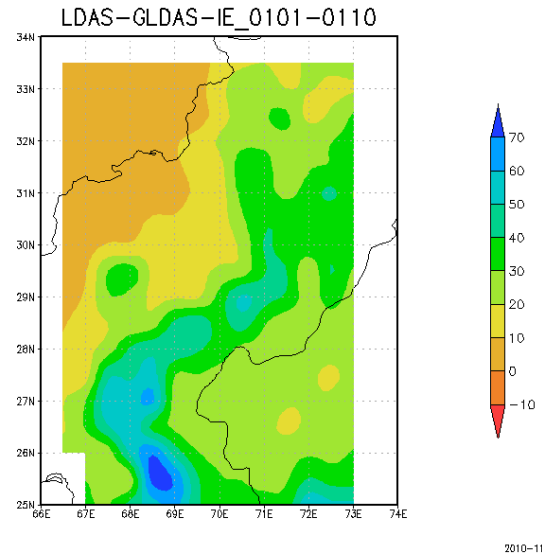
10days averaged hydrological parameters in the middle Indus



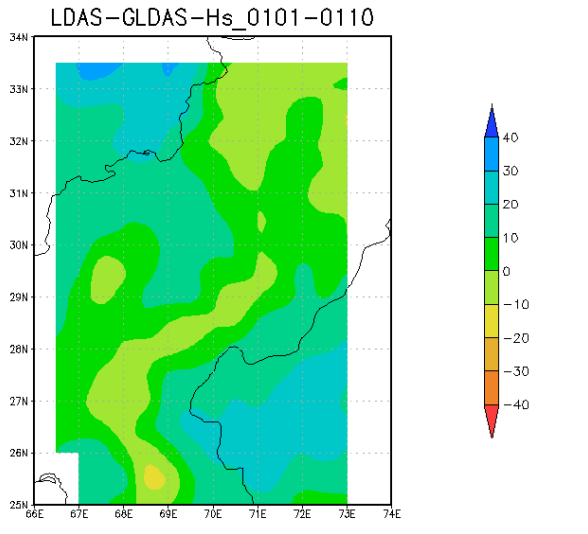
Surface soil moisture



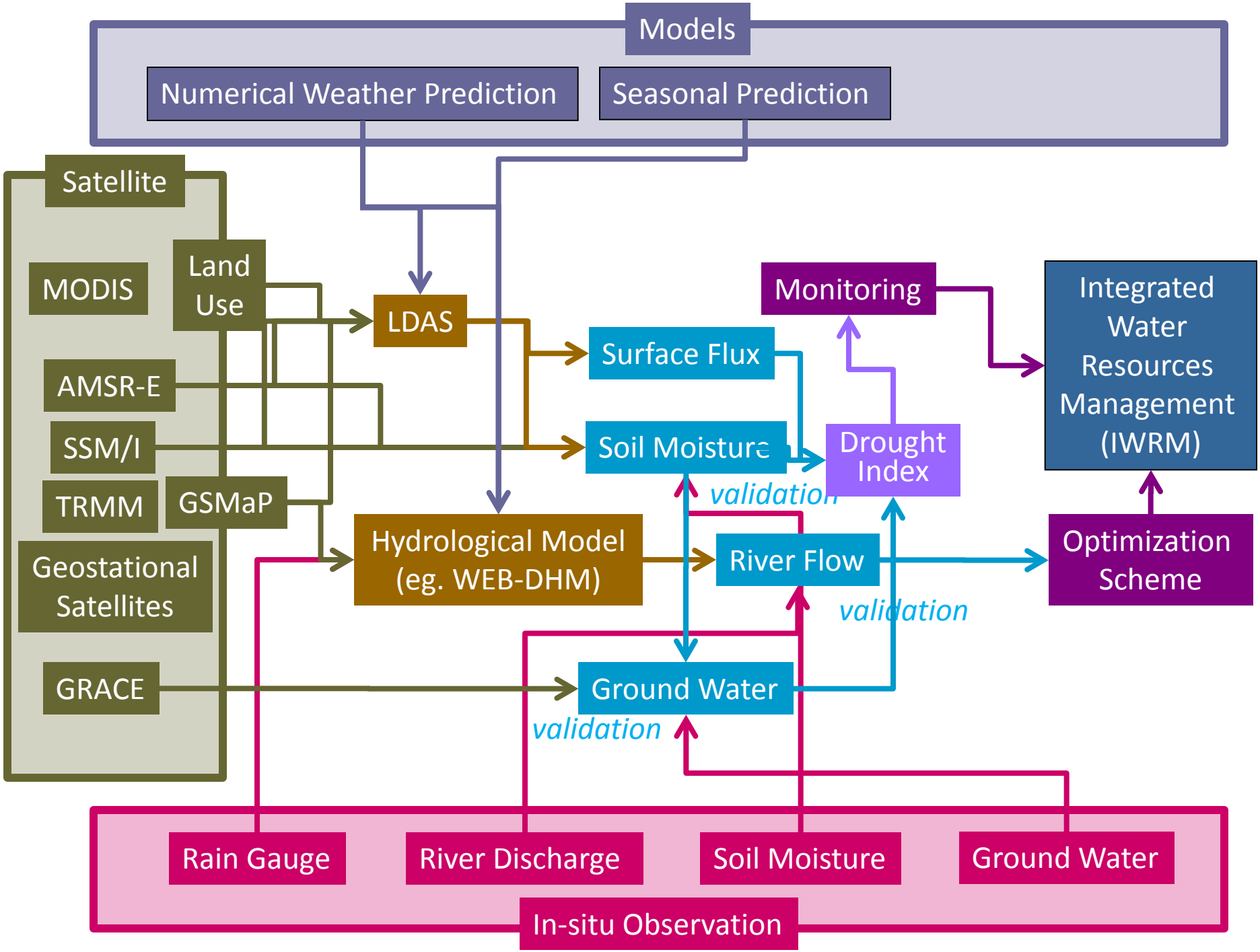
Root zone soil moisture



Latent heat



Sensible heat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Drought Quantification: The Standard Anomaly Index

1) Transform the best-fit distribution pattern into a standardized distribution

$$x_{transformed} = \frac{x - \mu}{\sigma}$$

2) Normalize by calculating SA

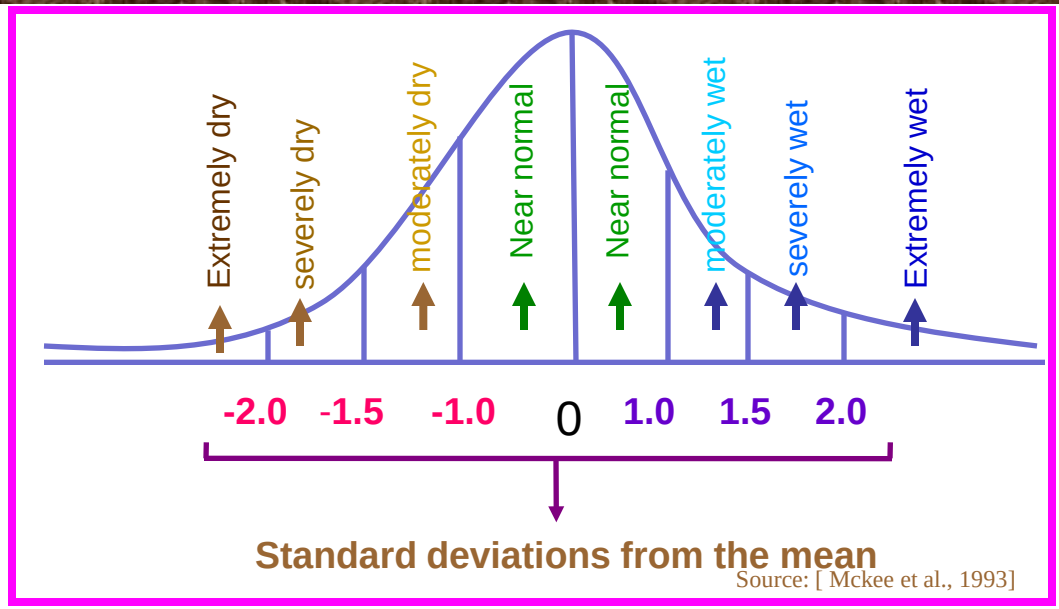
$$SA = Z = \frac{x_{transformed} - \bar{x}_{transformed}}{\sigma_{transformed}}$$

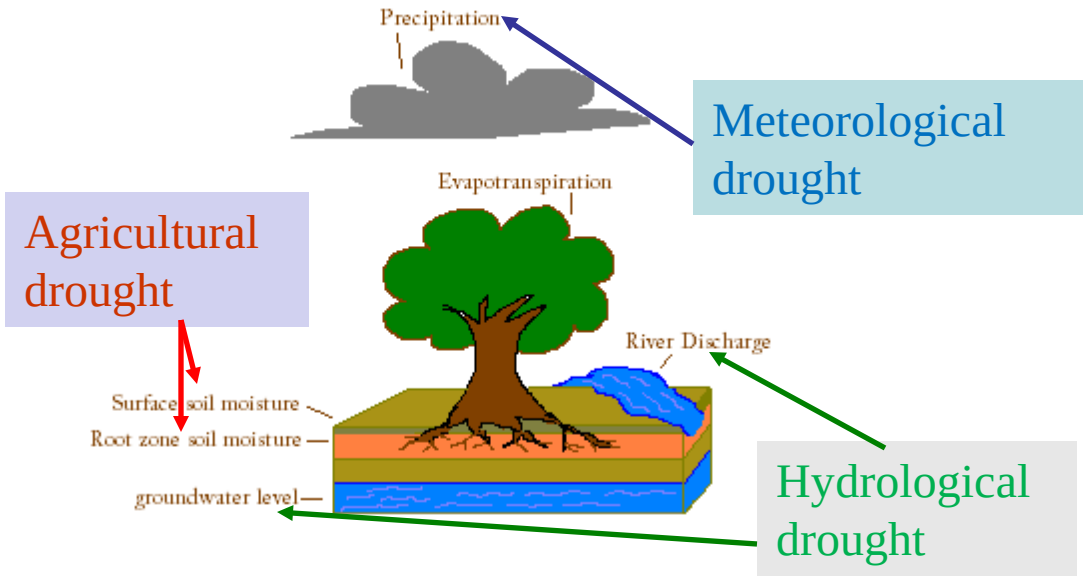
$$\sigma = \sqrt{\mathrm{var}(x)}$$

$$\mathrm{var}(x) = \int (x-\mu)^2 f(x)dx$$

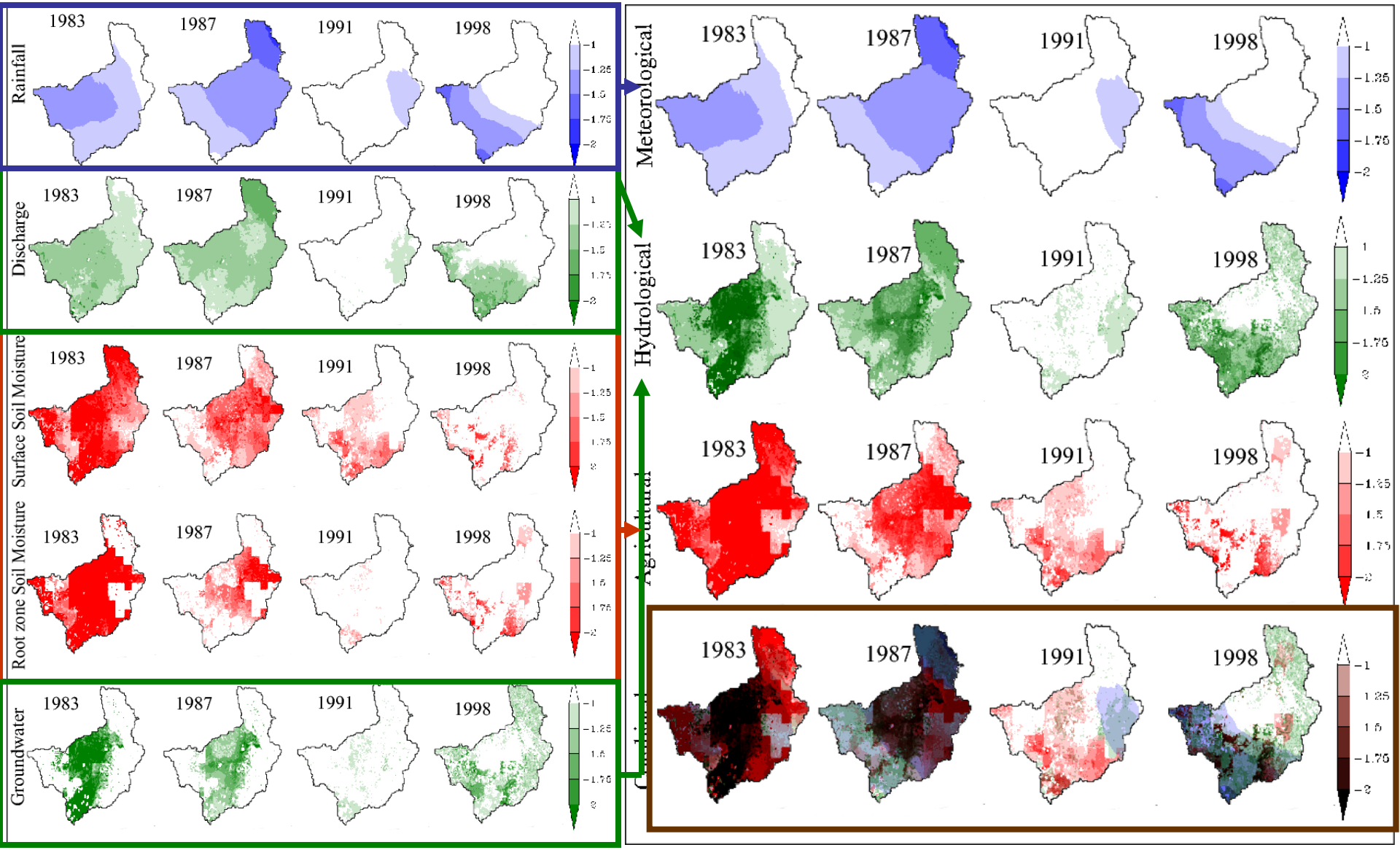
$$\mu = \int x f(x)dx$$

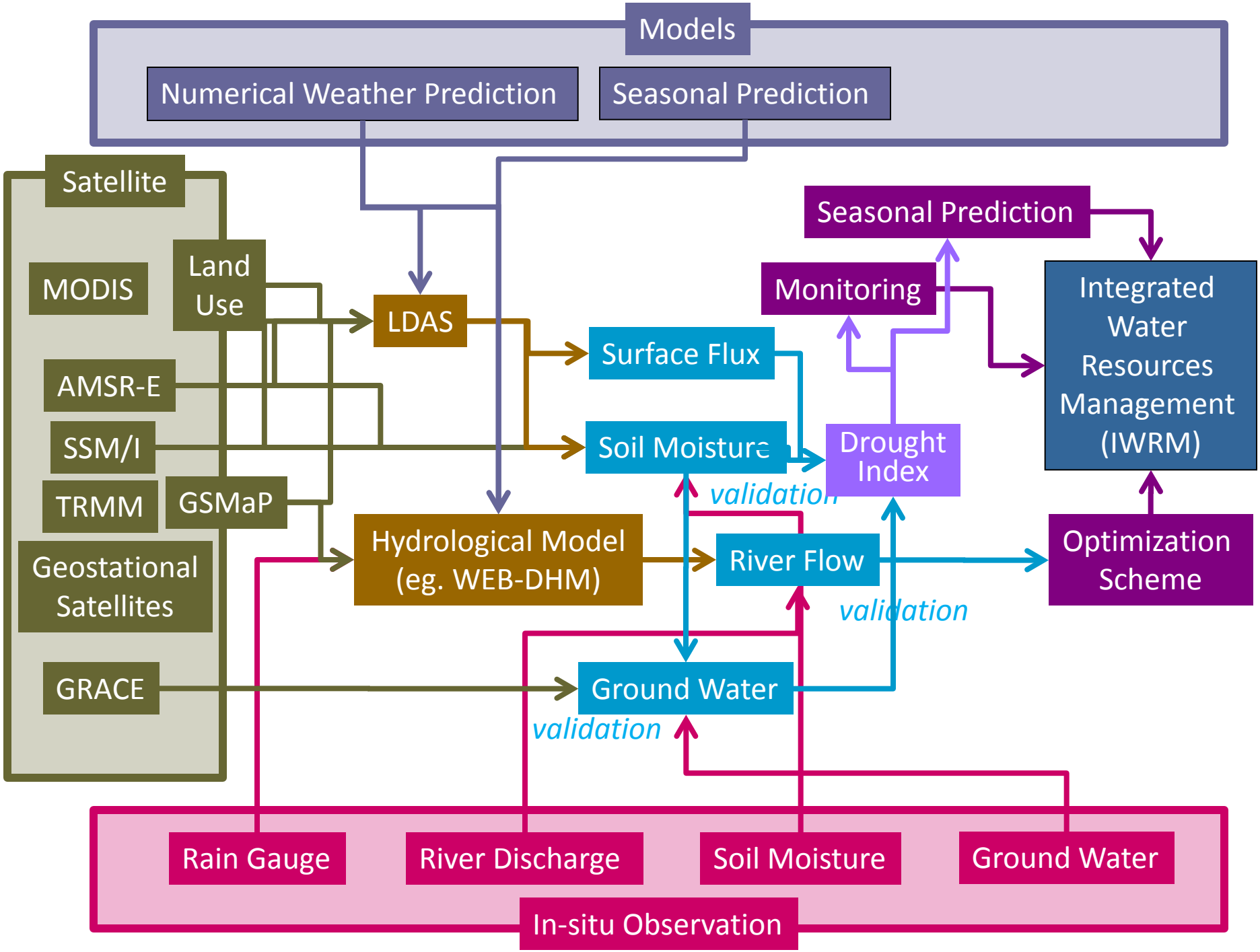
Jaranilla-Sanchez, P. A., et al. (2011), Water Resour. Res., in press.





Spatial SA: Philippines

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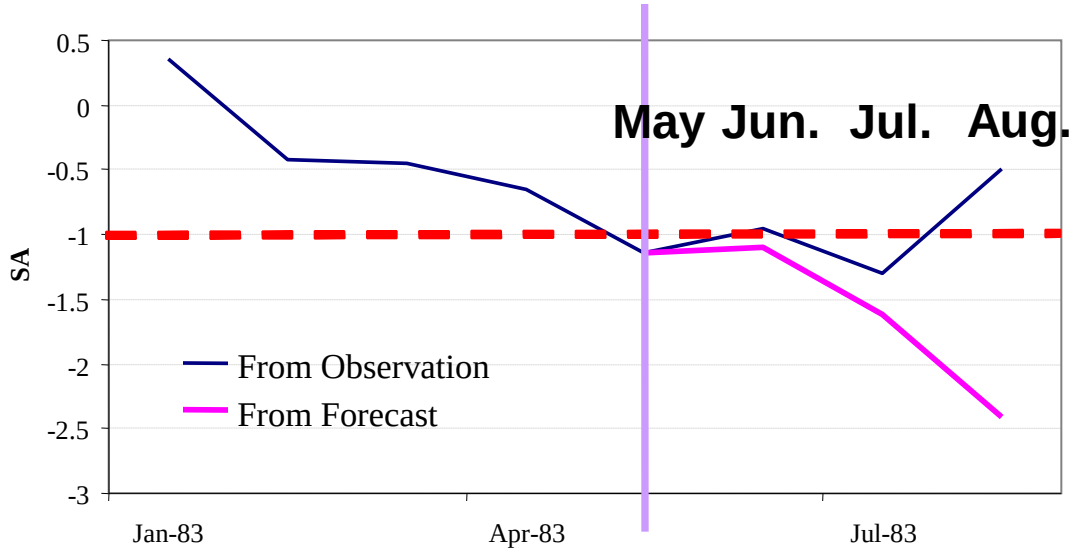
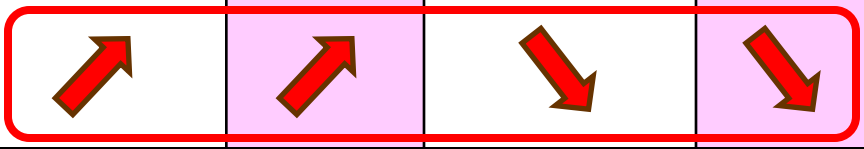
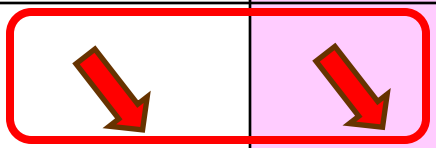
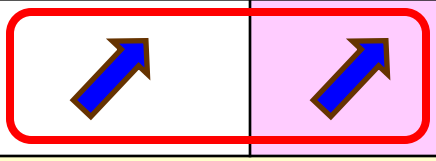
Seasonal Drought Prediction

Month	SA FROM OBSERVED DISCHARGE	SA FROM FORECAST DISCHARGE
June	-0.954	-1.010455
July	-1.30505	-1.61425
August	-0.4937	-2.41276

Close enough, drought conditions can be forecasted

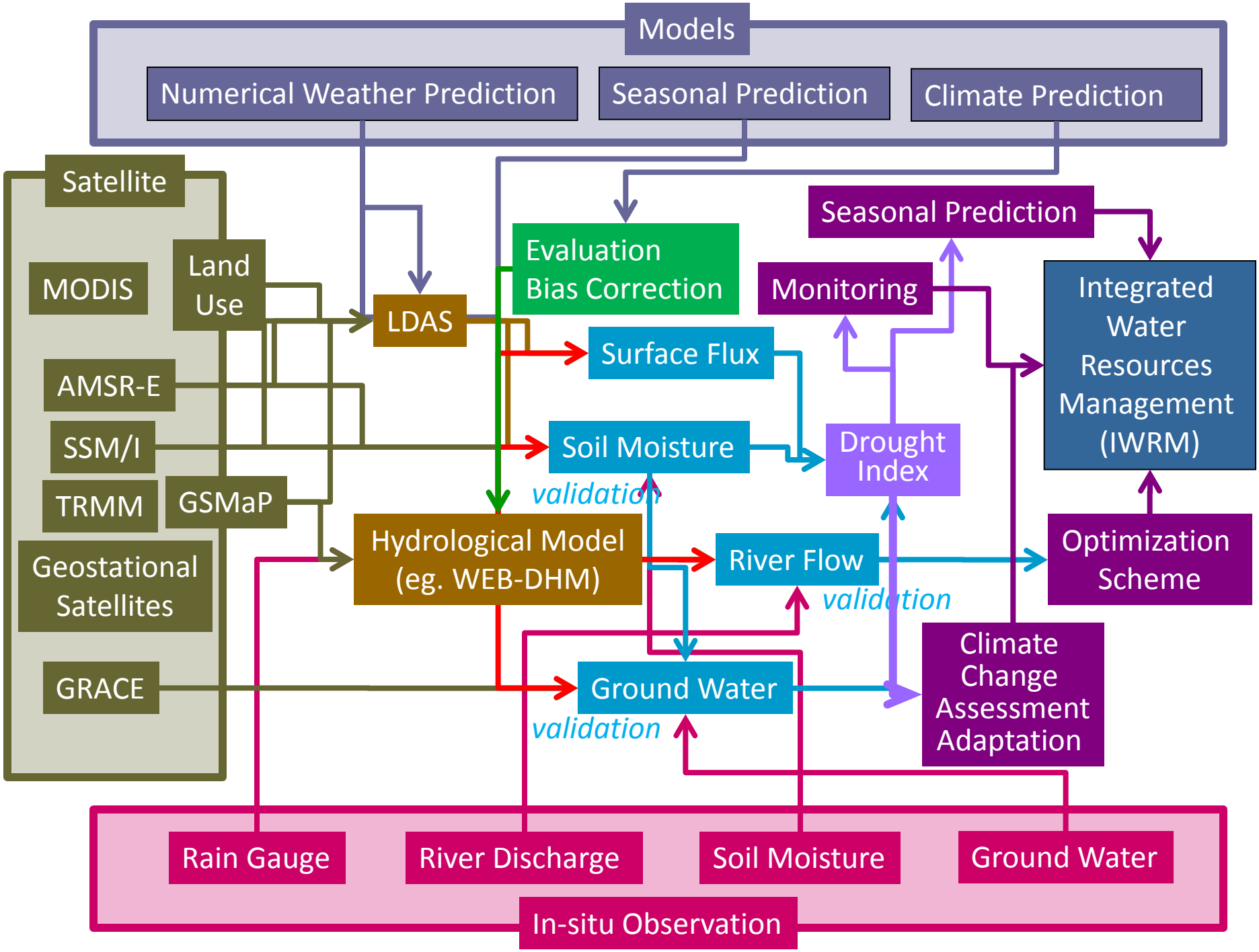


Seasonal Drought Prediction

Months	1st		2nd		3rd	
Year	Observed	SFC	Observed	SCF	Observed	SCF
1983						
1991						
1997						
1999-2000						

ARROW Legends: **red**= drought; **green**=normal; **blue**=wet

e.g. increase towards drought conditions 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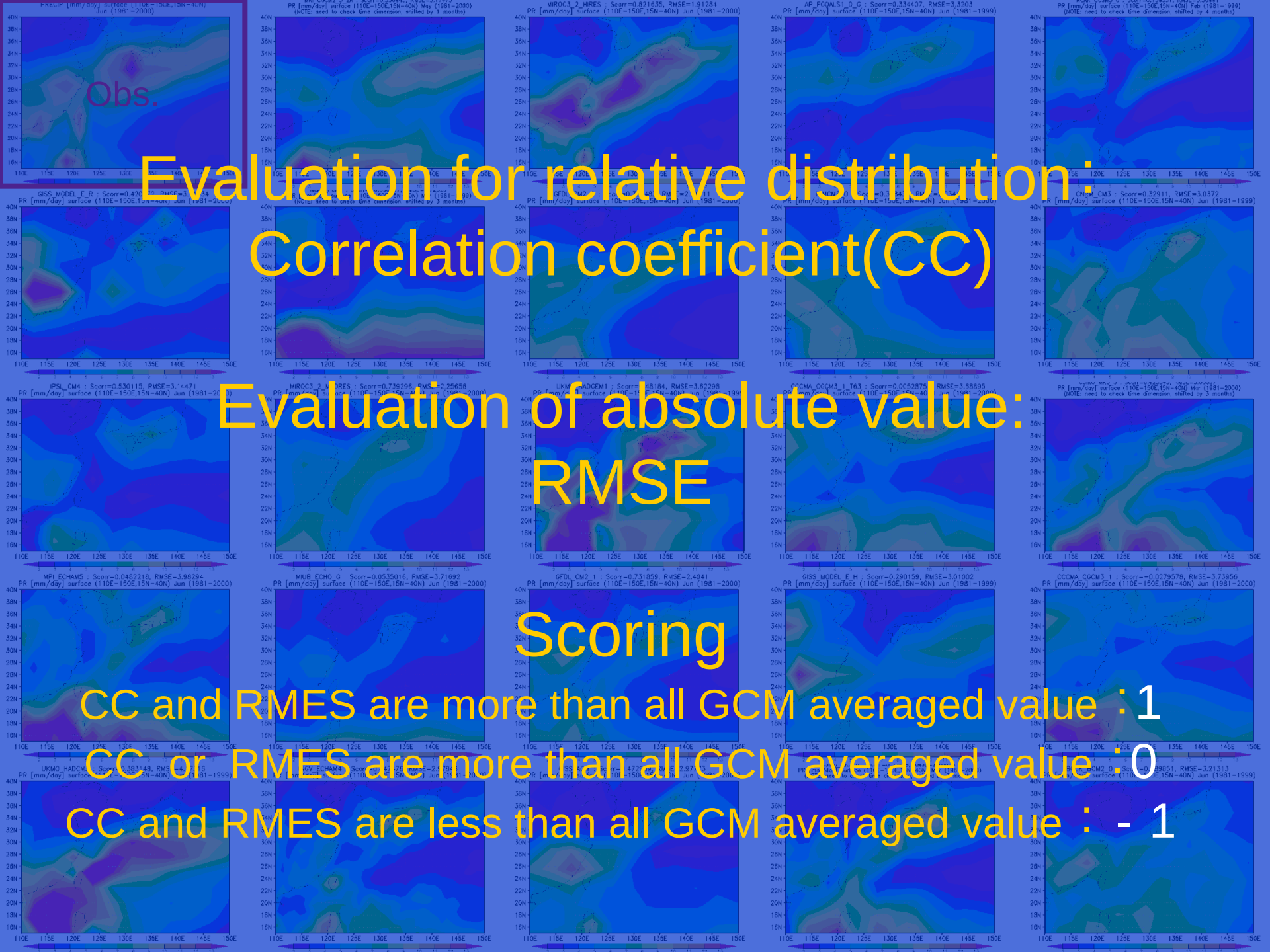


Evaluation for relative distribution：
Correlation coefficient(CC)

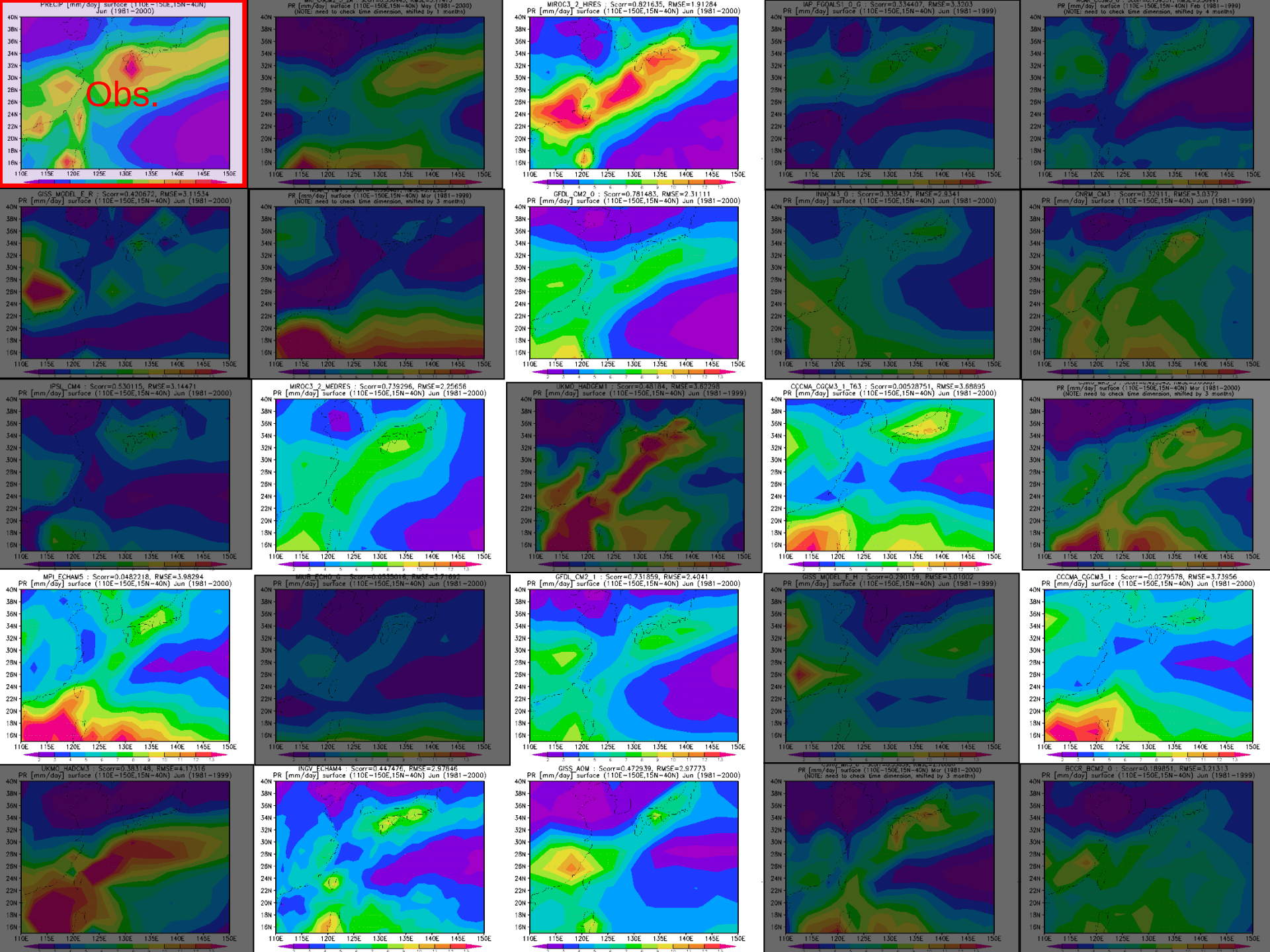
Evaluation of absolute value:
RMSE

Scoring

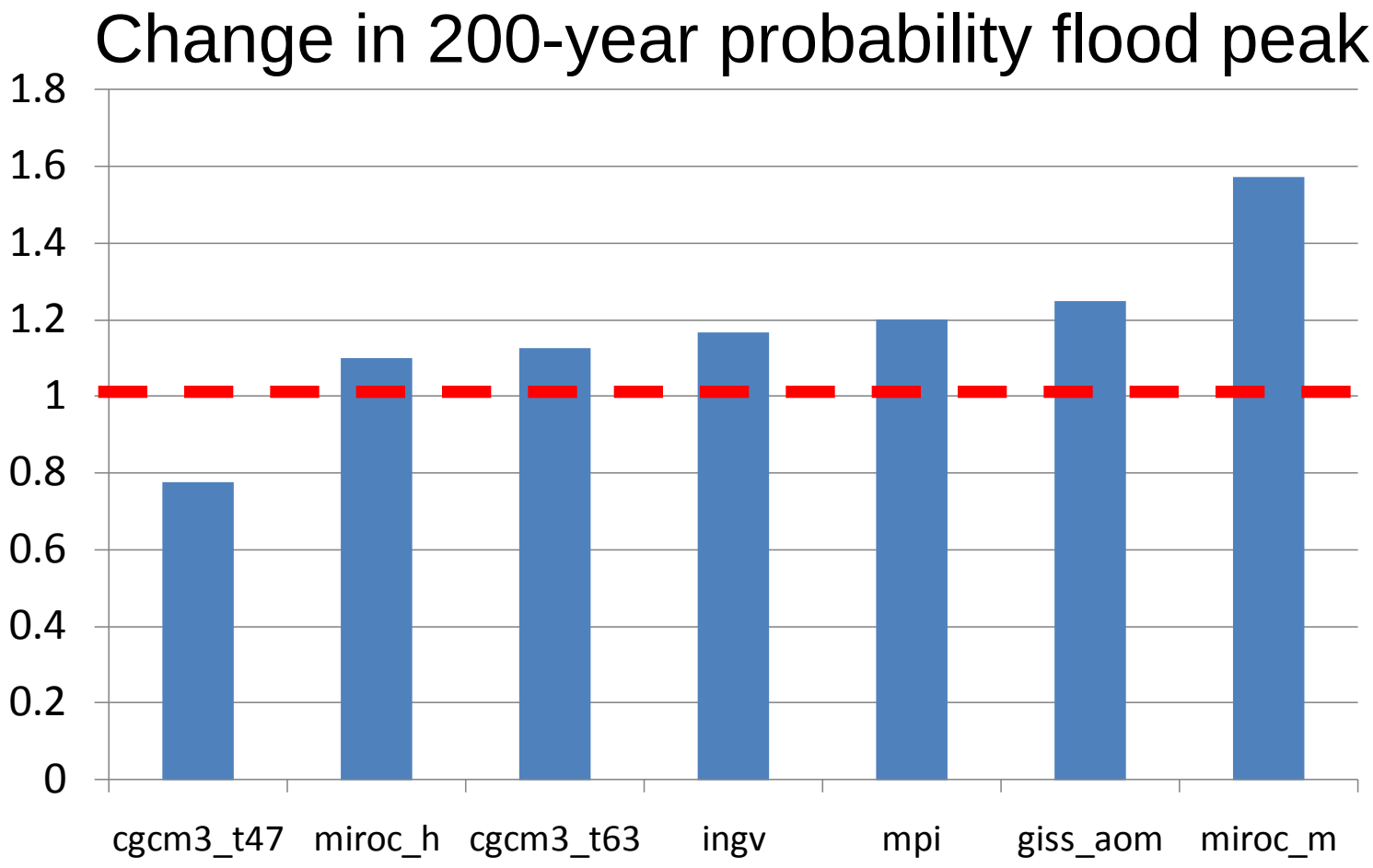
CC and RMES are more than all GCM averaged value ：1

CC or RMES are more than all GCM averaged value：0

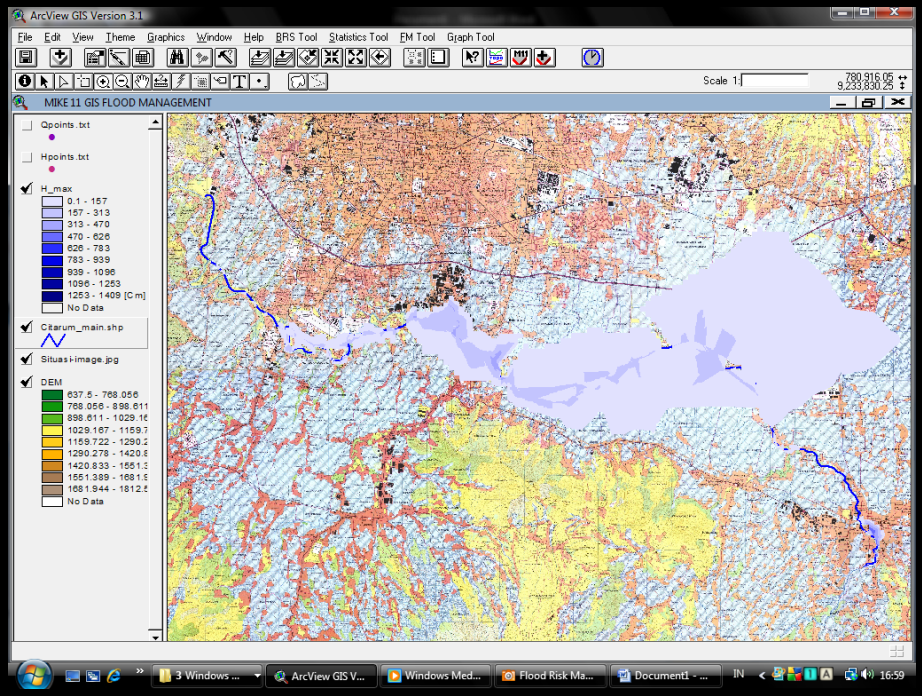
CC and RMES are less than all GCM averaged value ： - 1

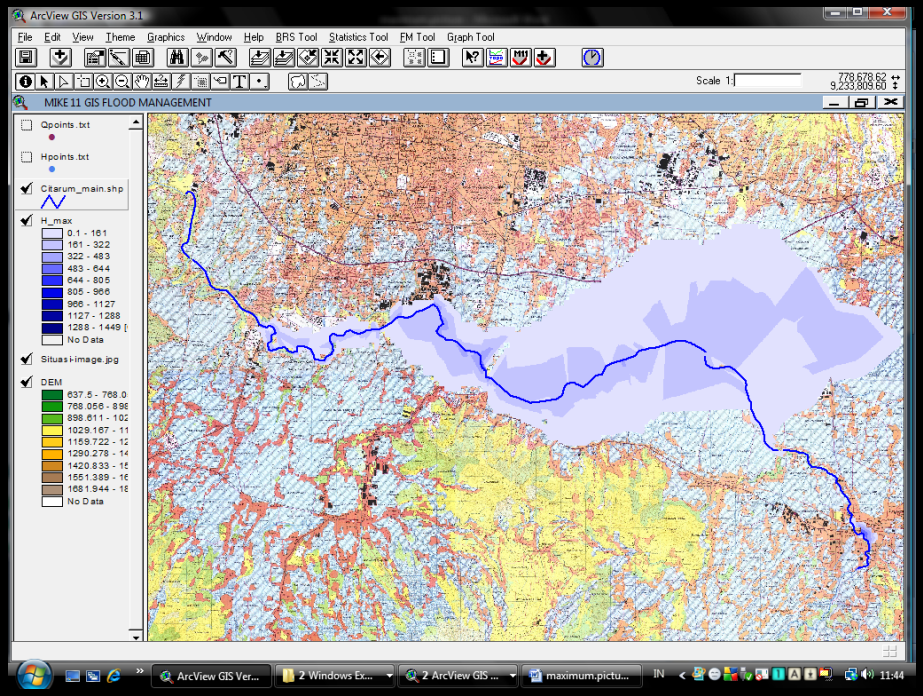

PRECIP [mm/day] surface (110E-150E,15N-40N)
Jun (1981-2000)
Obs.
MIROC3_2_HIRES : Scorr=0.821635, RMSE=1.91284
PR [mm/day] surface (110E-150E,15N-40N) Jun (1981-2000)
IAP_FGOALS1_0_G : Scorr=0.334407, RMSE=3.3203
PR [mm/day] surface (110E-150E,15N-40N) Jun (1981-1999)
GISS_MODEL_E_R : Scorr=0.420672, RMSE=3.11534
PR [mm/day] surface (110E-150E,15N-40N) Jun (1981-2000)
GFDL_CM2_0 : Scorr=0.781483, RMSE=2.3111
PR [mm/day] surface (110E-150E,15N-40N) Jun (1981-2000)
INMCM3_0 : Scorr=0.338437, RMSE=2.9341
PR [mm/day] surface (110E-150E,15N-40N) Jun (1981-2000)
CNRM_CM3 : Scorr=0.32911, RMSE=3.0372
PR [mm/day] surface (110E-150E,15N-40N) Jun (1981-1999)
IPSL_CM4 : Scorr=0.530115, RMSE=3.14471
PR [mm/day] surface (110E-150E,15N-40N) Jun (1981-2000)
MIROC3_2_MEDRES : Scorr=0.739296, RMSE=2.25656
PR [mm/day] surface (110E-150E,15N-40N) Jun (1981-2000)
UKMO_HADGEM1 : Scorr=0.48184, RMSE=3.62298
PR [mm/day] surface (110E-150E,15N-40N) Jun (1981-1999)
CCCMA_CGCM3_1_T63 : Scorr=0.00528751, RMSE=3.68895
PR [mm/day] surface (110E-150E,15N-40N) Jun (1981-2000)
MPI_ECHAM5 : Scorr=0.0482218, RMSE=3.98294
PR [mm/day] surface (110E-150E,15N-40N) Jun (1981-2000)
GFDL_CM2_1 : Scorr=0.731859, RMSE=2.4041
PR [mm/day] surface (110E-150E,15N-40N) Jun (1981-2000)
GISS_MODEL_E_H : Scorr=0.290159, RMSE=3.01002
PR [mm/day] surface (110E-150E,15N-40N) Jun (1981-1999)
CCCMA_CGCM3_1 : Scorr=-0.0279578, RMSE=3.73956
PR [mm/day] surface (110E-150E,15N-40N) Jun (1981-2000)
UKMO_HADCM3 : Scorr=0.383149, RMSE=4.17316
PR [mm/day] surface (110E-150E,15N-40N) Jun (1981-1999)
INGV_ECHAM4 : Scorr=0.447476, RMSE=2.97846
PR [mm/day] surface (110E-150E,15N-40N) Jun (1981-2000)
GISS_AOM : Scorr=0.472939, RMSE=2.97773
PR [mm/day] surface (110E-150E,15N-40N) Jun (1981-2000)
BCCR_BCM2_0 : Scorr=0.189851, RMSE=3.21313
PR [mm/day] surface (110E-150E,15N-40N) Jun (1981-1999)

Climate Change Impact Assessment



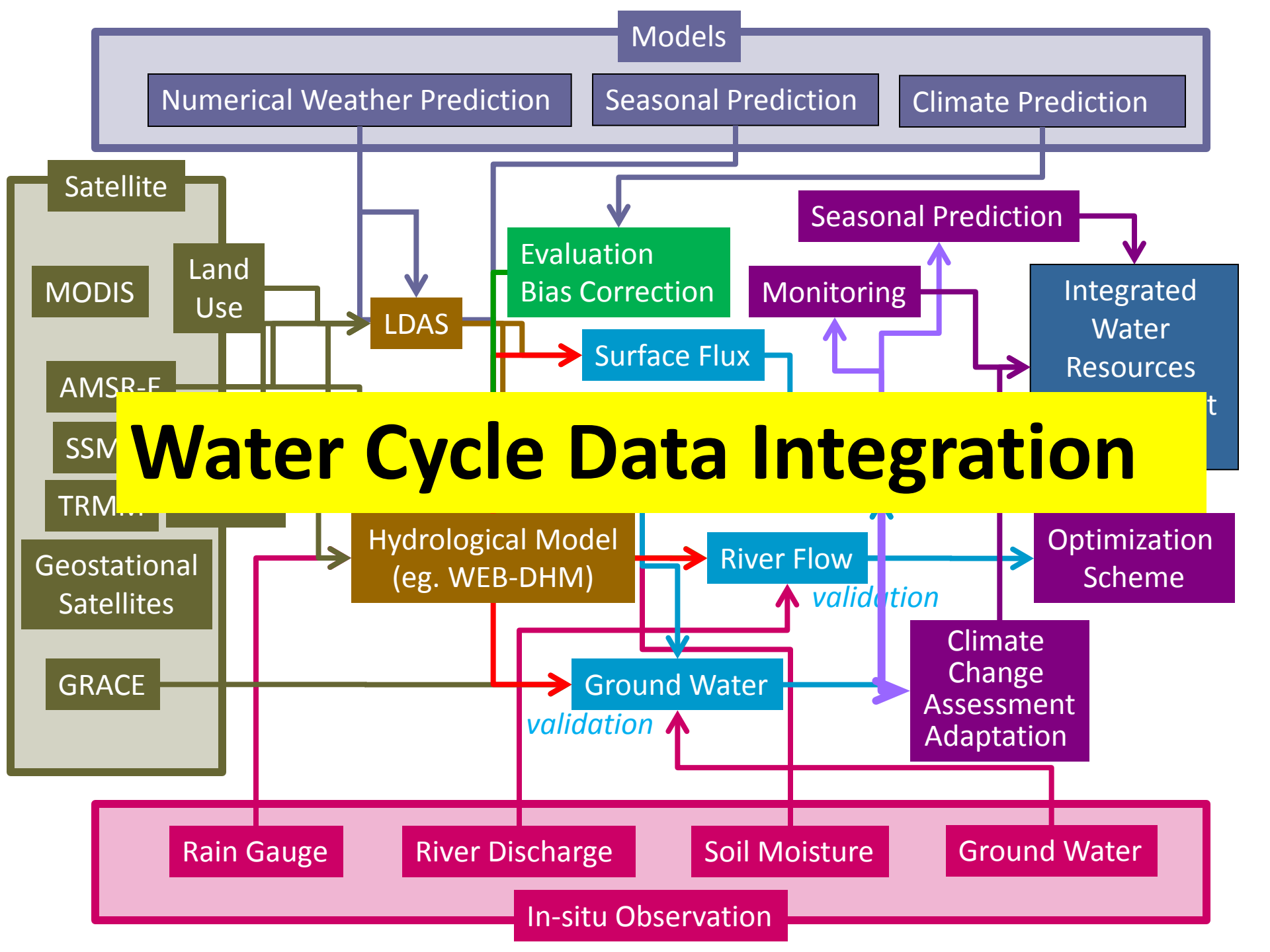
Climate Change Impacts on Flood Control Plan in Indonesia





10year Probable flood
Current Climate

10year Probable flood
50 years later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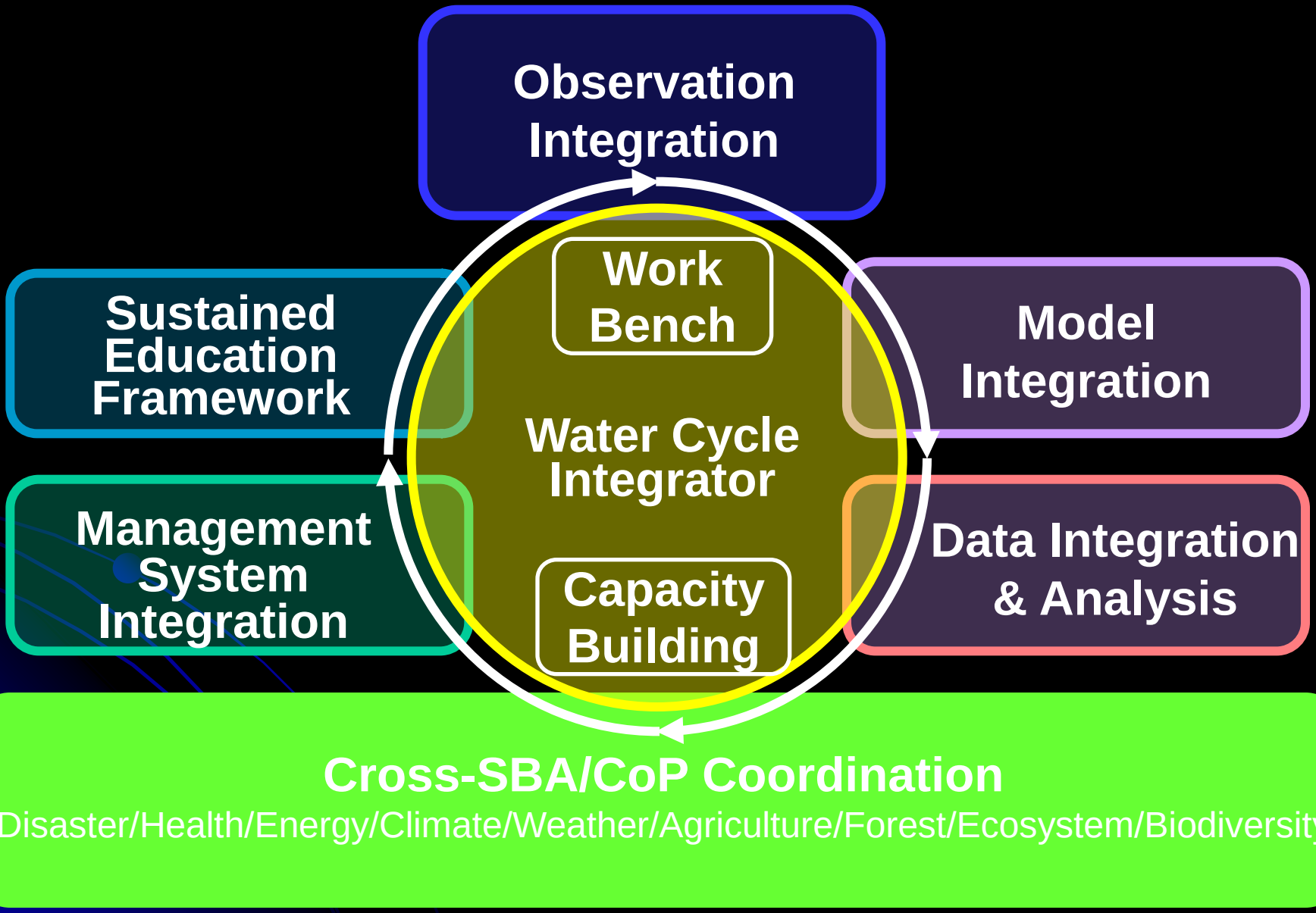
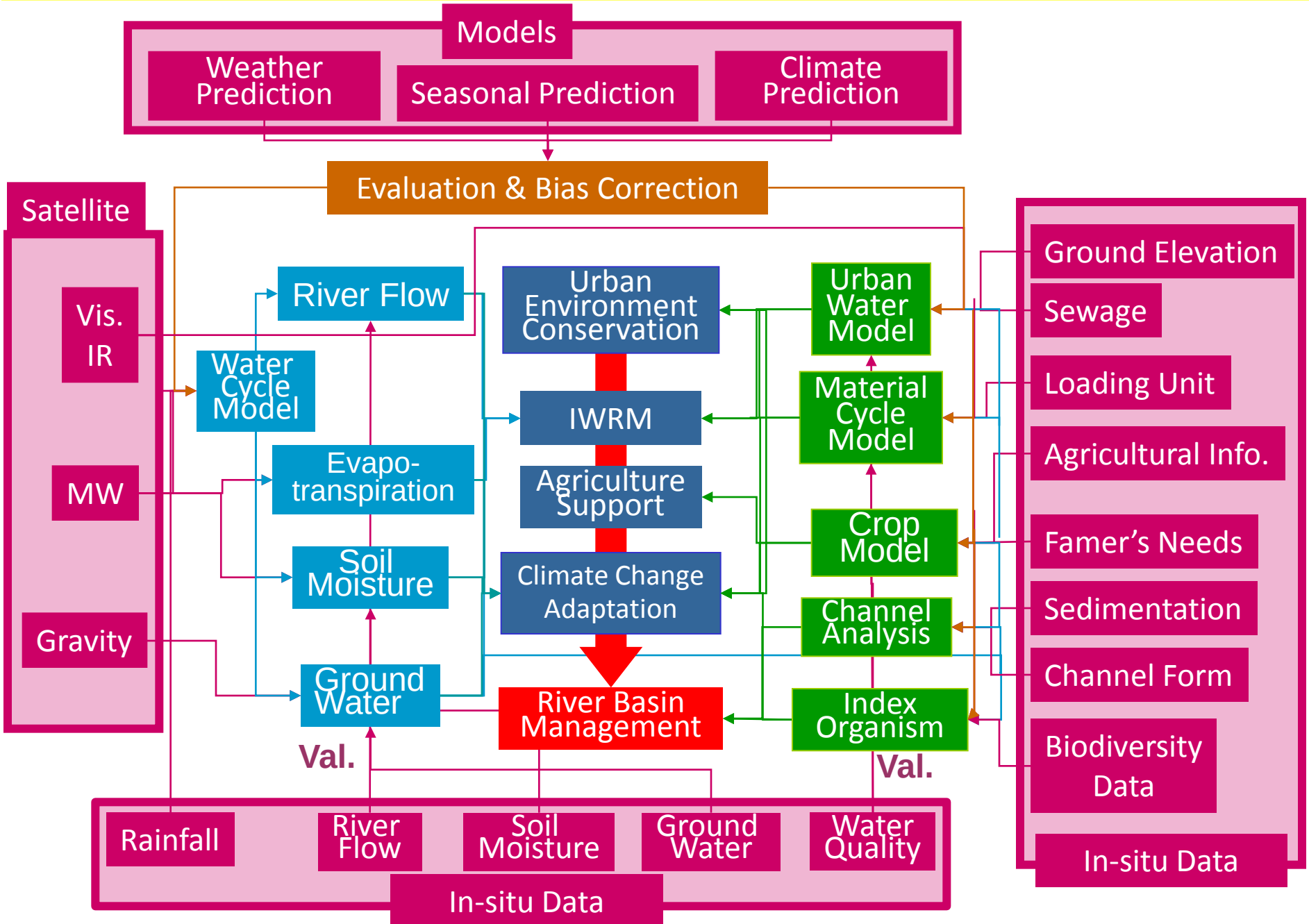
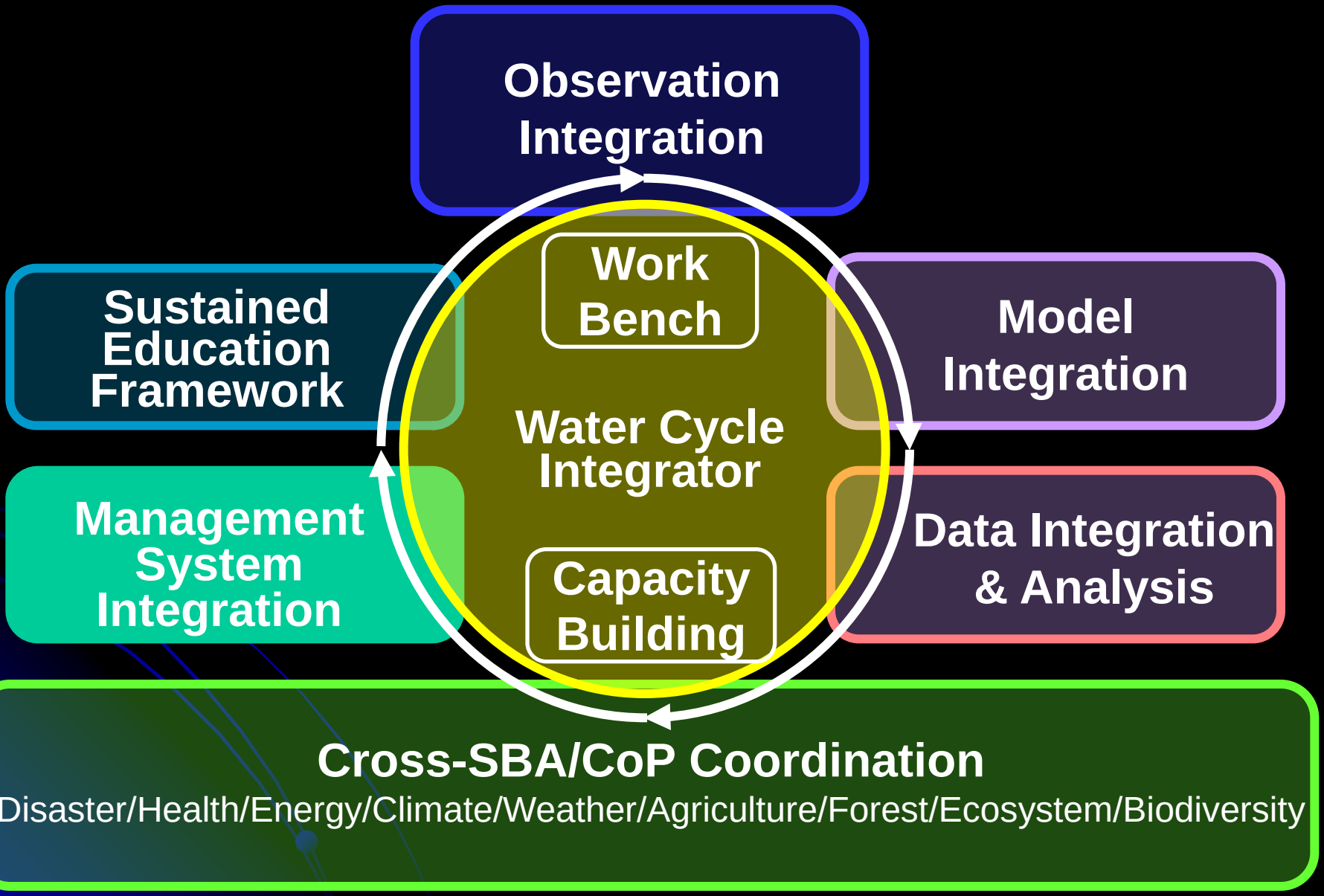


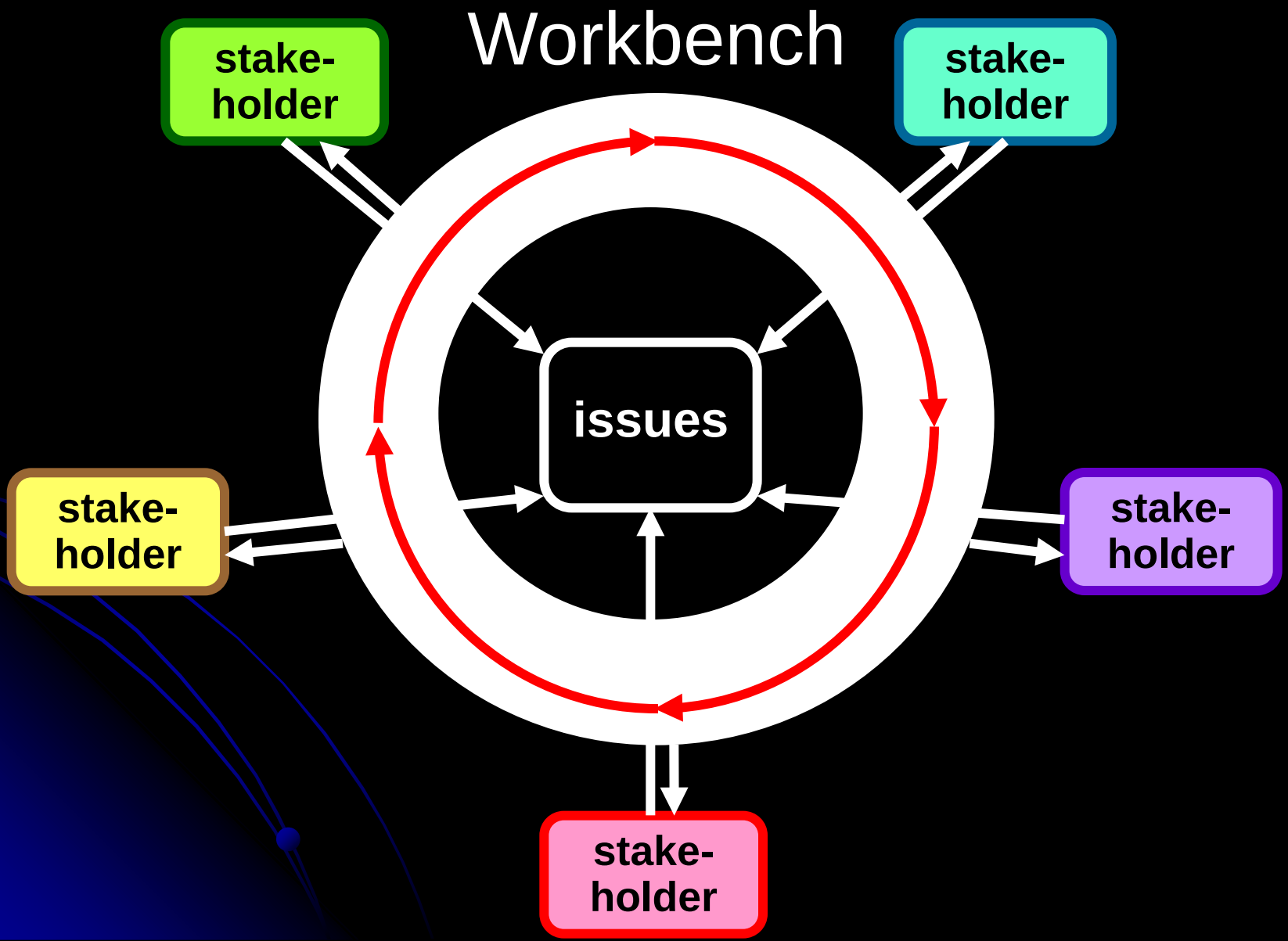
Water Cycle Integrator (WA01-C1, 2012-2015 WP)



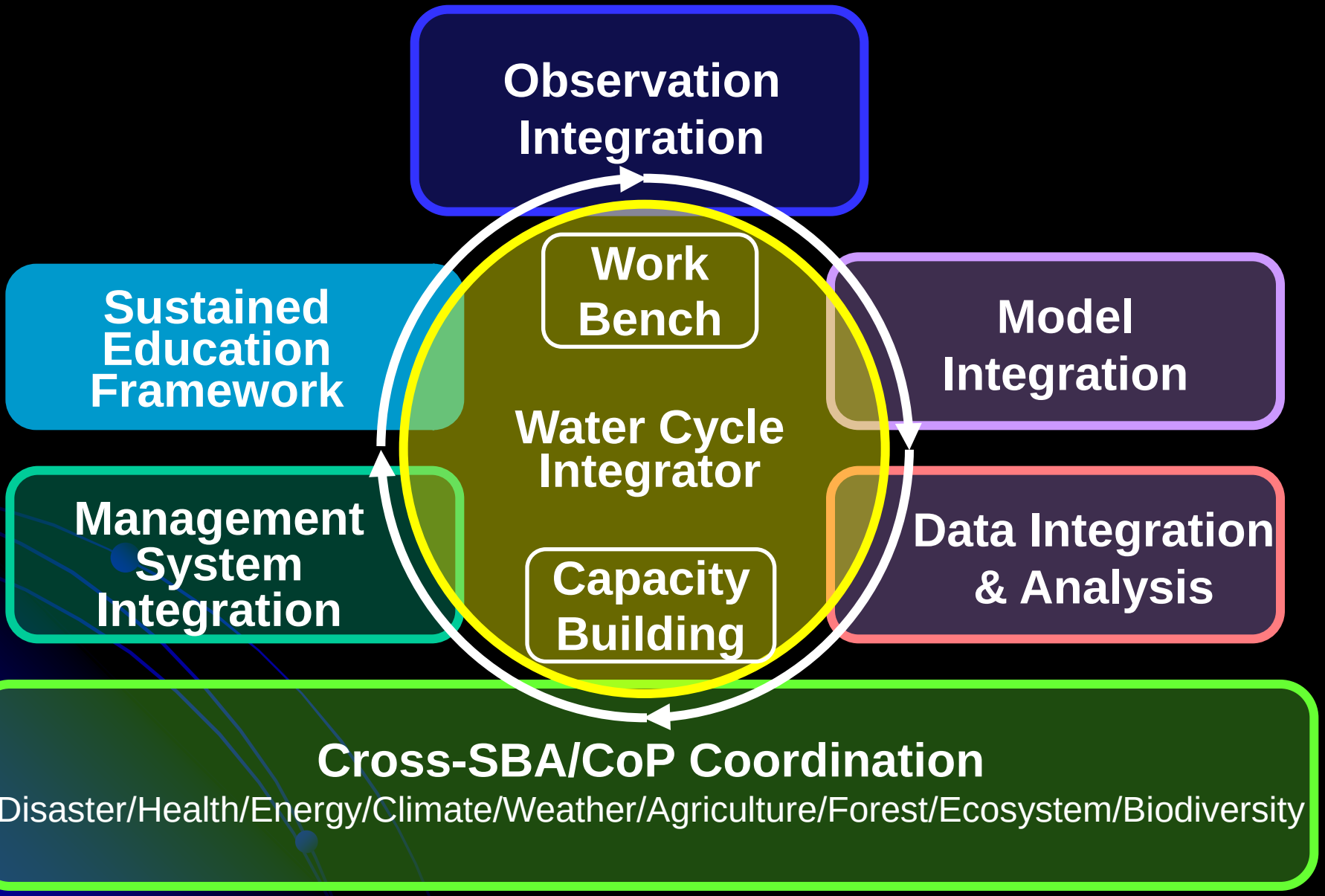
Integrated & Coordinated Approach



Sharing data & information, and working together

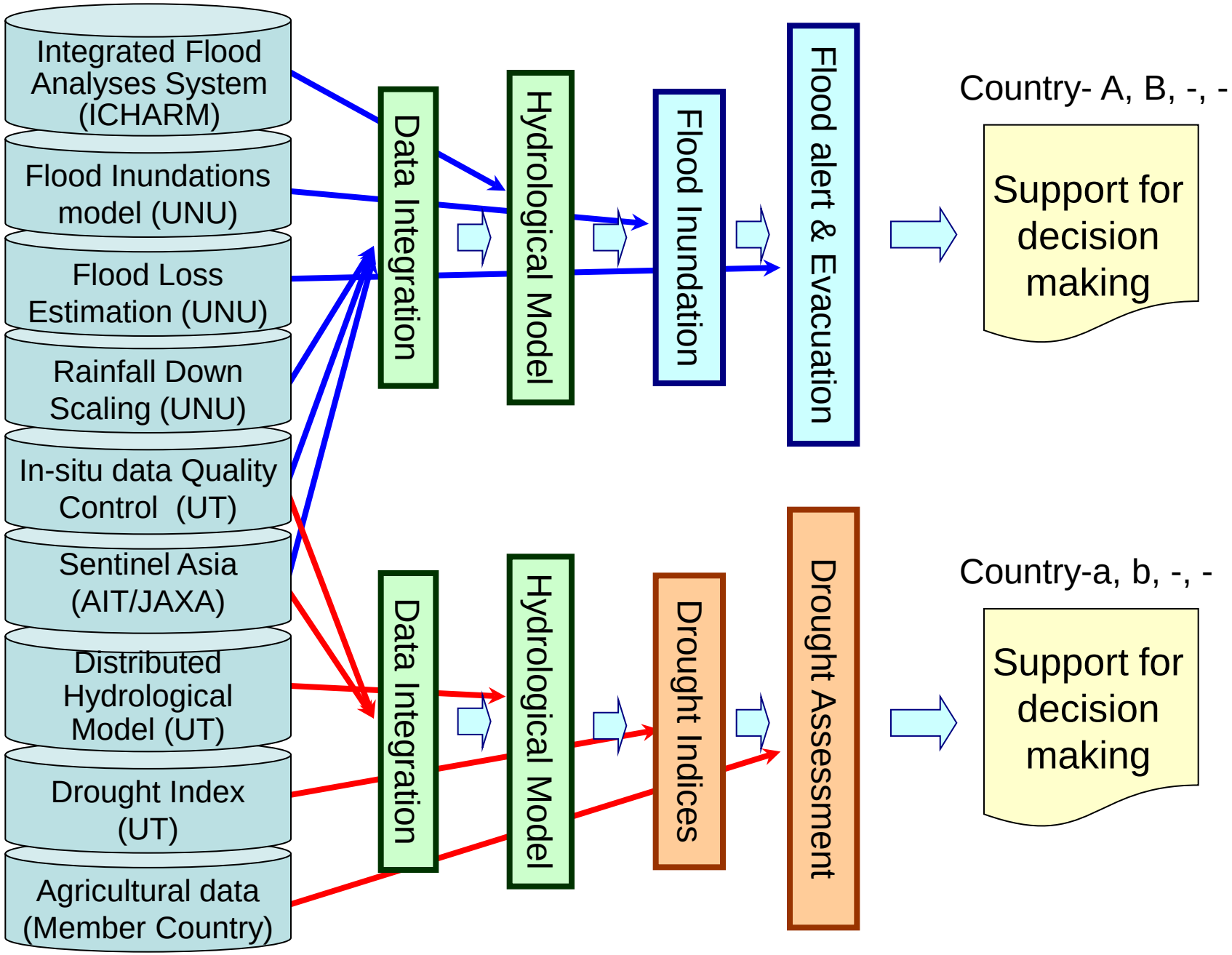


Integrated & Coordinated Approach

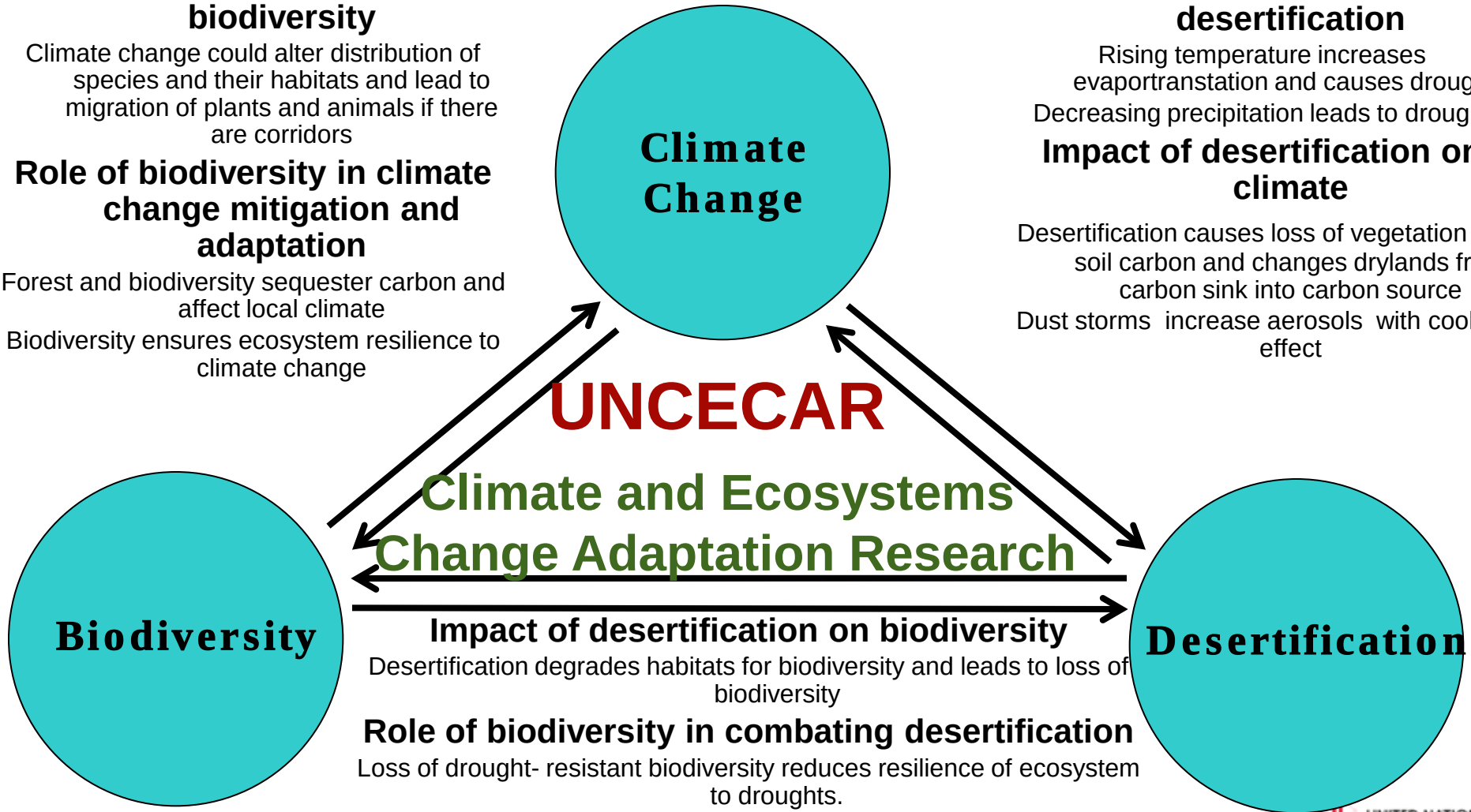


Training Modules

Training Course



Interactions between climate change, biodiversity and desertification



Impact of climate change on biodiversity

Climate change could alter distribution of species and their habitats and lead to migration of plants and animals if there are corridors

Role of biodiversity in climate change mitigation and adaptation

Forest and biodiversity sequester carbon and affect local climate

Biodiversity ensures ecosystem resilience to climate change

Impact of Climate change on desertification

Rising temperature increases evaportranstation and causes drought

Decreasing precipitation leads to drought

Impact of desertification on climate

Desertification causes loss of vegetation an soil carbon and changes drylands from carbon sink into carbon source

Dust storms increase aerosols with cooling effect

Impact of desertification on biodiversity

Desertification degrades habitats for biodiversity and leads to loss of biodiversity

Role of biodiversity in combating desertification

Loss of drought- resistant biodiversity reduces resilience of ecosystem to droughts.

Vegetation protects soil from erosion and stabilizes slopes from landslides.

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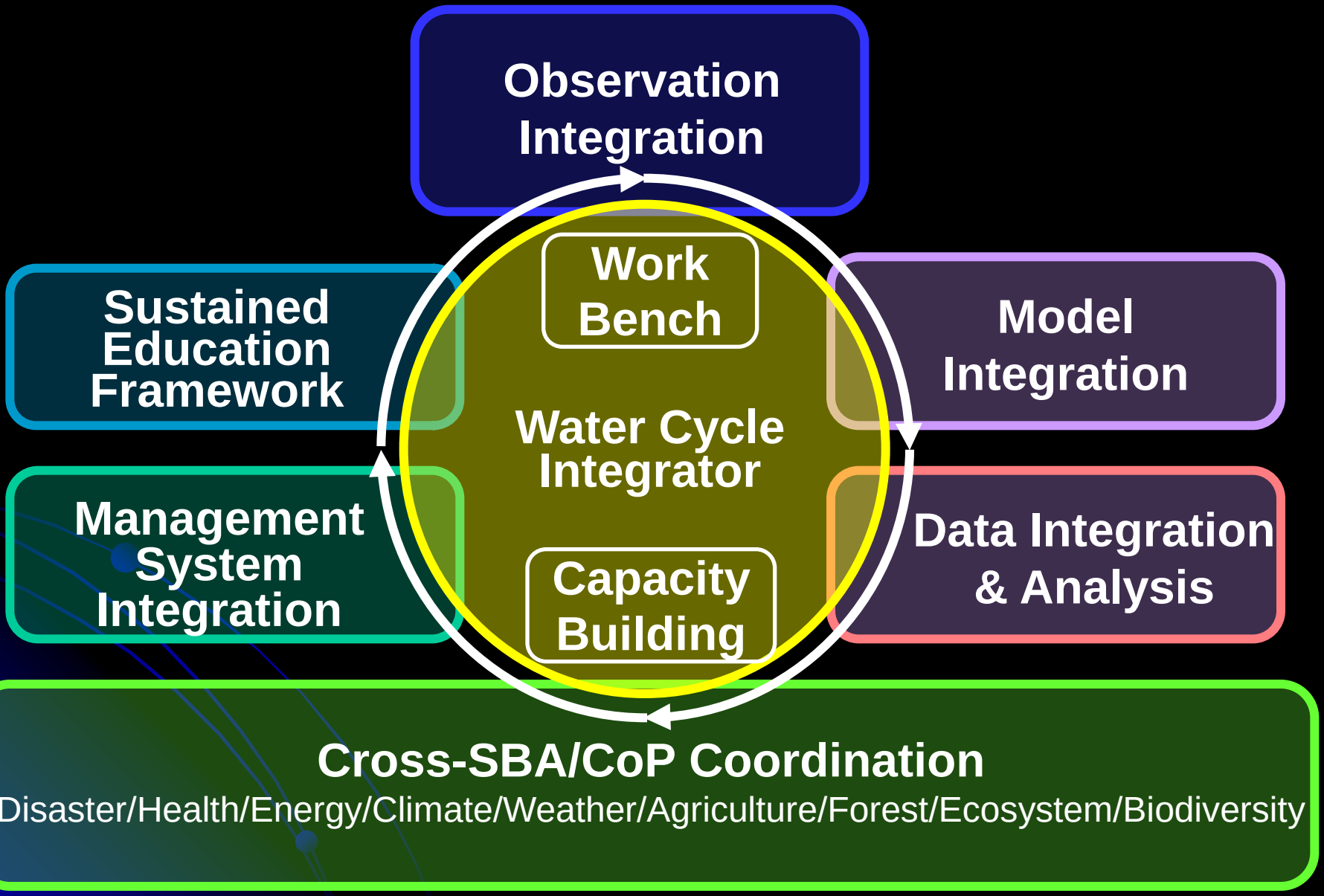

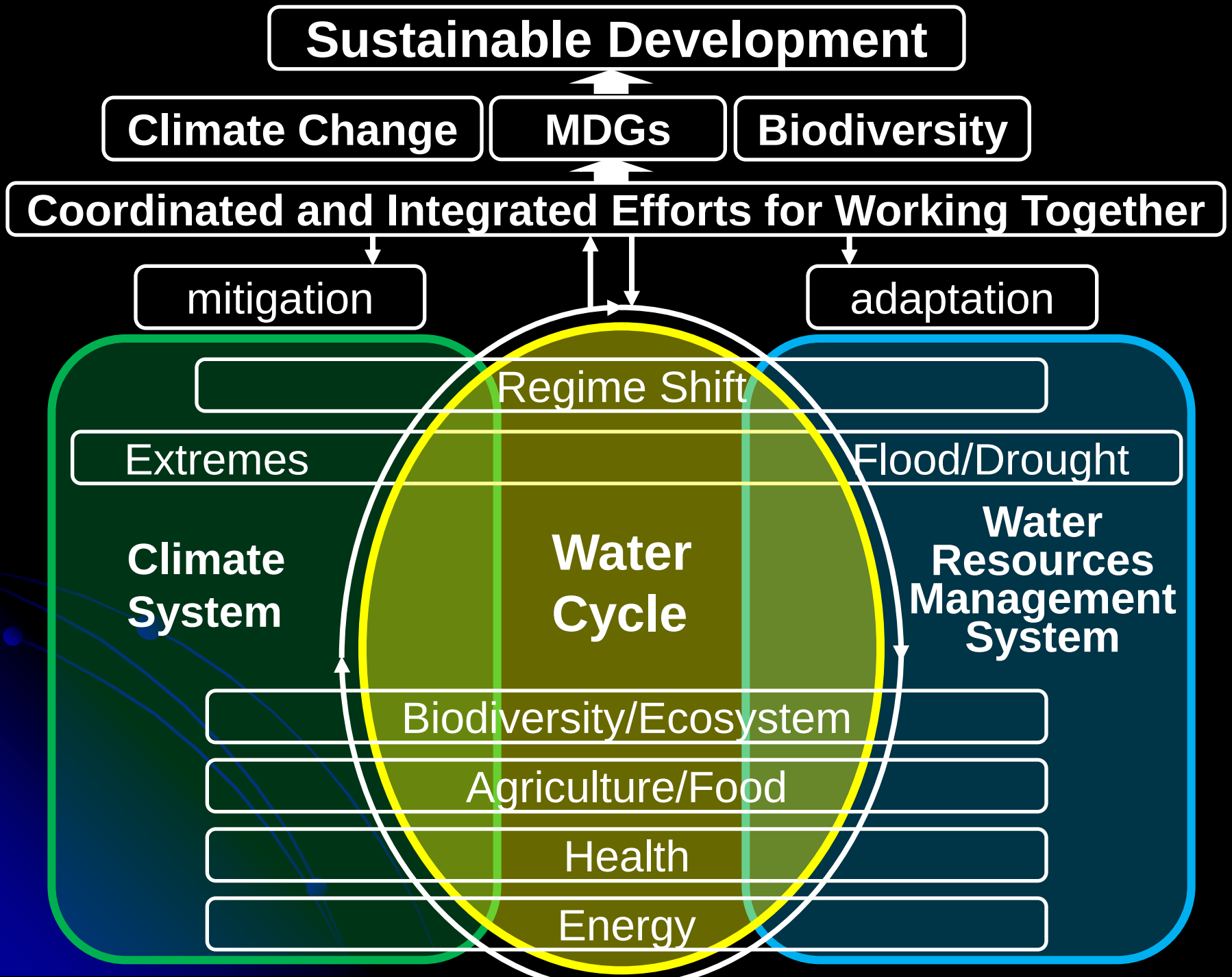
Sustainable Development
Climate Change
MDGs
Biodiversity
Coordinated and Integrated Efforts for Working Together
mitigation
adaptation
Regime Shift
Extremes
Flood/Drought
Climate System
Water Cycle
Water Resources Management System
Biodiversity/Ecosystem
Agriculture/Food
Health
Energy


DATA AND INFORMATION,
SCIENCE AND TECHNOLOGY,
COOPERATION FRAMEWORK,
AND PEOPLE
ARE NOW READY.
Actions are now required.
Thank You.