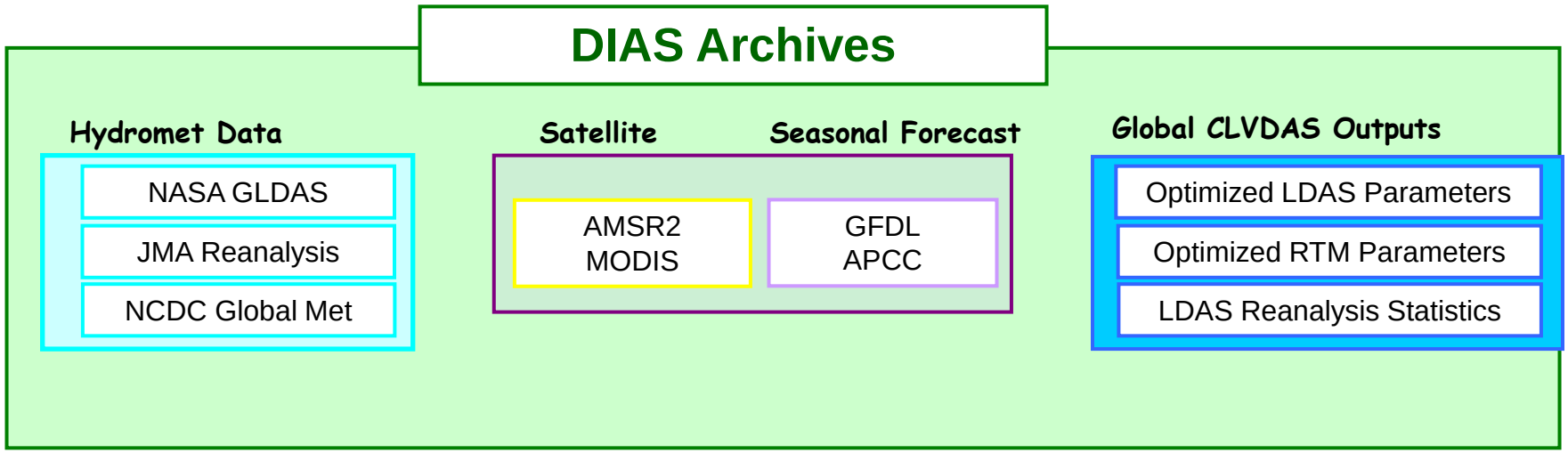
# Hydrometeorology-Agriculture Droughts Monitoring and Prediction System

**Toshio Koike**
The University of Tokyo
and
International Centre for Water Hazard and Risk Management (ICHARM)

ICHARM
United Nations Educational, Scientific and Cultural Organization
THE UNIVERSITY OF TOKYO
DIAS Data Integration & Analysis System

# Hydrometeorology-Agriculture Droughts Prediction System

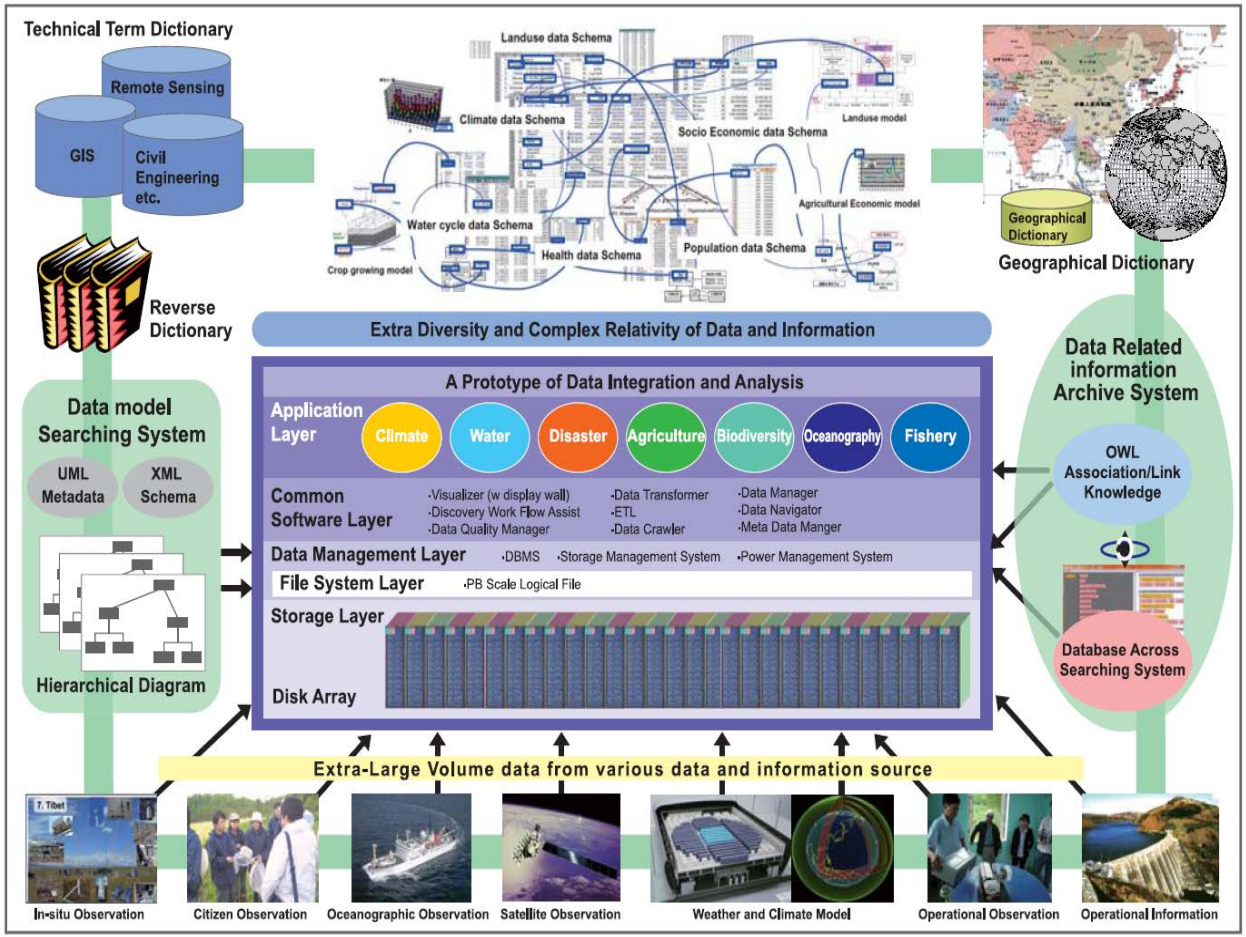


DIAS
Data Integration & Analysis System

THE UNIVERSITY OF TOKYO

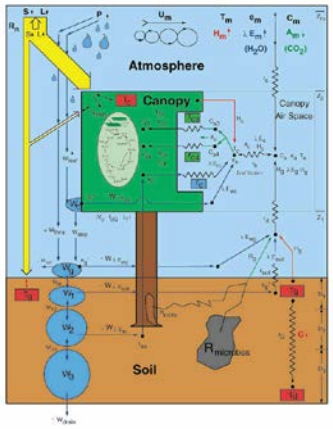
# Data Integration and Analysis System

To create knowledge enabling us to solve the Earth environment problems, to reduce the disaster risk, and then, to generate socio-economic benefits,



# Hydrometeorology-Agriculture Coupled Model

Energy and Water flux Balance



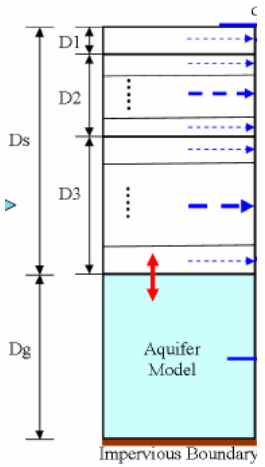

Rice Production

Dynamic Vegetation

Irrigation System

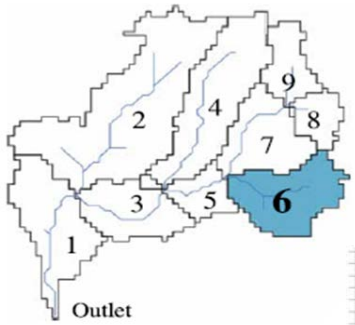
Water and Energy Budget Distributed Hydrological Model (WEB-DHM)

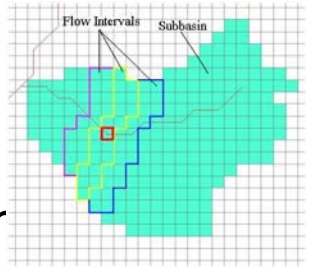
Dam Operation



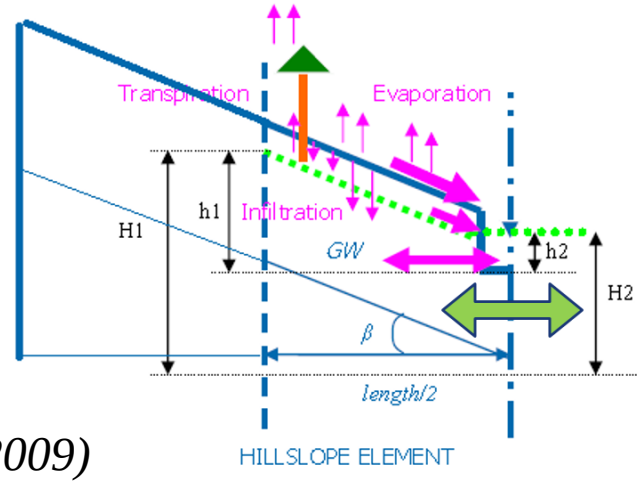

Vertical Soil moisture Profile

Lateral flow, Gridded to Flow-interval



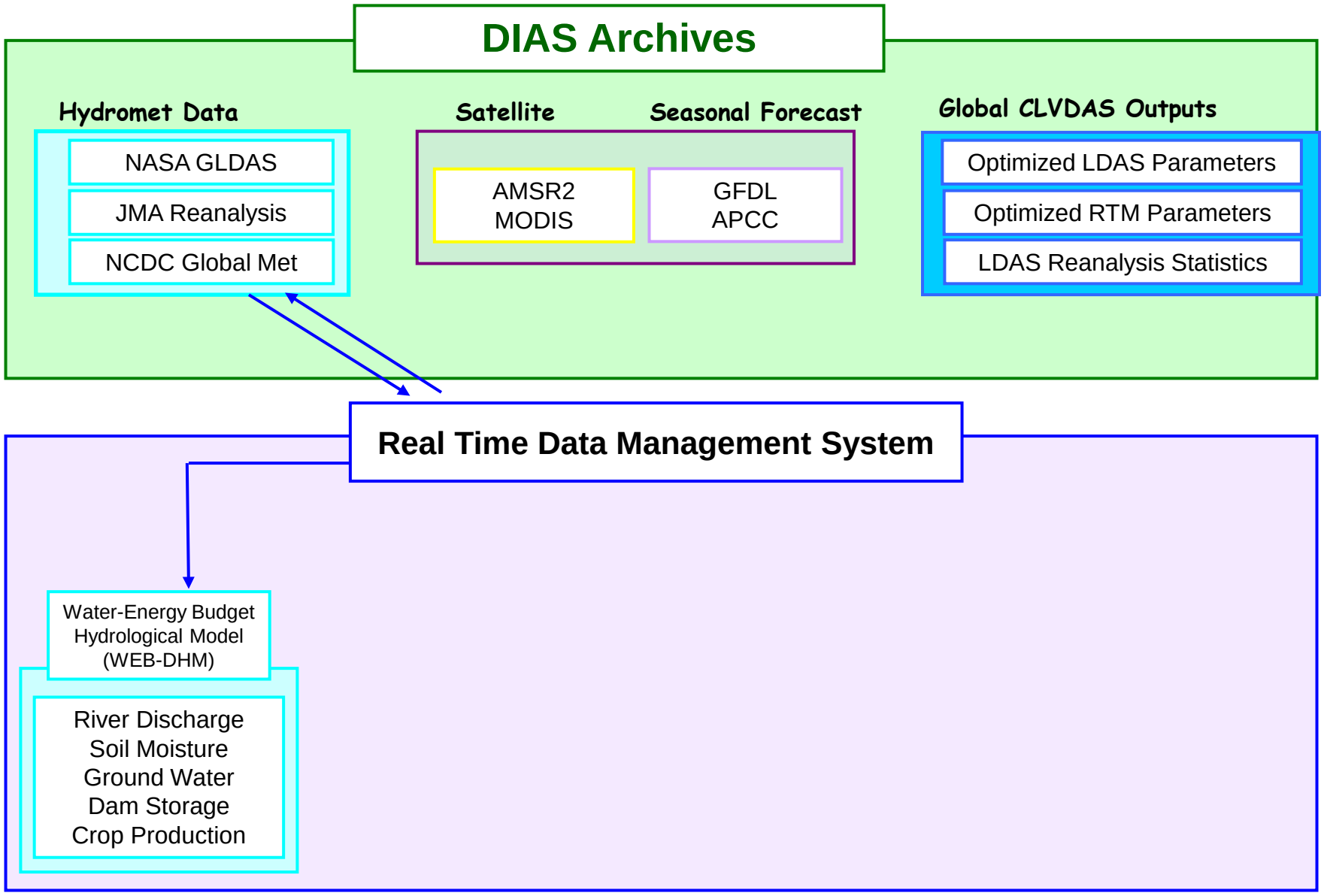



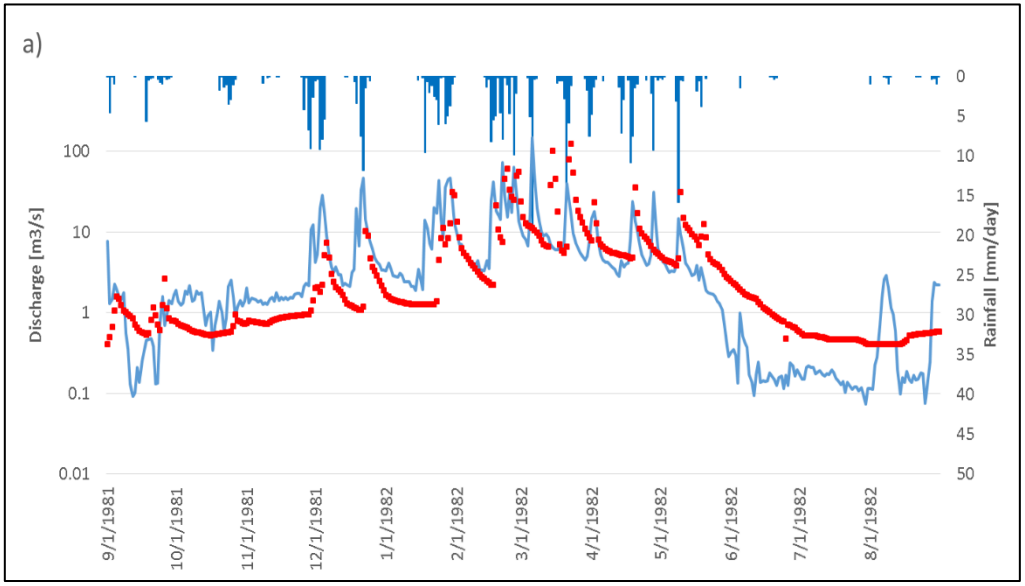

Riverflow Via Kinematic Wave Equation



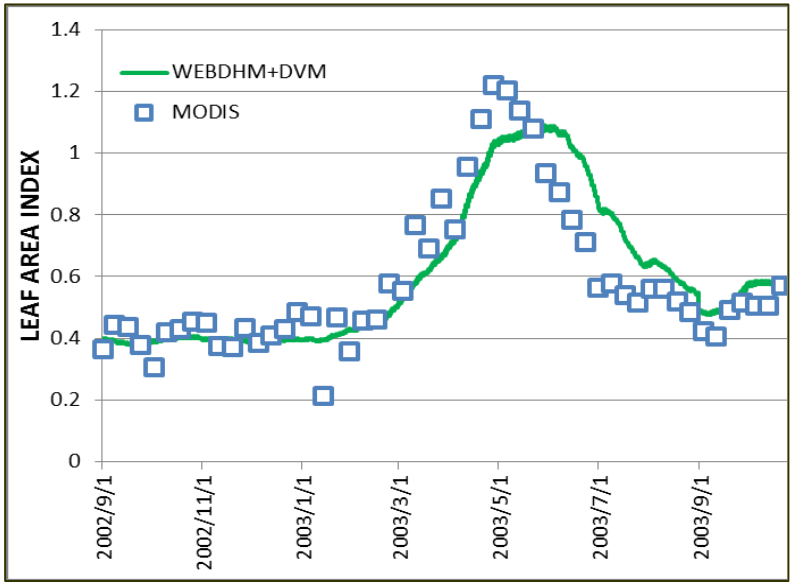

*Wang, Koike, et al. JGR (2009)*

# Hydrometeorology-Agriculture Droughts Prediction System

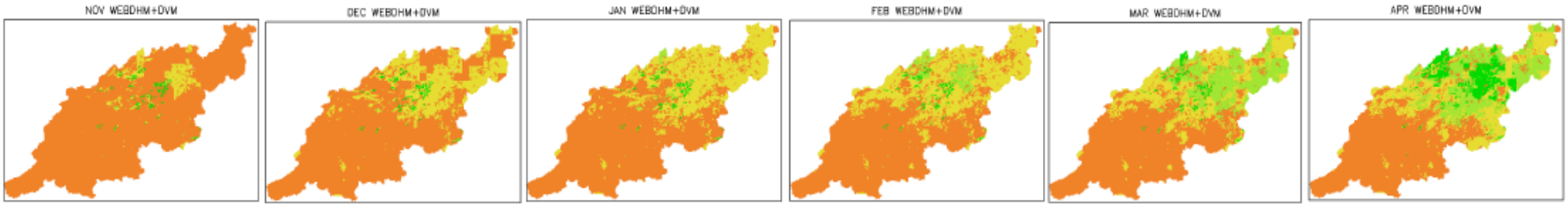




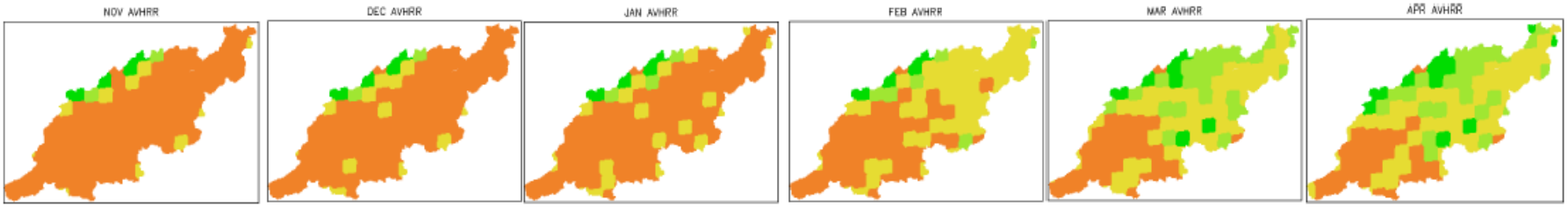

River Discharge (obs. & simulated)




LAI (obs. & simulated)




Seasonal variation of LAI by the Coupled Model (above) and MODIS (below)

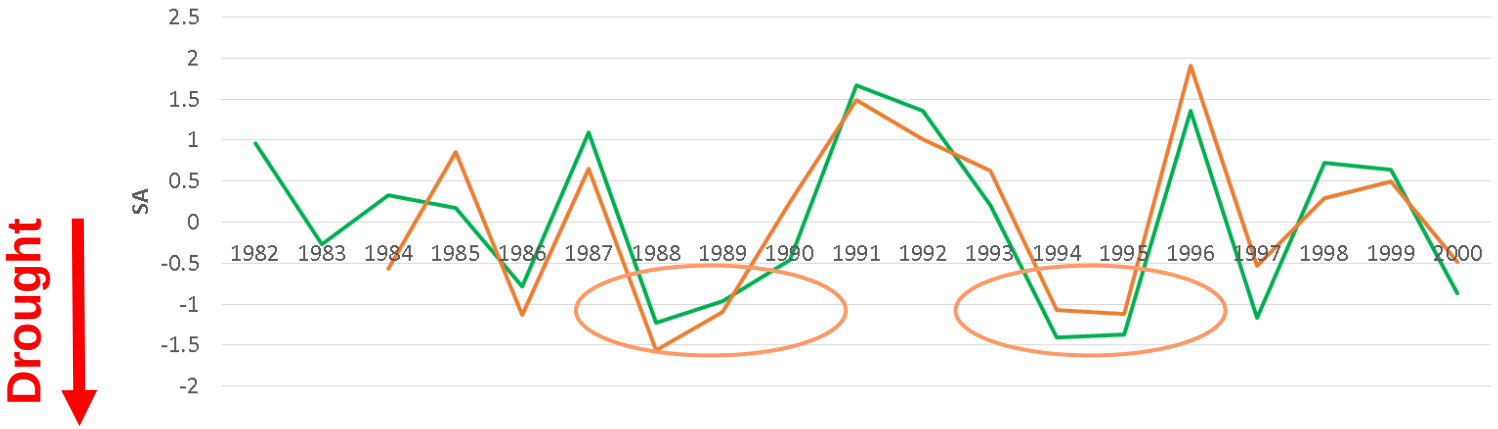



*Sawada, Koike, et al. WRR (2014)*

# - Agricultural Drought Index -

Drought indices (SA index)
Green:simulated annual peak LAI and Orange:nationwide crop production

R =0.89



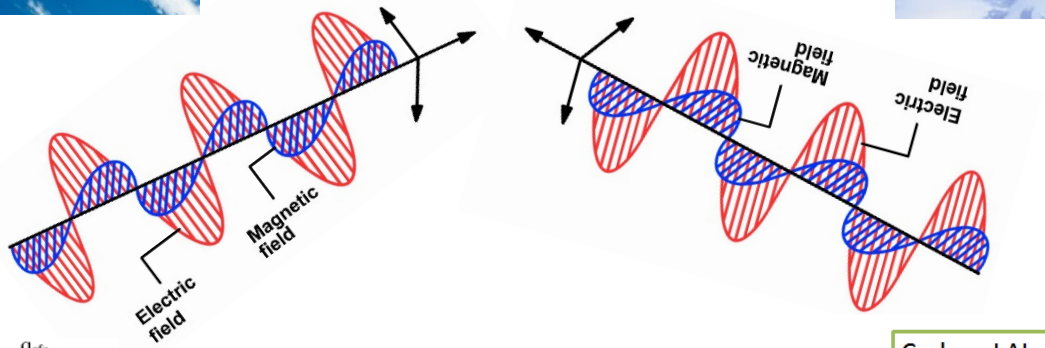

→ The drought index calculated from the model-estimated annual peak of leaf area Index correlates well with the drought index from nationwide annual crop production.
→ Severe droughts (food shortage) in 1988-1989 and 1994-1995 are reported on FAO report [FAO, 2005]

*Sawada, Koike, et al. WRR (2014)*

AMSR-E

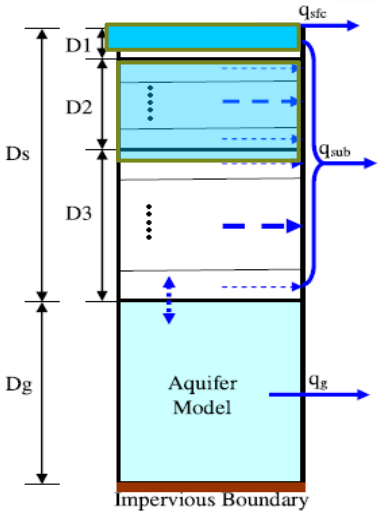
# Coupled Data Assimilation

AMSR2

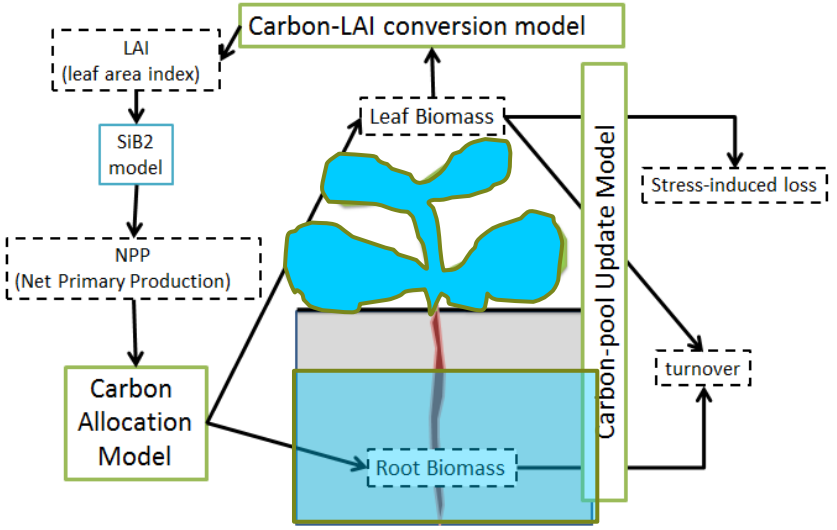



Electronic-Magnetic Wave

+




**Land surface model**

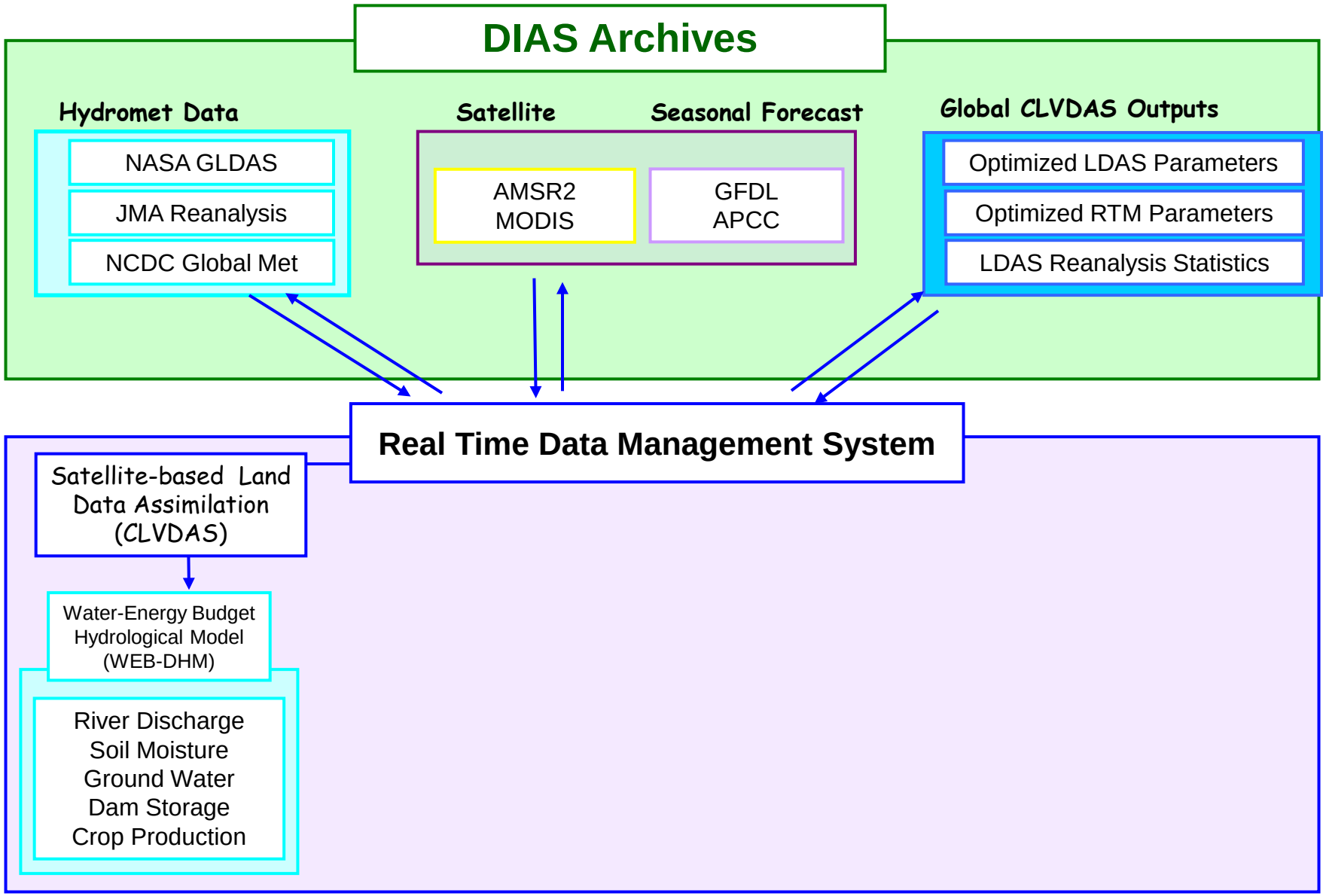



Dynamic Vegetation Model

*Yang, Koike, et al. JMSJ (2007)*

*Sawada & Koike, JGR (2014)*

# Hydrometeorology-Agriculture Droughts Prediction System

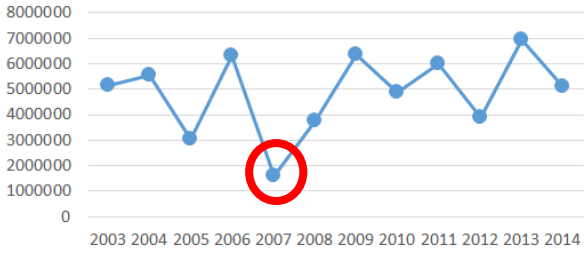


# Drought analysis

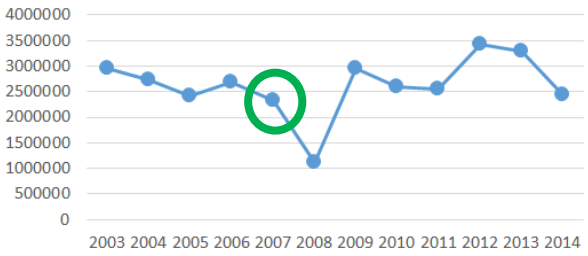
## Wheat production

### 2007 Morocco Drought

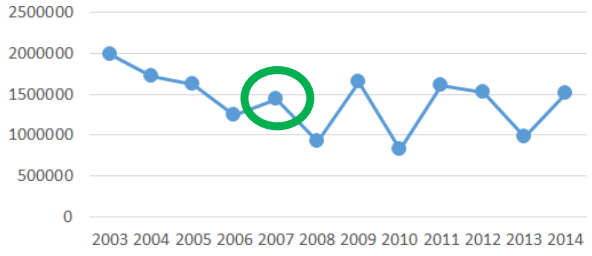
Morocco



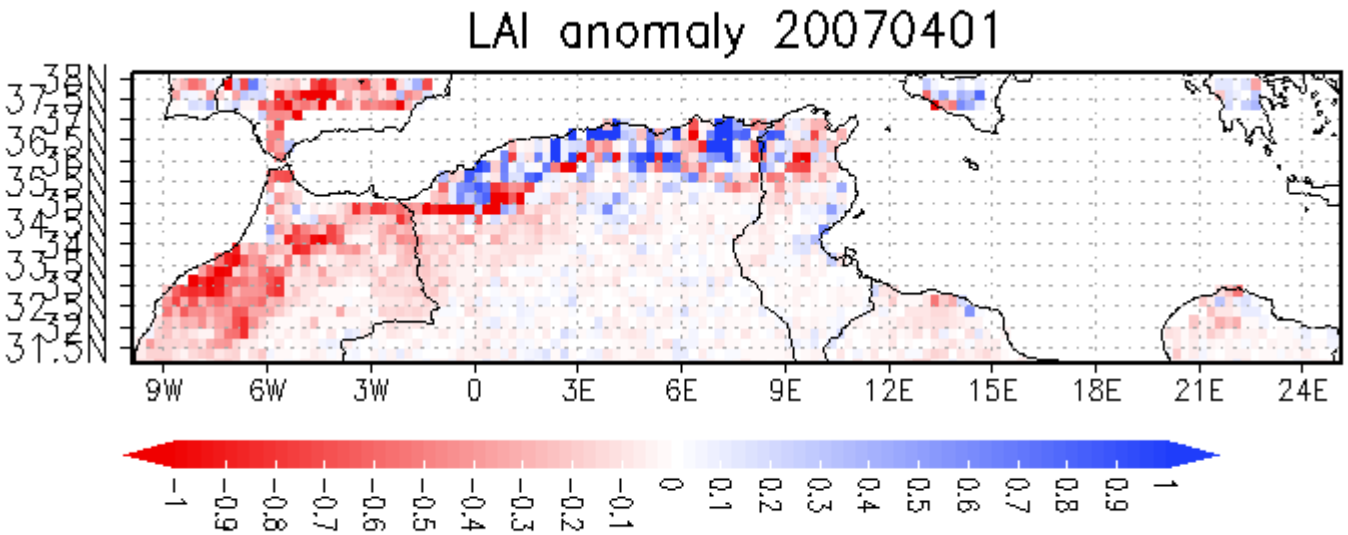

Algeria




Tunisia




### LAI anomaly from CLVDAS



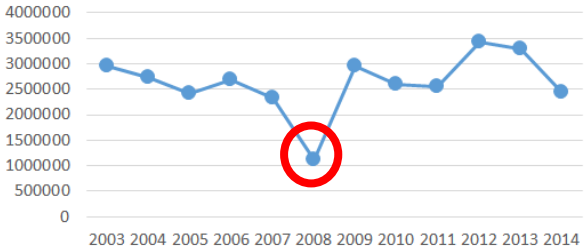
# Drought analysis

## Wheat production

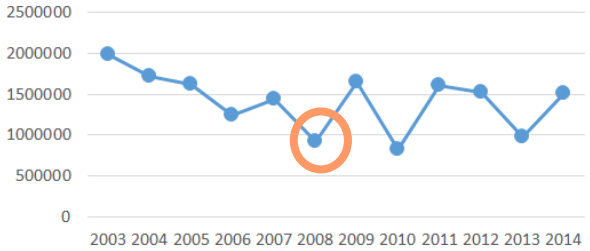
### 2008 Morocco, Algeria, & Tunisia Drought

Morocco

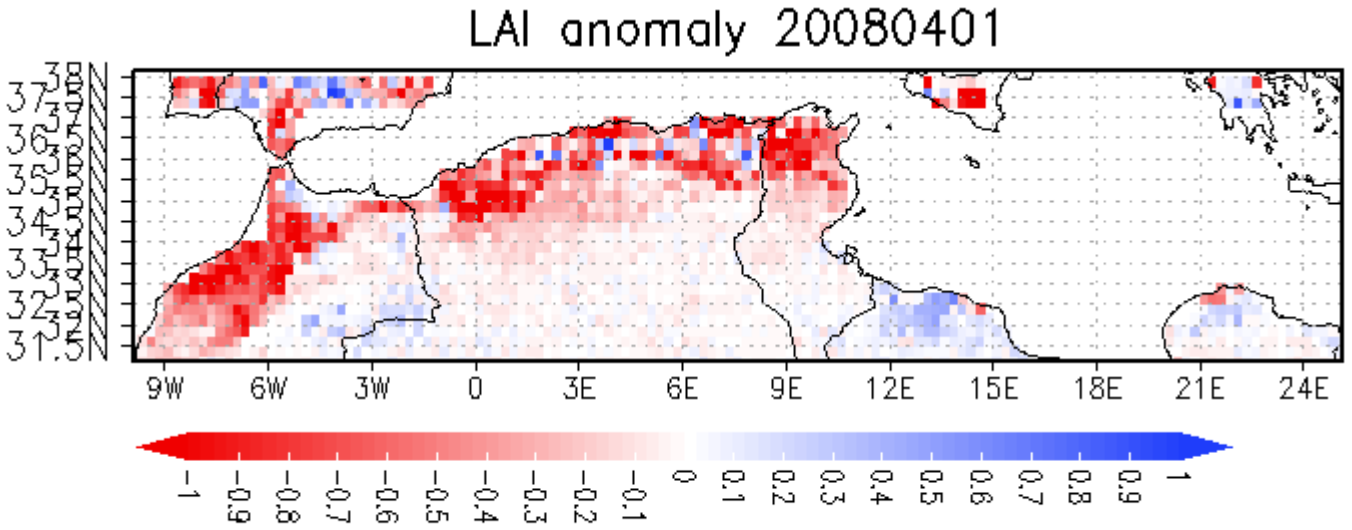

Algeria




Tunisia




## LAI anomaly from CLVDAS

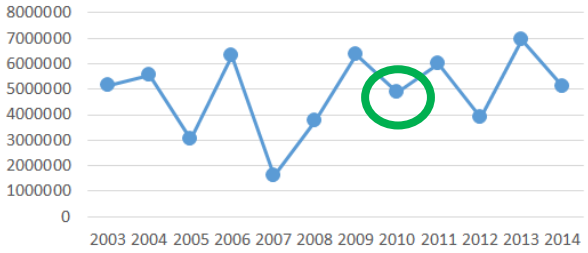


# Drought analysis

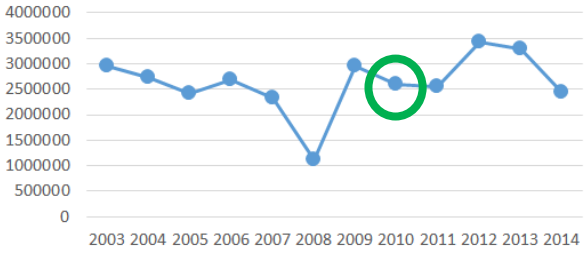
## Wheat production

**2010 Tunisia Drought**

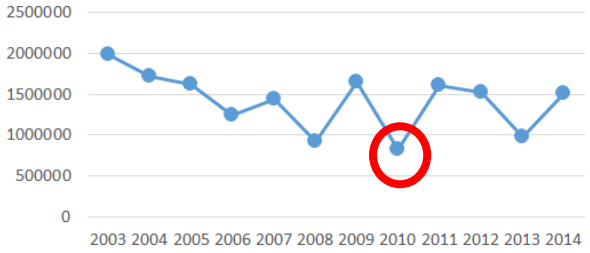
Morocco



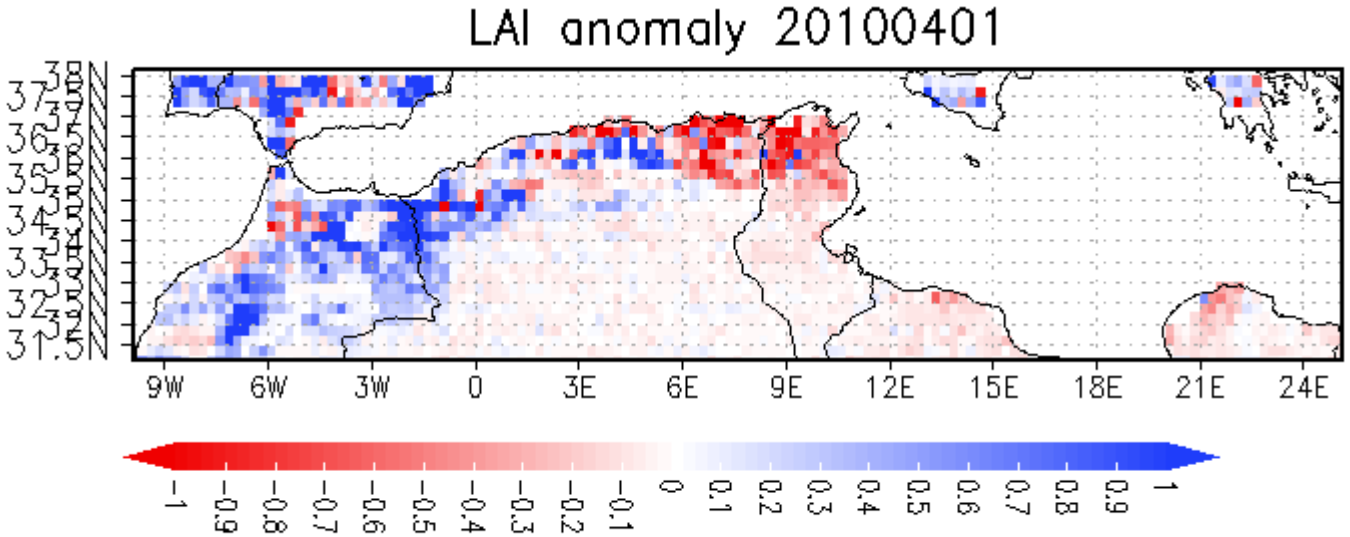

Algeria



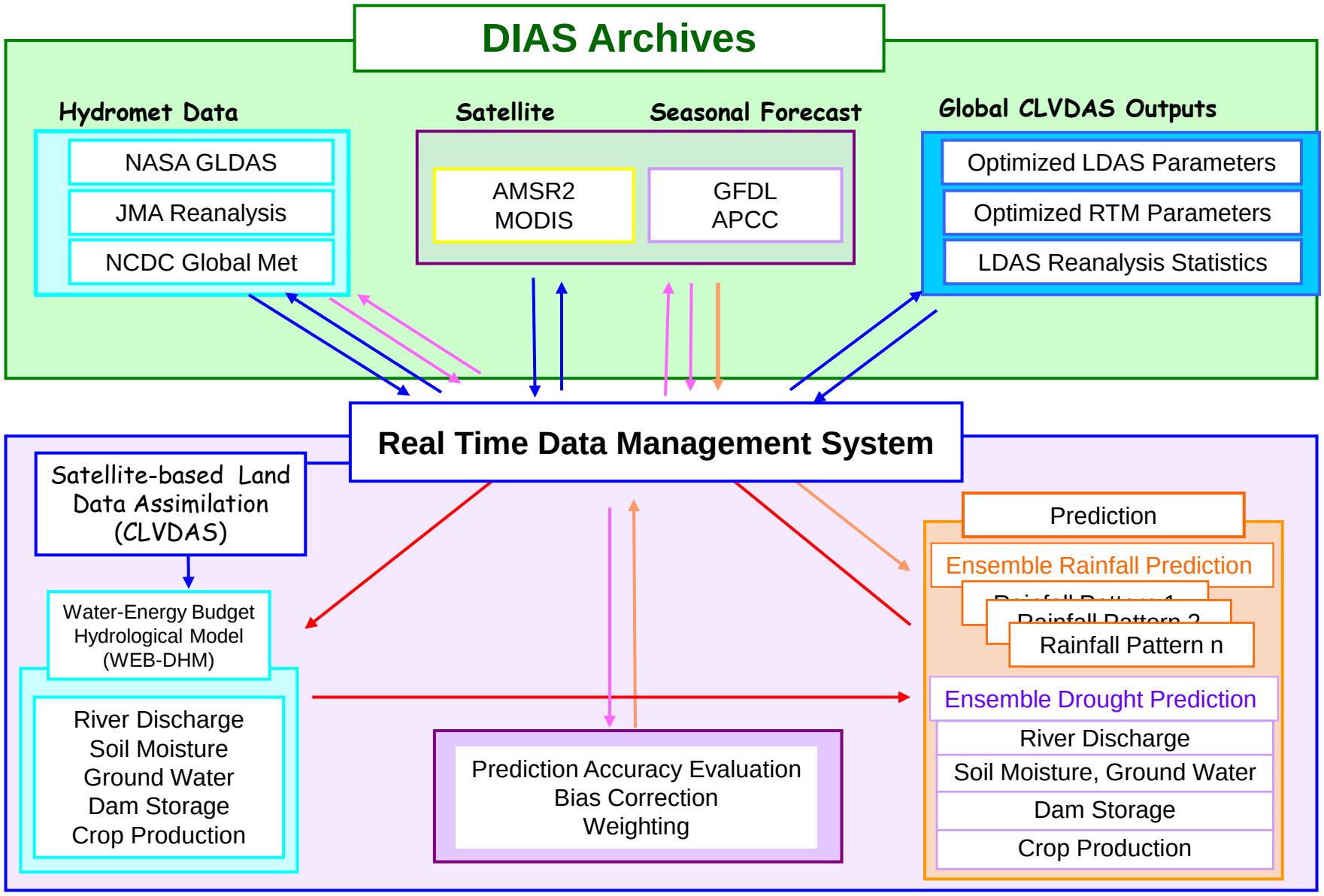

Tunisia




## LAI anomaly from CLVDAS



# Hydrometeorology-Agriculture Droughts Prediction System

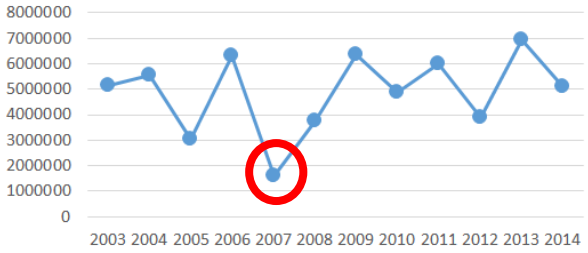


# Drought analysis

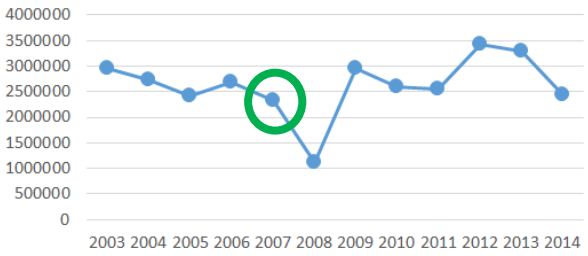
## Wheat production

### 2007 Morocco Drought

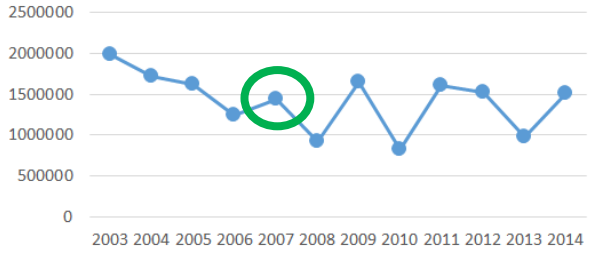
Morocco



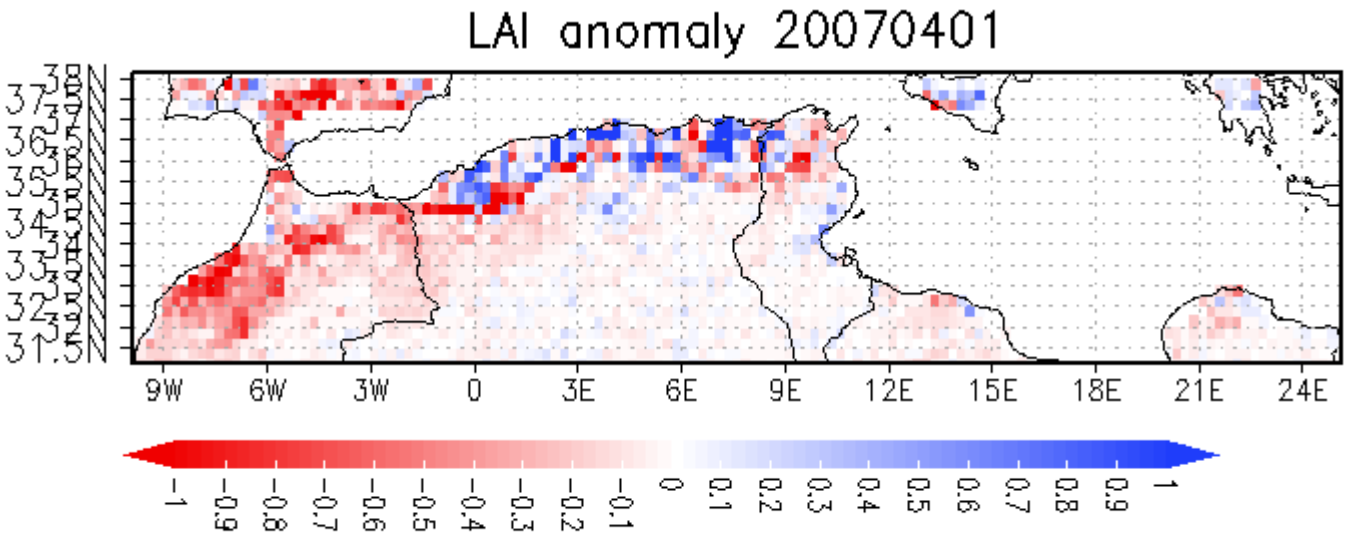

Algeria




Tunisia




### LAI anomaly from CLVDAS



# Agricultural-Drought Monitoring in Panjab

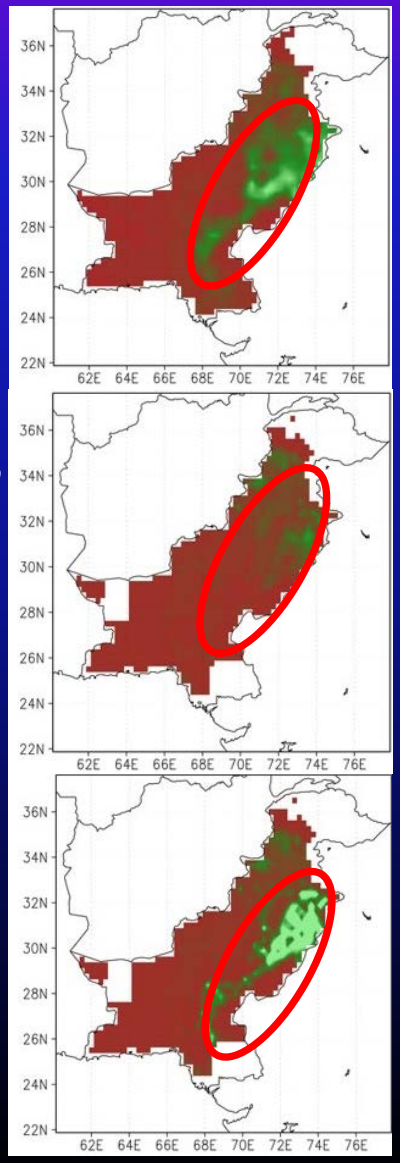
Winter, 2007

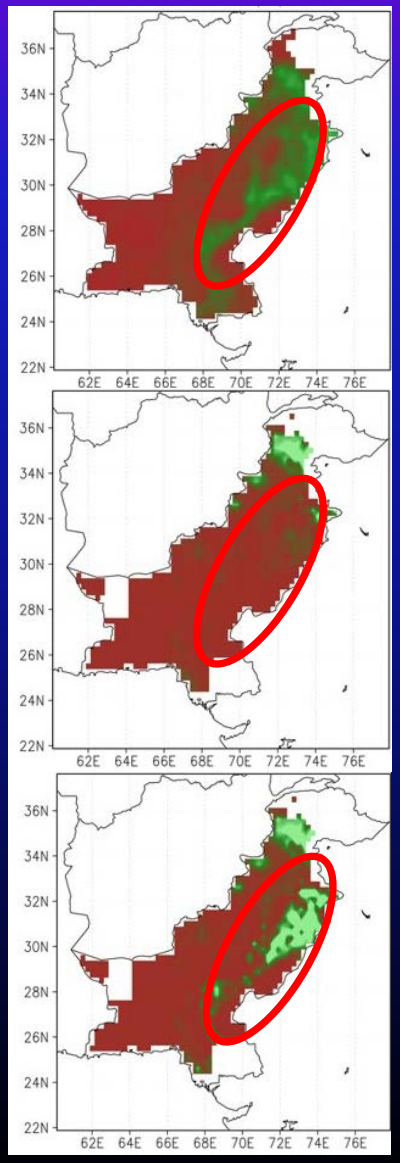
Summer, 2007

Satellite

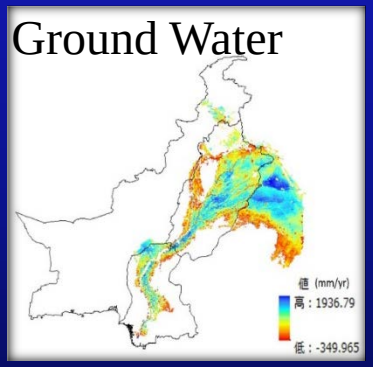
Preliminary

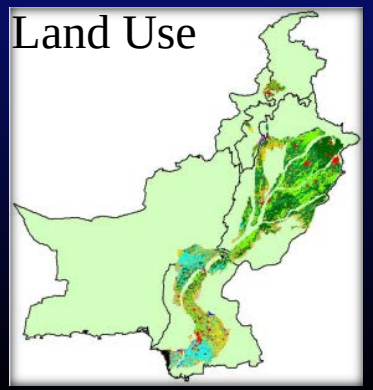
Improved

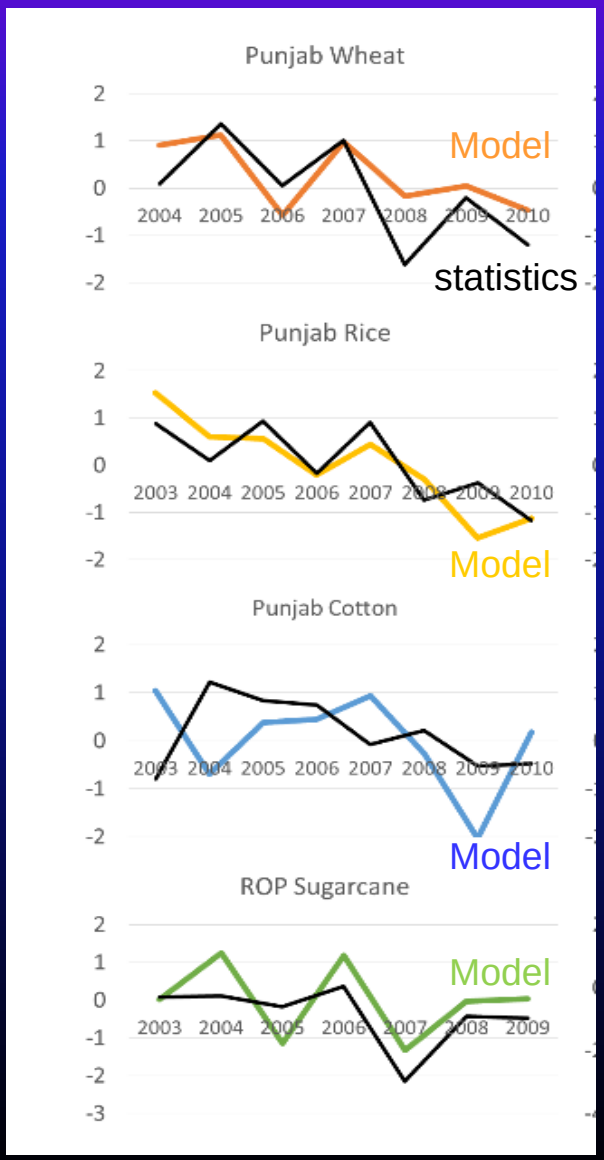




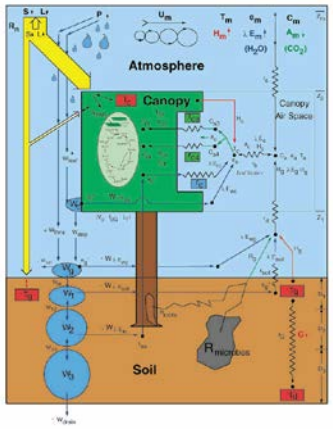


# Hydrometeorology-Agriculture Coupled Model

Energy and Water flux Balance



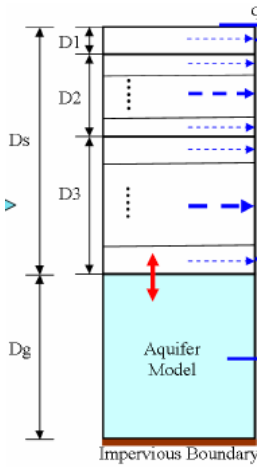

Rice Production

Dynamic Vegetation

Irrigation System

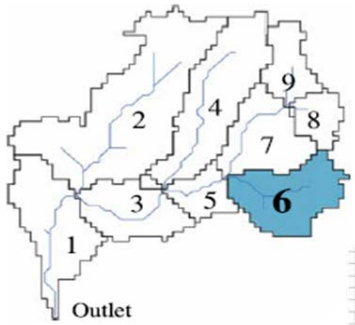
Water and Energy Budget Distributed Hydrological Model (WEB-DHM)

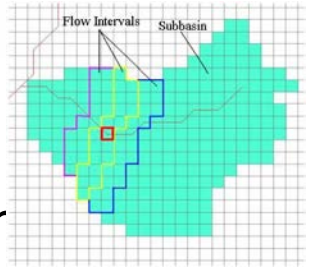
Dam Operation



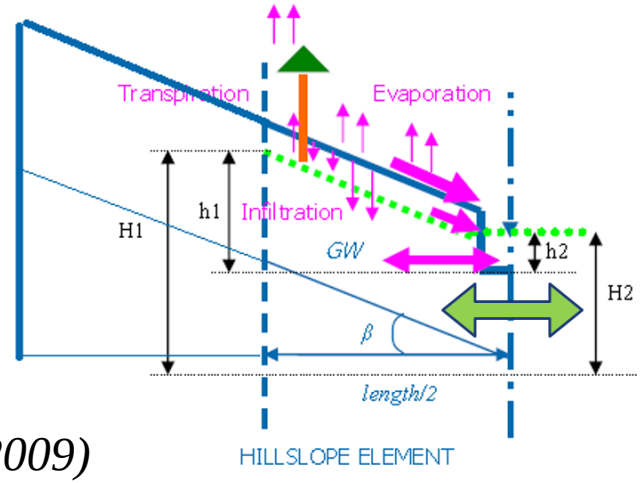

Vertical Soil moisture Profile

Lateral flow, Gridded to Flow-interval



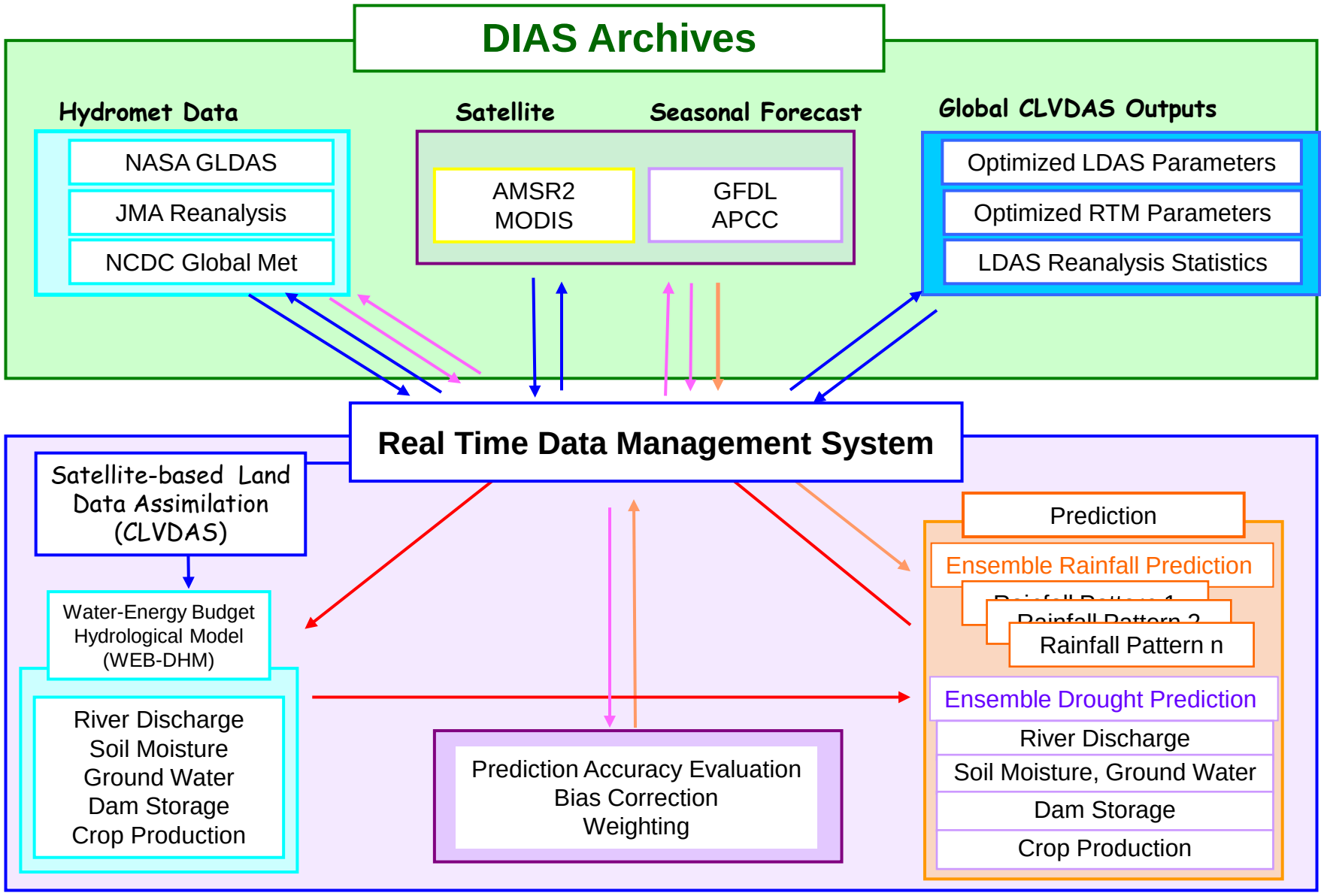




Riverflow Via Kinematic Wave Equation

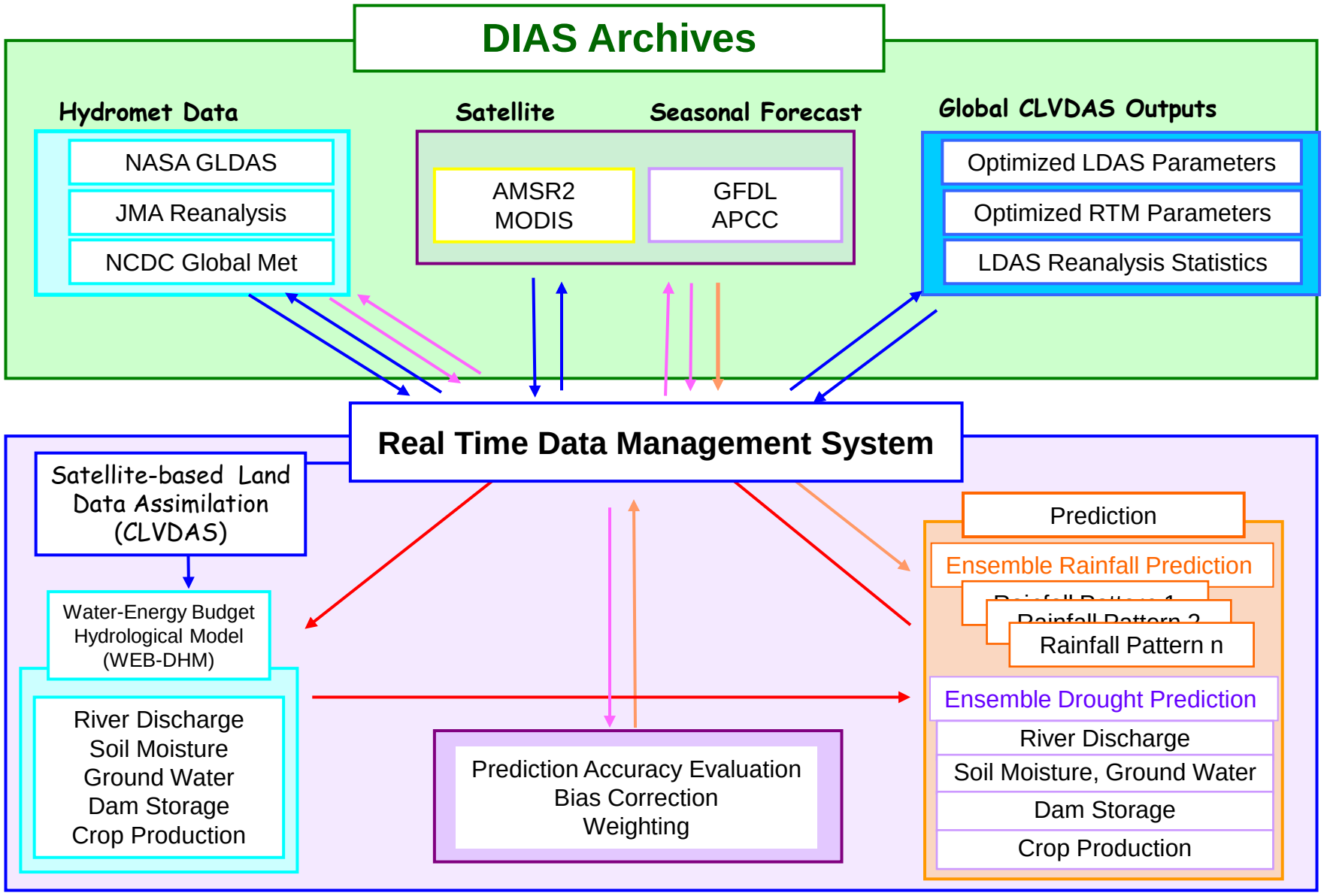



*Wang, Koike, et al. JGR (2009)*

# Hydrometeorology-Agriculture Droughts Prediction System



# Hydrometeorology-Agriculture Droughts Prediction System



DROUGHT EMERGENCY

EXECUTIVE BRIEF

# HORN of AFRICA DROUGHT

**2011**

4 August 2011

## HIGHLIGHTS

- 12.4 million people are in urgent need of assistance in Djibouti, Ethiopia, Kenya and Somalia.
- Neighbouring countries – South Sudan, Sudan, and Uganda – all require support to ensure the crisis in the Horn of Africa does not spill over their borders.
- FAO funding gap as of 4 August 2011: **USD 111.8 million.**

### PRIORITY AGRICULTURAL CHALLENGES

- protecting livestock assets by preventing livestock disease outbreaks to ensure the continued functioning of vital livestock export markets.
- enabling farmers to plant during the coming rainy season to ensure the availability of food in the next season.
- increasing households' access to food through cash-for-work that has a longer-term benefit in terms of rehabilitating vital