

# PROMISE (Predictability and variability of monsoons, and the agricultural and hydrological impacts of climate change)

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## PROMISE



Predictability and variability of monsoons and the agricultural and hydrological impacts of climate change



**A 3 year research project funded under Framework 5 of the European Union (grant number EVK2-CT-1999-00022)**

For more information see <http://ugamp.nerc.ac.uk/promise>

## PROMISE Partners



- 1 UREADMY (Department of Meteorology, University of Reading)
- 2 CIRAD (Centre de coopération internationale en recherche Agronomique pour le Développement)
- 3 CNRM (Météo France)
- 4 DMI (Danish Meteorological Institute)
- 5 ICTP (International Centre for Theoretical Physics)
- 6 CEH (Centre for Ecology and Hydrology)
- 7 LMD (Laboratoire de Mécanique Dynamique)
- 8 MPI (Max Planck Institute)
- 9 Met Office (Hadley Centre for Climate Prediction and Research)
- 10 UREADAG (Department of Agriculture, University of Reading)
- 11 ECMWF (European Centre for Medium Range Weather Forecasting)
- 12 CRC (Centre de Recherches de Climatologie)
- 13 CINECA

## Goals of PROMISE

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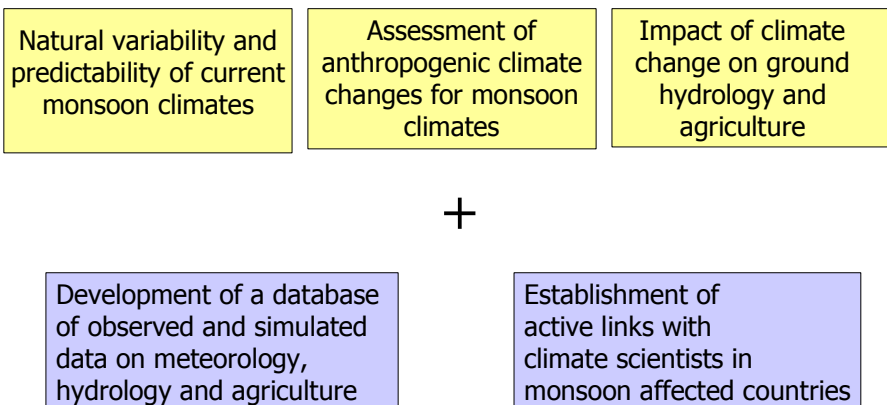


PROMISE aims to improve understanding of:

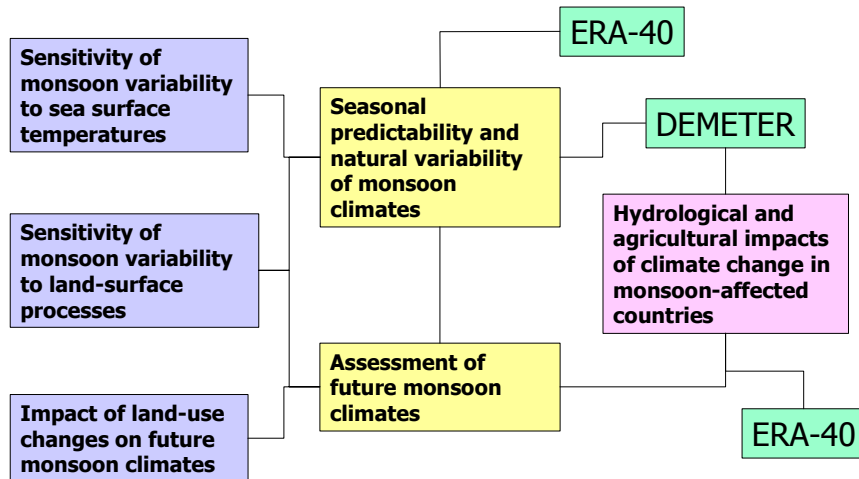
- The potential for seasonal prediction and the benefits that would accrue in terms of the management of water resources and agriculture
- The impacts of climate change on tropical countries, in particular on the availability of water resources for human use and on the productivity of crops and the potential changes in natural vegetation

## PROMISE Research and Support

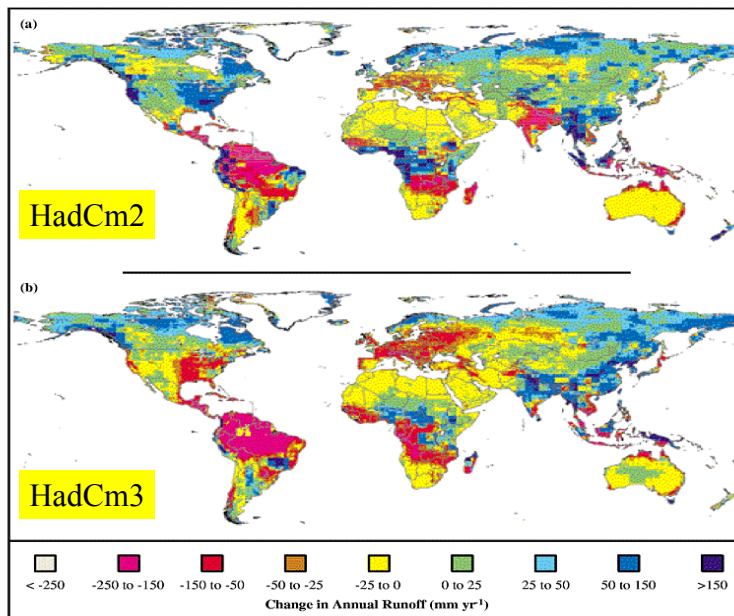
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## Main areas of PROMISE research



## Predicted runoff change by 2050



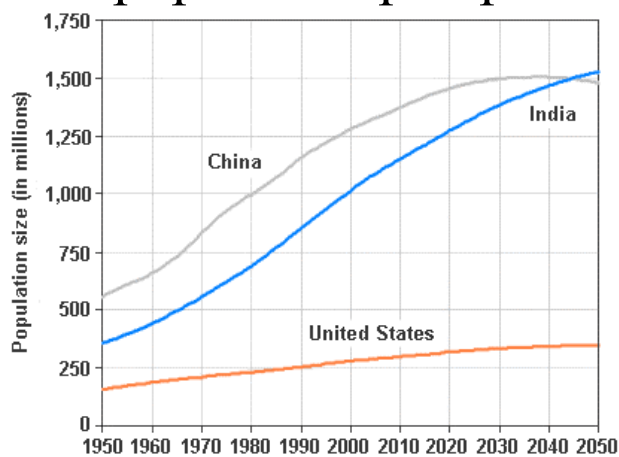
Predicted change in runoff in 2050 compared to 1990-1996 with CO<sub>2</sub> forcing (IPCC 2001).

### Cities with more than 100,000 people in 1997



→ More than 50% of the world population lives in Asia

### World population prospects ...



Source: United Nations Population Division 1998

→ India predicted to be the most populated country by 2050

# GWAVA

## Global Water Availability Assessment

Jeremy Meigh  
Centre for Ecology & Hydrology  
(Institute of Hydrology)  
Wallingford, UK  
in conjunction with  
British Geological Survey

### GWAVA Detailed Objectives

- Consistent methodology at the global scale
- Representation of spatial variability in water availability and demands
- Representation of seasonal and year-to-year variability in water resources
- Accounting for the real properties of water resources systems
- Tackling problems of international basins
- Combined treatment of surface and groundwater
- Ability to take into account scenarios of population growth, urbanisation, economic development and climate change

## General approach - 1

- 0.5 by 0.5 degree grid for both water availability and demands
- Rainfall-runoff model for surface water
- Long series of climate inputs to estimate actual availability
- Linking grid cells to simulate river network
- Models to account for effects of:
  - lakes, reservoirs and wetlands
  - abstractions and return flows
  - inter-basin transfers

## General approach - 2

- Groundwater availability based on aquifer properties and recharge estimates
- Water demands based on current and projected population and livestock numbers, information on irrigation and industrial use
- Indices of water availability versus demand derived at the grid cell scale

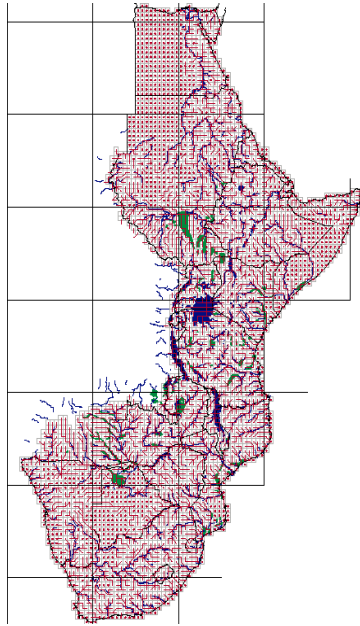
## Inputs and data sources

- Physical and water resources data
  - Elevation, River network
  - Vegetation, Soil type
  - Lakes, Reservoirs and Wetlands
  - Aquifer properties
- Climate
  - Rainfall - 30 year time series, Evaporation
- Demand related information
  - Population, Livestock numbers, Industrial and Irrigation demands

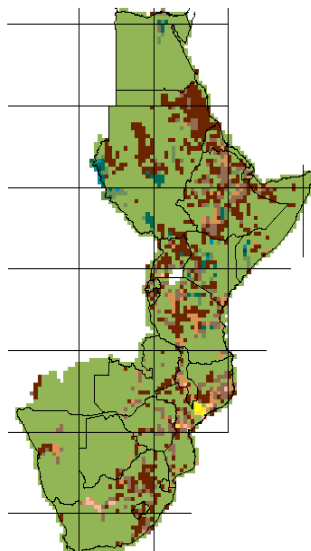
## GWAVA and PROMISE

- GWAVA model has been developed for South and East Africa where it has been calibrated and used to produce scenarios of future water availability.
- GWAVA model is being extended to West Africa, using the land use scenarios currently under development for climate change studies within PROMISE.

## River network and cell linkages



## Change in water availability index

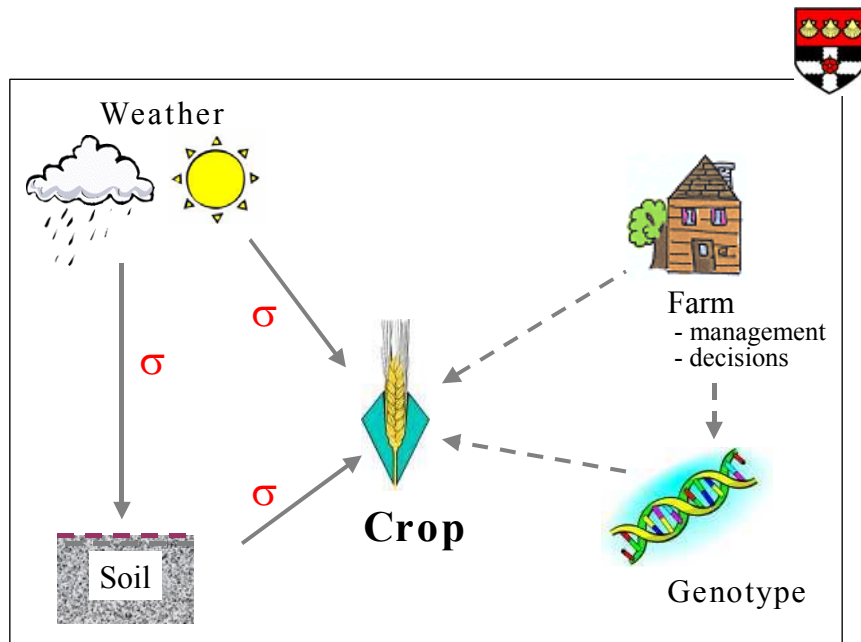
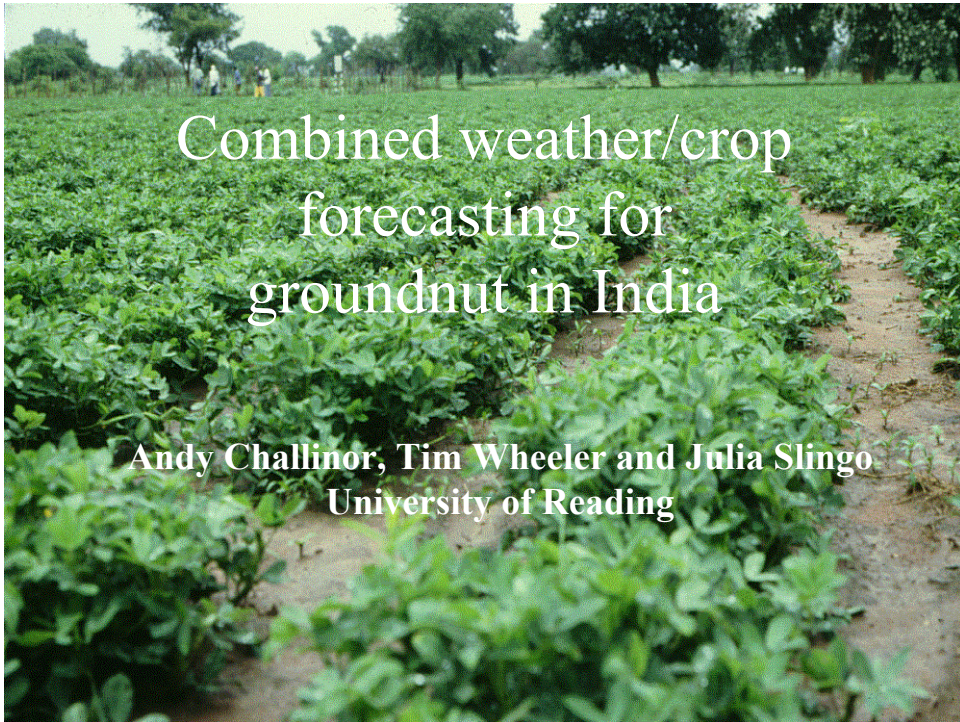


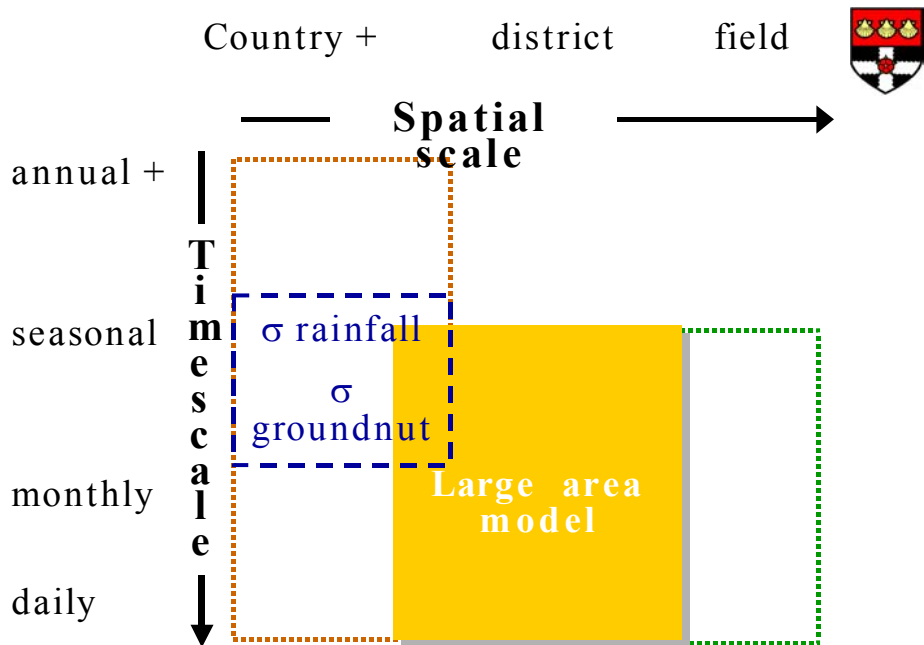
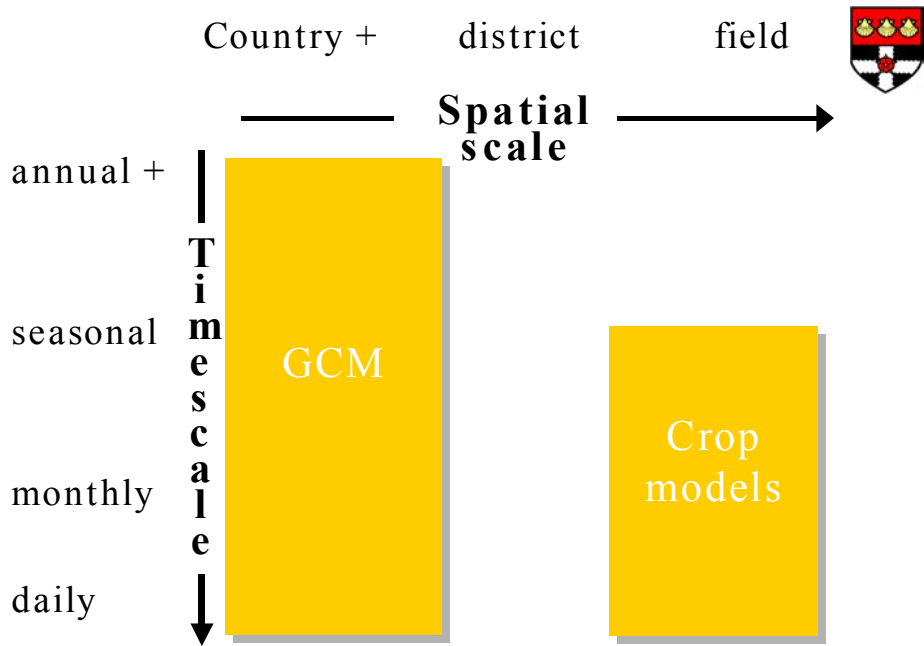
### 2050, taking in to account:

- **Supply** changes due to climate change
- **Demand** changes due to:
  - increasing population
  - population distribution
  - increasing per capita demands (improved living standards and industrialisation)

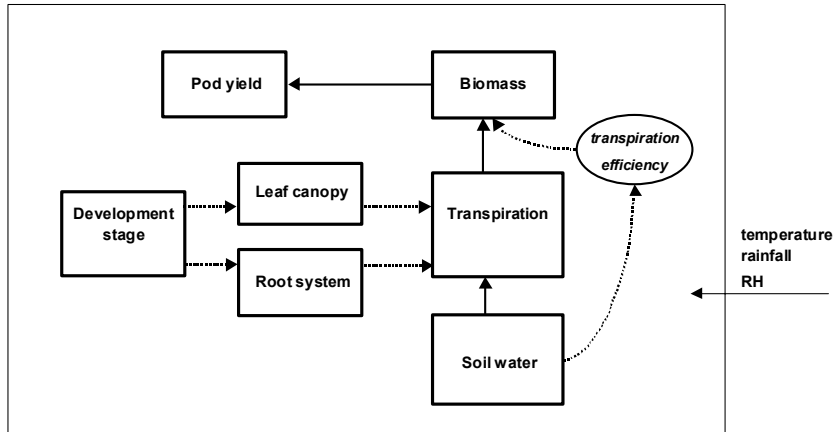
0 to -1.90  
5 to -1.50  
0 to -0.50  
0 to 0.20  
0 to 1.00  
0 to 1.75  
0 to 2.00







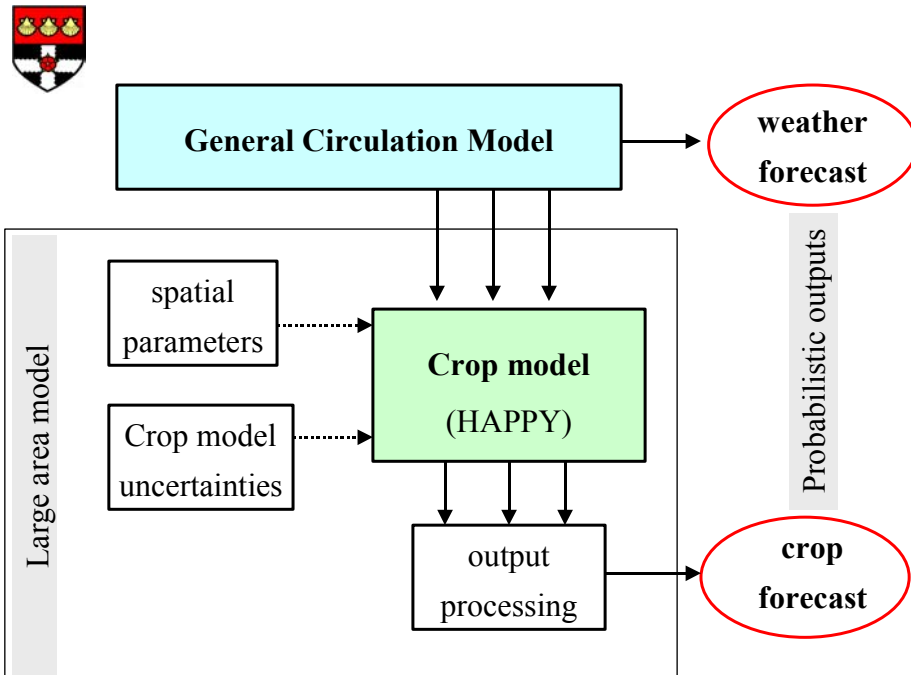
## Huge Area Potential Peanut Yield (HAPPY!!) model



## Calibrating and testing HAPPY



- Calibrate using field/district data.
- Test in hindcast mode using ERA-40 data to drive HAPPY.
- Compare predicted crop yields with observed crop yields.
- Re-calibrate HAPPY?





# DHC\_CP

## Diagnostic Hydrique des Cultures Champs Pluviométriques

### *Crop Water Balance Calculation Using Satellite based Rainfall Estimates*

*Presented by :*

*Abdallah SAMBA, Agrometeorologist  
AGRHYMET Regional Centre at Niamey, NIGER  
Trieste, June 2001*

AGRHYMET

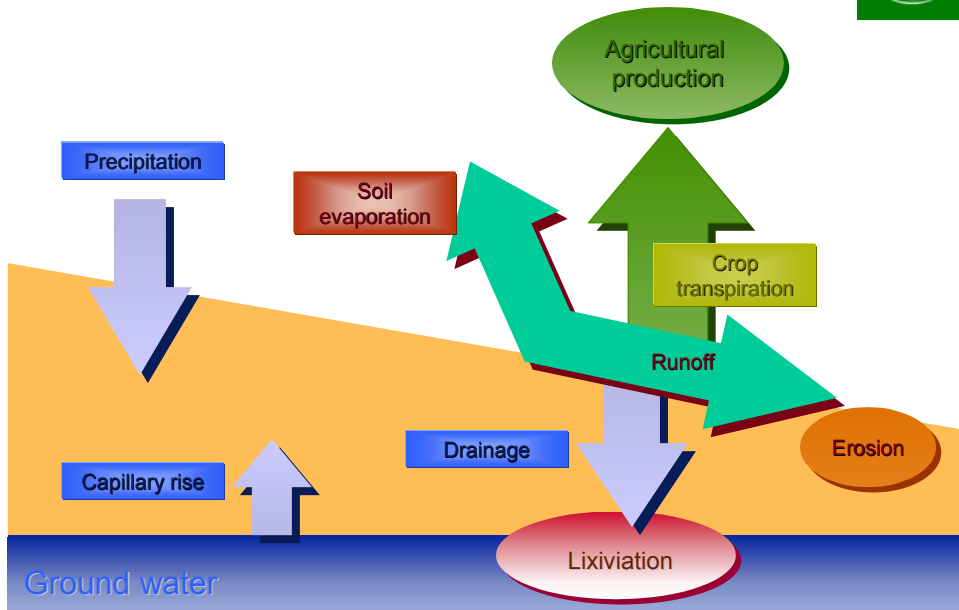
CIRAD



## Introduction

- Need to forecast the yields of food crops in order to :
  - best manage the cereal stocks
  - control the distribution of food
  - start food aid in time
- Sophistication of the techniques based on the statistical investigations
- Using water balance simulation to obtain parameters which enable estimation of yields.

Water fluxes and their effects ( ⇨ )  
on agricultural hydrosystem ( ○ )



Simplification for Water Balance simulation  
(The DHC4 model )

