



# CEOP

## Land Model Working Group

Melbourne, Australia  
20 August 2009



# Previous Coordinated Land Modeling Activities



## • **Project for Intercomparison of Land-surface Parameterization Schemes**

- Local scale; several phases/locations; many groups/models involved
- Goal: Coordinate the evaluation of the next generation of land-surface schemes

## **Global Soil Wetness Project 1 & 2**

- Global scale; 1987-88 and 1986-95; many groups/models involved
- Objectives:
  - Produce state-of-the-art global data sets of land surface fluxes, state variables, and related hydrologic quantities;
  - Develop and test large-scale validation, calibration, and assimilation techniques over land;
  - Provide a large-scale validation and quality check of the ISLSCP data sets;
  - Compare Land Surface Schemes, and conduct sensitivity studies of specific parameterizations and forcings, which should aid future model and data set development.

## **North American Land Data Assimilation Systems**

- North American domain; 8 groups; 4 LSMs; identical, high quality forcing
- Goal: Improve initialization and simulation of the land surface in coupled forecast simulations by forcing uncoupled LSMs with observation-based data



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## **Motivation:**

- Land surface models (LSMs) encapsulate our understanding of physical processes at the land-atmosphere interface
- Observations are imperfect
- Data assimilation and related modeling techniques allow LSMs to integrate data from multiple sources in a physically coherent manner
- LSMs enable spatial and temporal downscaling, data gap filling, and quality control

**Purpose:** To coordinate global land modeling activities and share data, toward the common goal of generating physically coherent fields of land surface states and fluxes through the integration of disparate data products.

## **Objectives:**

- 1) Identify and gather gridded global meteorological forcing data sets that are available for regional to global off-line LSM simulations
- 2) Analyze the consistency among the data sets to help assess uncertainty
- 3) Share model results and cooperate on intercomparison and cross-validation
- 4) *Participate in related land modeling coordination efforts and applications activities*



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• **Relevance to CEOP:** Direct relevance to GEWEX Phase II Objectives 1 and 2:

Objective 1: Produce consistent research quality data sets complete with error descriptions of the Earth's energy budget and water cycle and their variability and trends on interannual to decadal time scales, and for use in climate system analysis and model development and validation.

Objective 2: Enhance the understanding of how energy and water cycle processes function and quantify their contribution to climate feedbacks.

## **Current Involvement:**

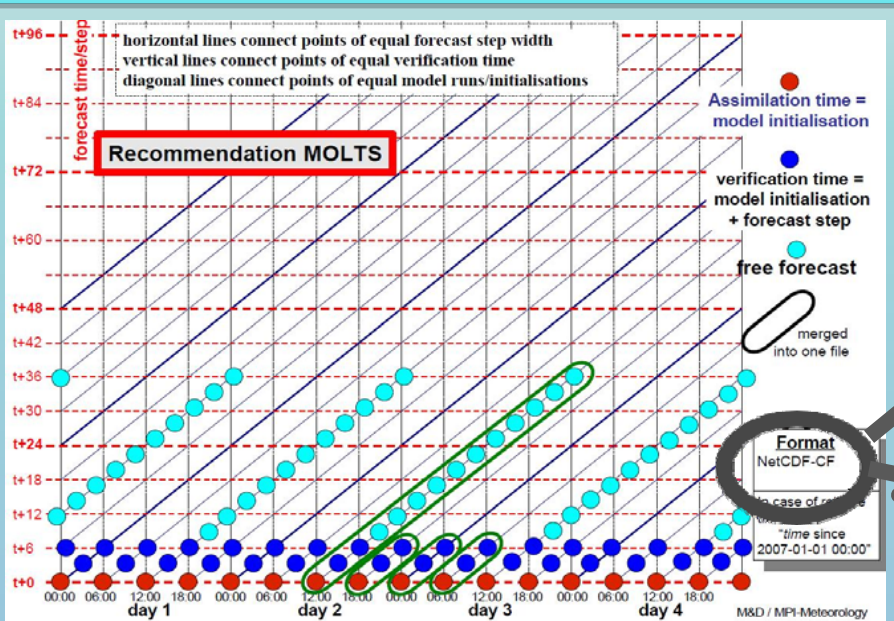
- University of Tokyo (T. Koike, T. Graf)
- NASA/GSFC (M. Rodell, D. Mocko, H. Kato Beaudoin, M. Bosilovich, C. Peters-Lidard)
- Princeton University (E. Wood)
- NOAA/NCEP (M. Ek, J. Meng)
- George Mason University (P. Houser)
- Indian Ministry of Earth Sciences (M. Ravindranath)
- Northern Illinois University (J. Song)
- Universidad de Concepcion, Chile (R. Abarca del Rio)

## **Accomplishments:**

- Various model forcing and output datasets
- Model location time series (MOLTS)
- Many studies published in CEOP special issue of JMSJ and elsewhere



# CEOP MOLTS Standardization



**JMA  
NetCDF  
conversion  
software**

## Beate's list of variables in CF convention

AEVAP_S	JMA	Evaporation		lon lat time	water_evaporation_amount
AEVAP_S	UKMO	Evaporation		lon lat time	water_evaporation_amount
AEVAP_S	CPTEC	Evaporation		lon lat time	water_evaporation_amount
AEVAP_S	GMAO	EVAP	8	lon lat fc_time	water_evaporation_amount
AEVAP_S	CMC	Evaporation flux	dt	lon lat time	water_evaporation_flux

MPI structure requirement

- Standard filename convention
- Standard station names

Phase I

Phase II



# Activities and Opportunities for Collaboration



## **Land Information System:**

- Advanced software infrastructure for modeling and data assimilation
- Modular structure facilitates incorporation of new models and capabilities
- Ideal platform for model intercomparison

## **Regional land data assimilation systems:**

- North American, South American, European, and Arab LDAS
- Regional optimization; often with high quality forcing and parameter data

## **LDAS-UT:**

- Development of radiative transfer model and advanced assimilation capabilities
- Improving precipitation forecasts in coupled simulations

## **Global LDAS:**

- Global forcing and output available from <http://disc.gsfc.nasa.gov/hydrology>
- Development of innovative modeling and assimilation algorithms

## **Princeton Forcing Dataset:**

- Internally consistent 50+ year global land model forcing dataset
- Ideal for long term global simulations and model intercomparison



# Potential Synergy Among Related Efforts



## **CEOP Land Model Group**

- Much to offer, including a solid foundation in ground observations
- Premier land model infrastructure, forcing, and data assimilation expertise

## **GEWEX Global Land Atmosphere System Study (GLASS):**

- Legacy of successful collaborative endeavors includes PILPS and GSWP
- Purview includes coordinating land surface modeling activities
- GLASS/QUEST benchmarking workshop proposed for February 2010

## **LandFlux:**

- Aims to produce highest quality global land surface flux datasets emphasizing the use of observations and/or data integration

## **Regional Applications:**

- RHPs
- Arab LDAS example



# “Monitoring the Water Cycle in the Arab Region Using NASA Satellite and Data Assimilating Model Technology”

**Funding Source:** U.S. Agency for International Development (USAID)

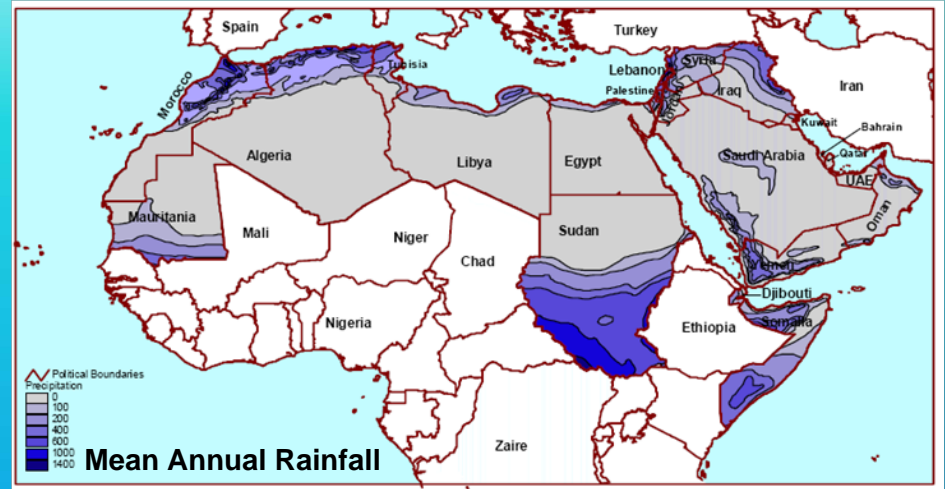
**Participants:** NASA/GSFC, Arab Water Academy, U. Wisconsin (M. Ozdogan), USDA/BARC (M. Anderson), U. California-Irvine (Sorooshian)

**Goal:** Map hydrological states and fluxes in the Middle East - North Africa (MENA) region, which will serve as a basis for regional water resources assessments.

**Method:** Optimize a land data assimilation system for the MENA region, in which satellite data, in situ observations from Arab countries, and meteorological analyses will be used for parameterization, forcing, data assimilation, and validation.

## **Benefits:**

- Near-real time monitoring of water resources across political boundaries
- Historical and regional perspective on local hydrological variability
- Rapid assessment of the severity and extent of droughts and floods
- A scientific tool for agricultural planning, including irrigation
- Potential to assess hydrological impacts of climate change
- A starting point for international cooperation







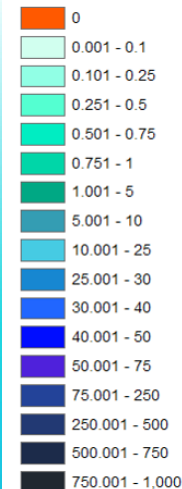
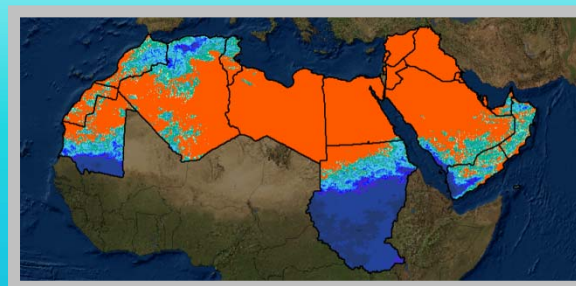
# Arab LDAS



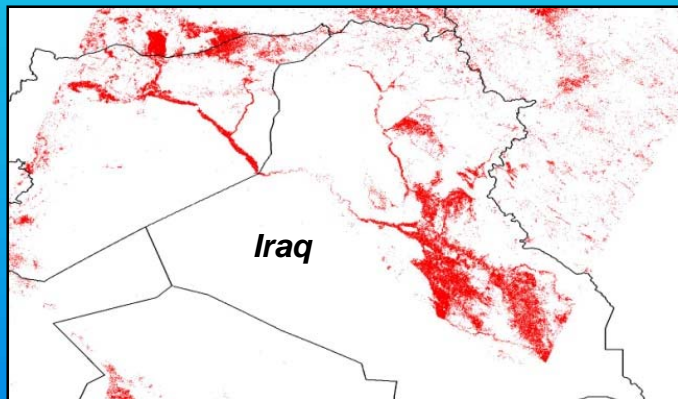
0.125° Grid



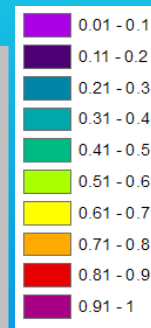
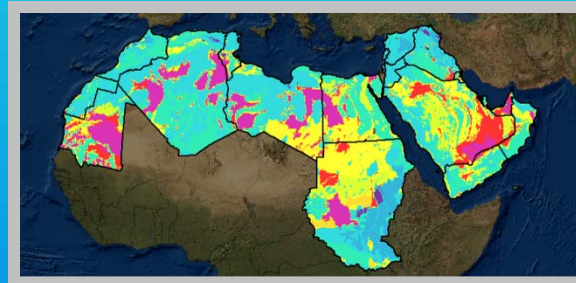
PERSIANN 0.04° Precipitation, July 2007



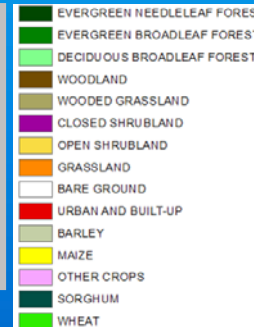
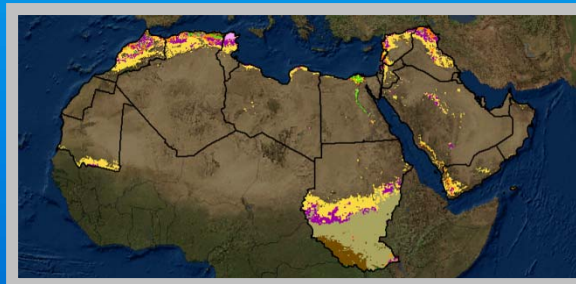
MODIS 250m Intensity of Irrigation



Fraction of Sand



Dominant Land Cover Type



GRACE data assimilation  
Runoff routing  
Irrigation modeling



# CEOP Land Model Working Group: Summary



**Purpose:** To coordinate global land modeling activities and share data, toward the common goal of generating physically coherent fields of land surface states and fluxes through the integration of disparate data products.

**Relevance to CEOP:** Direct relevance to Objectives 1 and 3

**Current Involvement:** Eight institutions

## **Related Initiatives:**

- GLASS
- LandFlux
- Applications-oriented collaborations

## **Data Availability:**

- NASA/GSFC: <http://disc.gsfc.nasa.gov/hydrology/>
- Princeton: <http://hydrology.princeton.edu/data.pgf.php>

**Key Issue:** Integration with other coordinated land modeling activities