

IGWCO COP Planning Meeting

NASA Water Summary Presentation

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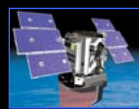
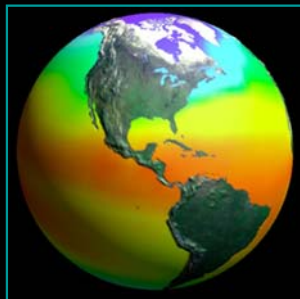
14 March 2011



Goulburn-Murray Water



Study Earth from space to advance scientific understanding and meet societal needs.



Cloudsat



Jason



Quikscat



CALIPSO



Airborne Science



Aqua



Aura



Terra



Tropical Rainfall Measuring Mission (TRMM)



Gravity Recovery And Climate Experiment (GRACE)



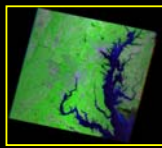
Ice, Clouds, and Land Elevation Satellite (ICESat)



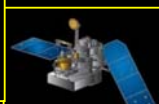
New Millennium Program Earth Observing-1 (NMP EO-1)



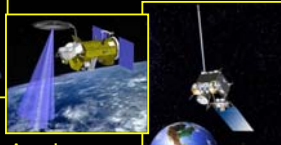
Solar Radiation and Climate Experiment (SORCE)



Landsat Data Continuity Mission (LDCM)



GPM



Aquarius



Geostationary Operational Environmental Satellite (GOES) O/P/R



NOAA Polar Operational Environmental Satellite (POES), N and N'



National Polar-Orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project (NPP)





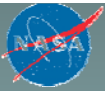
SMAP



ICESAT-2

NASA develops and operates Earth-observing satellites that monitor changes to our planet's oceans, ice caps, land masses and atmosphere from a unique global perspective

 Missions in Development
 Missions in Operation



GPM Reference Concept

An international satellite mission to unify and advance global precipitation measurements from dedicated and operational satellites

Low-Inclination Observatory (40°)

GMI (10-183 GHz)
(NASA & Partner LRD 2014)

- Enhanced temporal sampling for near-realtime monitoring of hurricanes and midlatitude storms
- Improved estimation of rainfall accumulation

GPM CORE Observatory (65°)

DPR (Ku-Ka band)
GMI (10-183 GHz)
(NASA-JAXA, LRD 2013)

- Precipitation physics observatory
- Reference standard for inter-calibration of constellation precipitation measurements



Partner Satellites:

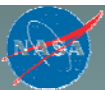
GCOM-W1, DMSP, Megha-Tropiques, plus MetOp, NOAA-N', NPP, NPOESS (over land)

NASA & JAXA precipitation data processing systems

Next-generation global precipitation products with improved accuracy and consistency within a unified framework

International science cooperation

Radiometer Intercalibration, algorithm development, and ground validation



Soil Moisture Active/Passive (SMAP) Mission

Soil Moisture Mapping

A **dedicated** soil moisture mission selected as a new Earth science mission

NASA fly an active / passive microwave soil moisture with mission in the 2014 timeframe

SMAP consists of an L-Band radar & radiometer in a low Earth, sun-synchronous orbit

Extends soil moisture to deeper depths with improved spatial resolution

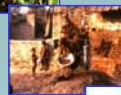
Societal Benefits:



▪ Water, Energy & Carbon Cycles



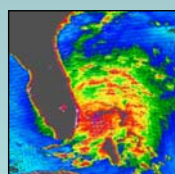
▪ Water and Food



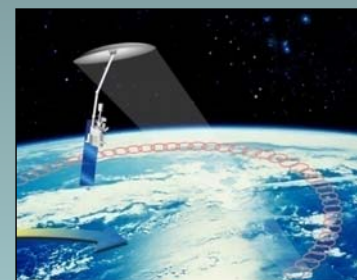
▪ Water Quality and Human Health



▪ Water and the Environment



- Weather & Climate Prediction
- Severe Storm Forecasts
- Agriculture Food Production
- Drought Monitoring and Assessment
- Flood Prediction, Assessment and Inundation Mapping



SMAP Applications web site
<http://smap.jpl.nasa.gov/benefit/>



Surface Water Ocean Topography (SWOT) Stream Discharge and Surface Water Height



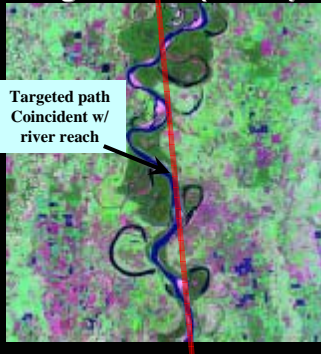
Planned Interferometric Mission (~ 2020)

Motivation:

- critical water cycle component
- essential for water resource planning
- stream discharge and water height data are difficult to obtain globally

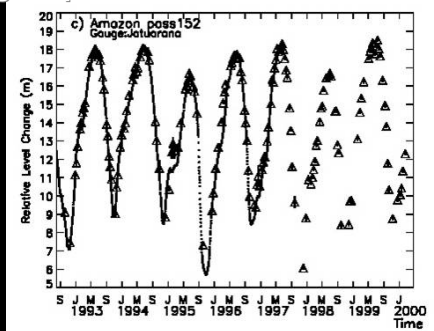
Mission Concepts:

Laser Altimetry Concept e.g. ICESat (GSFC)

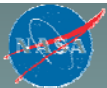
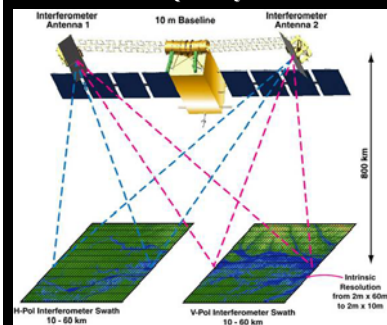


Radar Altimetry Concept

e.g. Topex/Poseidon over Amazon R.



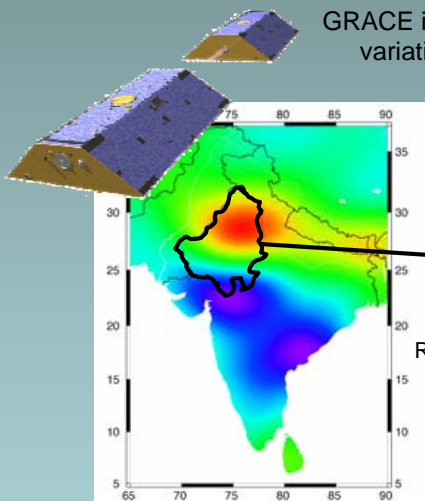
Interferometer Concept (JPL)



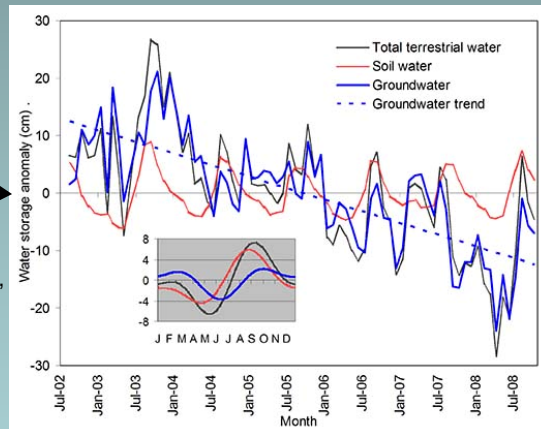
GRACE Reveals Massive Depletion of Groundwater in NW India

The water table is declining at an average rate of 33 cm/yr

GRACE is unique among Earth observing missions in its ability to monitor variations in all water stored on land, down to the deepest aquifers.



Trends in groundwater storage during 2002-08, with increases in blue and decreases in red. The study region is outlined.



Time series of total water from GRACE, simulated soil water, and estimated groundwater, as equivalent layers of water (cm) averaged over the region. The mean rate of groundwater depletion is 4 cm/yr. Inset: Seasonal cycle.

During the study period, 2002-08, 109 km³ of groundwater was lost from the states of Rajasthan, Punjab, and Haryana; triple the capacity of Lake Mead



TRACE



Terrestrial Regional North American Hydroclimate Experiment (TRACE)

Regional Hydroclimate Project (RHP) for an interdisciplinary, international, and interagency effort to make significant contributions to continental and finer scale hydroclimate science and solutions.

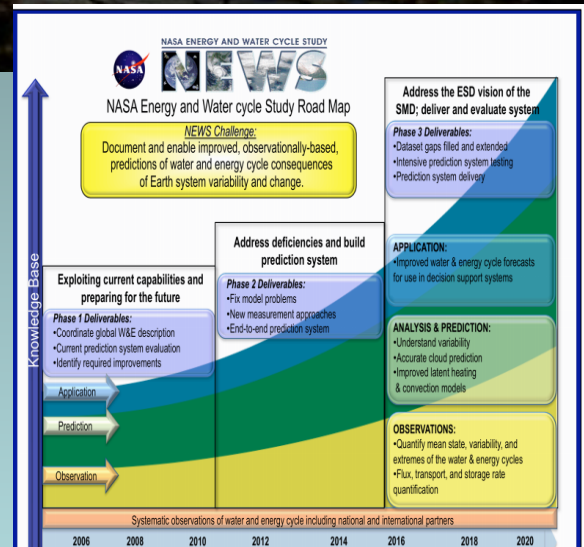
- The TRACE objective is to entrain, integrate, and coordinate the vast array of interdisciplinary observational and prediction resources available to significantly advance skill in predicting and managing changes in North American water resources, as an integral part of the global climate system.
- The TRACE mission is to measure and predict North American energy and water variations, trends, and extremes through improved observations and prediction, thereby providing the scientific underpinnings of future climate services.
- An Initial Community Discussion Workshop to examine the implementation of a new regional hydroclimate project, TRACE, will be held April 18-20, 2011 at the Crowne Plaza Hotel in Silver Spring, MD

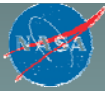


➤ The overarching long-term NASA Energy and Water Cycle Study (NEWS) grand challenge can be summarized as *documenting and enabling improved, observationally based, predictions of water and energy cycle consequences of Earth system variability and change*. The importance of documenting and predicting water and energy cycle variations and extremes is necessary to accomplish this benefit to society.

NASA's Energy and Water Cycle Study is extending its program to include new projects (ROSES 2010) to mine the vast data and model resources through innovative analyses to make progress against the NEWS goals.

➤ These new projects will focus on exploiting existing resources to be used from previous or ongoing NASA sponsored research.





Global and North American Land Data Assimilation System (GLDAS & NLDAS) Datasets Available from GES DISC

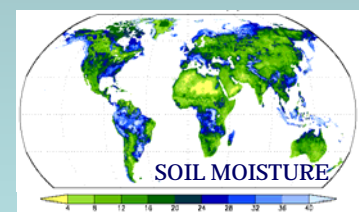
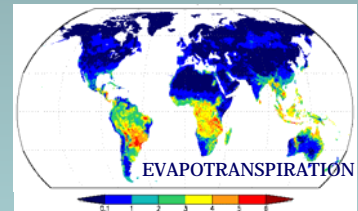
GOAL: GLDAS integrates ground and satellite derived observations (precipitation, solar radiation, snow cover, etc.) within sophisticated, physically-based numerical models to produce global, high resolution fields of land surface states (e.g., soil moisture) and fluxes (e.g., evapotranspiration).

USES: GLDAS supports forecast initialization studies, water resources applications, and water and energy cycle investigations.

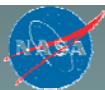
SIGNIFICANCE: GLDAS datasets are some of the most popular downloads from the Goddard Earth Sciences (GES) Data and Information Services Center (DISC).

Data Type (Short Name)	Description	FTP	GIS	Monitor
GLDAS_0.25 degree_North America				
NLDAS_FORAN120_H_0102	Hourly primary forcing	✓	✓	✓
NLDAS_FORAN120_H_0102	Hourly secondary forcing	✓	✓	✓
NLDAS_MOSAN120_H_0102	Hourly Mosaic	✓	✓	✓
GLDAS_0.25 degree_Global				
GLDAS_NHAN1025LBP_3H	3 hours Health	✓	✓	✓
GLDAS_NHAN1025L_3H	3 hours Health	✓	✓	✓
GLDAS_1.0 degree_Global				
GLDAS_CLM1025LBP_3H	3 hours CLM	✓	✓	✓
GLDAS_CLM10_3H	Monthly CLM	✓	✓	✓
GLDAS_MOS1025LBP_3H	3 hours Mosaic	✓	✓	✓
GLDAS_MOS10_3H	Monthly Mosaic	✓	✓	✓
GLDAS_NHAN1025LBP_3H	3 hours Health	✓	✓	✓
GLDAS_NHAN10_3H	Monthly Health	✓	✓	✓
GLDAS_VIC10_3H	3 hours VIC	✓	✓	✓
GLDAS_VIC10_3H	Monthly VIC	✓	✓	✓

<http://disc.gsfc.nasa.gov/hydrology/index.shtml>



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NASA Water Resources

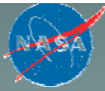
Goal: Facilitate application of NASA Earth science products as a routine use in integrated water resources management for the sustainable use of water. Also includes extreme events of drought and floods and the adaptation to the impacts from climate change.

WATER RESOURCES (WR) FUNCTIONAL THEMES:

- 1) Streamflow & Floods (Includes Snowpack)
- 2) Drought Monitoring & Prediction
- 3) Irrigation and Water Delivery
- 4) Water Quality
- 5) Climate Change and Water Resources

Highlights: NASA Applied Sciences Program works to use NASA products for global applications strongly promoting a free and open exchange of data.

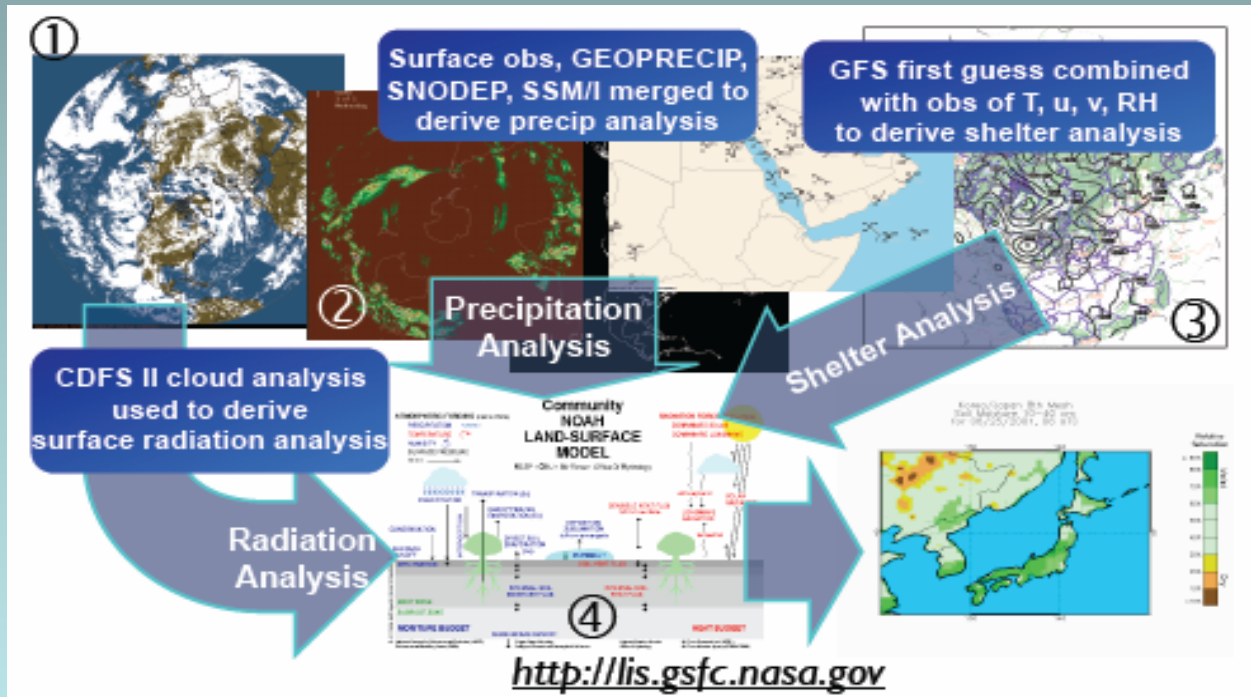
- MENA WISPs providing foundation for MENA Regional Center on Water
- NASA Joining ICIWaRM Cat II Water Center supporting UNESCO activities
- NASA WR Global Drought & ET Workshops (www.watercycleforum.com)
- NASA GEO Activities for ET, Capacity Building, GEOSS Africa WC, etc.
- Sponsoring numerous activities and projects nationally and internationally (<http://wmp.gsfc.nasa.gov>) to use NASA products in decision support tools to benefit society.



NASA LIS in Operations at the Air Force Weather Agency Also at NOAA NCEP and numerous other locations



NASA Land Information System (LIS) was employed as an operational system for the Air Force Weather Agency (AFWA) in February 2009. This represents a significant milestone for using NASA Earth science research of near real-time agriculture meteorology. AFWA-LIS plans to support global decision support



Middle East & North Africa (MENA) NASA Water Information System Platforms (WISPs) for Water Management

Joint Activity between NASA, the World Bank and USAID (with support from USDA and Universities)

- NASA, USAID, and the International Center for Biosaline & Agriculture (ICBA) have partnered to provide a regional (1/8°) Land Data Assimilation System of the MENA using remote sensing to address water management issues.
- The World Bank through the Global Environment Fund (GEF) and USAID is funding NASA to install Water Information System Platforms throughout the MENA (centers: Jordan, Tunisia, Morocco, Lebanon & Egypt) for country and regional (basin) use.
- NASA Water Information System Platform Tools
 - Regional (1/8°) to Local (1km and finer) water availability maps.
 - Monitoring & prediction of drought processes.
 - Flood warning & inundation mapping .
 - Climate and land use change impacts on water resources.
 - Estimates of Crop yield production, irrigation mapping and land cover change use.
 - Satellite data to estimate evapotranspiration and the consumptive water loss. Generation of maps of evapotranspiration from vegetative covers.
 - Estimation of changes to ground water and terrestrial water storage changes using GRACE satellite data.

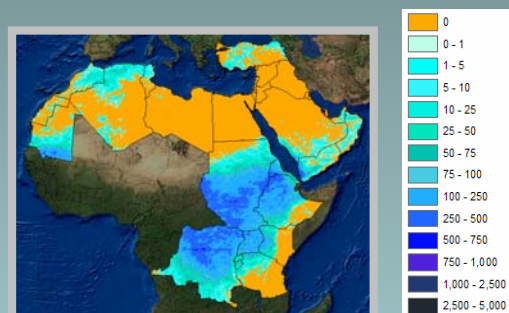


Figure 1. Precipitation (mm/month) for July 2007 at 0.04° resolution, from the UC Irvine PERSIANN-GCCS system. Hourly, near-real time data from PERSIANN will be a primary input to the MENA LDAS.

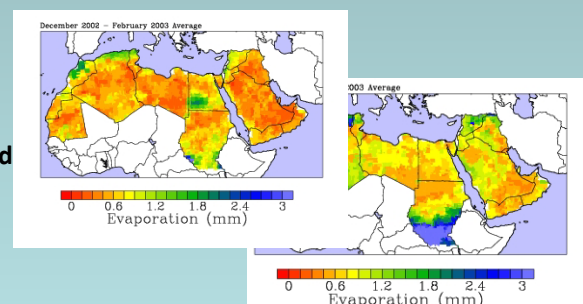


Figure 2. Seasonal variations in evapotranspiration (mm/month) over the MENA region, output from MENA LDAS. Top: December 2002 - February 2003 average. Bottom: June 2003 - August 2003 average. (Contact D. Toll and J. Bolten - NASA)



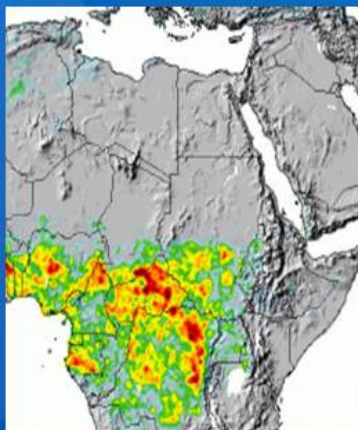
SERVIR

Regional Platform for Science and Policy
in the Americas, Africa & Central Asia



Expanding from 3-Platforms to 8 Platforms

Using earth observations and predictive models for environmental management, disaster response, and climate change adaptation.



Flood Forecasting in Africa

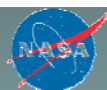


Training and Capacity Building



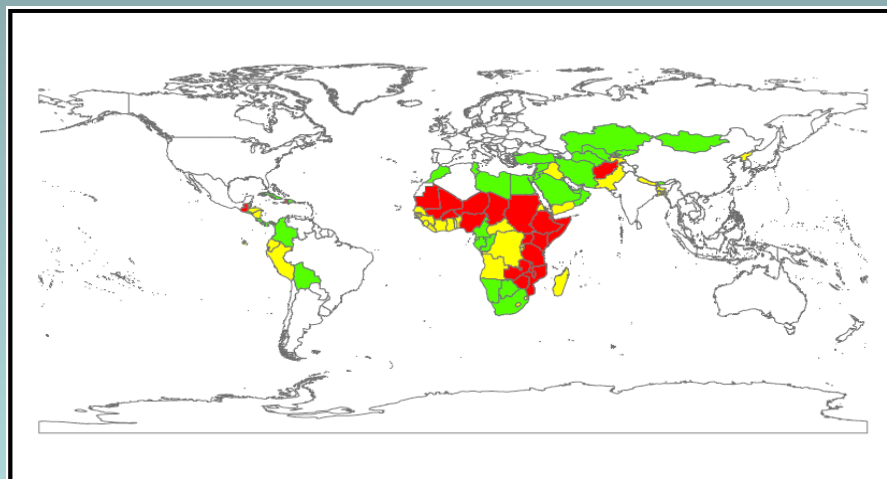
Tracking Fires in Guatemala Mexico

- Data and Models
- Online Maps
- Visualizations
- Decision Support
- Training
- Partnerships



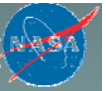
The Famine Early Warning Systems Network (FEWS-NET)

- Using NASA Land Information System (LIS) to Help Extend USAID FEWS-NET Coverage beyond Sub-Sahara
- Satellite Precipitation
- Satellite Snow Cover and Snow Water Equivalent
- Satellite Vegetation Greenness
- Crop Yield & Rangeland Forecasting

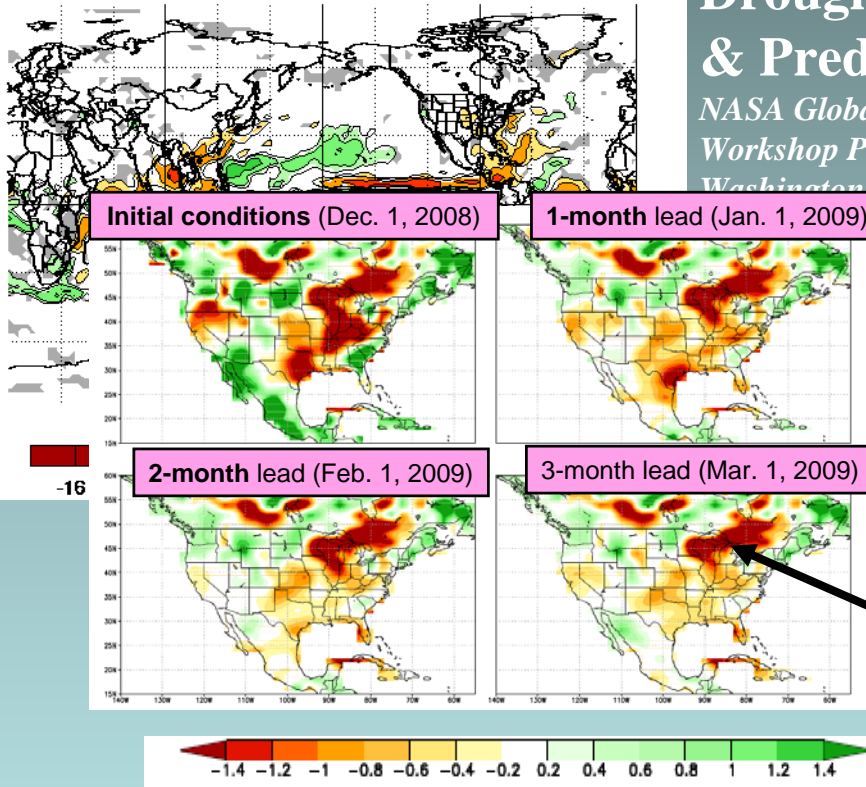


AMJ 2011 Precipitation init:2011/03

Drought Monitoring & Predictions



NASA Global Drought Monitoring Workshop Planned for April 2011 Washington, DC



Root zone soil moisture anomaly (expressed as standard normal deviate)

Drought conditions given a probability to persist into early March.

NASA Tools Developing Monitoring and Prediction Capabilities for Global Drought (Agricultural, Hydrological & Meteorological) Monitoring & Predictions

<http://gmao.gsfc.nasa.gov/forecasts/#> /

PI: R. Koster, NASA/GSFC