Using NASA Products of the Water Cycle for Improved Water Resources Management

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The Water Resources program addresses concerns and decision processes that are related to water availability, water forecast, and water quality. The goal of the Water Resources theme is to apply NASA satellite data to improve the Decision Support Tools (DSTs) of user groups that manage water resources. The Water Resources theme partners with Federal agencies, academia, private firms, and international organizations.
• Streamflow & Floods (Includes Snowpack)
• Drought Monitoring & Prediction
• Irrigation and Water Delivery
• Water Quality
• Climate Change and Water Resources
• Programmatic Activities (Partnering, Leveraging, Outreach etc.)
Key Partnerships

- **Federal:** EPA, NOAA-NCEP, NOAA-NOHRSC, NOAA-OHD, USGS, USAID, DoS, USDA, AFWA, USBR
- **State:** California DWR, USDM
- **NGO:** GEO, UNESCO-IHP, ACE-ICIWaRM, World Bank, UNESCO HELP

Interagency Organizations

- USGS Water Census Ad Hoc Team, Western US Federal Agency Support Team (WestFAST), Climate Change Analysis Water Working Group (C-CAWWG), Department of State Internal Water Working Group (Dol-IWG), Advisory Committee on Water Information – Subcommittee on Hydrology (ACWI-SOH), & US Army Corp ICIWaRM
NASA Satellites Contributing Most to Water Cycle Studies
Decadal Survey Missions Next Generation

Near-Term Missions:
- CLARREO
- ICESat-II
- SMAP

Mid-Term Missions:
- ACE
- ASCENDS
- HyspIR

Late-Term Missions:
Missions in Formulation and Implementation

GLORY
AQUIARIUS
NPP
LDCM
GPM
SMAP
ICESat-II
Applications Working Group (AppWG)

SMAP has the potential to enable a diverse range of applications including drought and flood guidance, agricultural productivity estimation, weather forecasting, climate predictions, human health risk, and defense systems. Applications across agencies are a unique feature of SMAP. Some of these applications are summarized on the Applications page.

Planning for SMAP applications has been initiated to identify early adopters, current partners, and future potential users of SMAP data. A SMAP Applications Working Group (AppWG) has been formed that includes the following objectives:

- Assess current applications benefits and requirements for SMAP products
- Develop a community of end-users that understand SMAP capabilities and are interested in using SMAP products in their application
- Target partners who can work with the SMAP project during the pre-launch period, particularly to assess impacts on their applications
- Provide information about SMAP to the broad user community

SMAP AppWG activities will be carried out mainly through emails and telecons. The AppWG will also take advantage of member attendance at conferences such as AGU and IGARSS to meet in person when possible.
Earth System Science

Sun-Earth Connection

Climate Variability and Change

Carbon Cycle and Ecosystems

Earth Surface and Interior

Atmospheric Composition

Weather

Water & Energy Cycle
NASA Applied Sciences Program
A Pathway Between Earth Science & Society

Results of NASA Earth Science Research

Uses by Partners and Stakeholder Communities

GEOSS Societal Benefit Areas:
- Natural Disasters
- Water Resources
- Agriculture
- Air Quality
- Ecosystems
- Weather
- Climate
- Public Health
Applied Sciences Program

USGEO Societal Benefit Areas

Agriculture
Climate
Disasters
Ecosystems
Energy

Health (incl. Air Quality)
Oceans
Water Resources
Weather
GRACE Reveals Massive Depletion of Groundwater in NW India

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

During the study period, 2002-08, 109 km$^3$ of groundwater was lost from the states of Rajasthan, Punjab, and Haryana; triple the capacity of Lake Mead.
Near Real Time Global Monitoring of Lakes and Reservoirs Phase IV

http://www.pecad.fas.usda.gov/cropexplorer/global_reservoir

Global Reservoir and Lake Monitor

Click on a region to view Reservoir/Lake Heights

Lake Huron Height Variations
TOPEX 10 Year Geo-referenced 10Hz Along Track Reference

Lake Urmia Height Variations
TOPEX 10 Year Geo-referenced 10Hz Along Track Reference

Lake Tharthar Height Variations
TOPEX 10 Year Geo-referenced 10Hz Along Track Reference

Aral Sea Height Variations
TOPEX 10 Year Geo-referenced 10Hz Along Track Reference

Updated Mon Feb 04 11:31:28 GMT 2008

Lake Height Variation (m)
- > +1
- +0.1 - +1
- -0.4 - 0
- -2 - -0.6
- < -2

Crop Intensity
- 50%
- 100%

Lake Urmia/Iran
Lake Tharthar/Iraq
Using NASA Evapotranspiration (ET) for Agriculture Water Consumptive Use
Three-tier agricultural monitoring uses multiple sensors.
Rapid data delivery allows for in-season data integration.

1st Tier: Regional Level
MODIS Terra (250-meter)

2nd Tier: Provincial Level
AWiFS IRS P-6 (56-meter)

3rd Tier: Field Level
Quickbird (2.4-meter)
Prototype of Soil Moisture Change (SMC) with Drought D-Level Overlay: JPL automated system produces data; weekly automatic uploaded to NOAA PSD, who creates multiple SMC products and derivatives with D-level overlay.

Expedited MODIS Vegetation Drought Response Index (VegDRI): USGS/EROS and NDMC have integrated MODIS NDVI 7-day composites into the national VegDRI model on a rapid, weekly schedule to meet requirements of US Drought Monitor authors.

Resolution Benchmark: NASA results have excellent resolutions to resolve the county-level goal of NIDIS. This is evident in the comparison of SMC and VegDRI products versus USDM drought maps at the lower resolution.

Improvements of USDM are Important for Users: NOAA NWS uses D2 to trigger drought information statements, IRS for tax deferrals, USDA programmatic usage, among others.
Sample of Project Summaries

Integrating NASA Earth Sciences Research results into Decision Support Systems for Agriculture and Water Management in SA University of Maryland

A Proto-type Land Surface OSSE Testbed for Obtaining High Resolution Soil Moisture Data for Decision Support Needs IGES

The Global Reservoir and Lake Monitoring System: Enhancing the USDA/FAS DSS with NASA, NRL and ESA Satellite Radar Alt. Data Transitioning an Operational NASA MODIS Agricultural Monitoring System into the USDA FAS Decision Support System University of Maryland

Enhancing the USDA Global Crop Production Decision Support System with NASA LIS and Water Cycle Satellite Observations USDA ARS


Benchmarking NASA Snow Research Results in NWS Hydrological Decision Support CREW

Developing Seasonal Predictive Capability for Drought Mitigation Decision Support System University of Illinois

Integrating Enhanced GRACE Water Storage Data into the U.S. and North American Drought Monitors NASA/GSFC

Introducing Remotely Sensed Irrigation Information into the USDA FAS Decision Support System University of Wisconsin

A Land Data Assimilation System for Famine Early Warning NASA GISS

Integration of NASA Models and Missions into Agricultural Decision Support USDA ARS

Enhancing California’s Water Resource Management and Decision Support System to Address Impacts of Climate Change University of California, Irvine

Improving BASINS/HSPF predictions of nitrogen export to improve TMDL accuracy using NASA imagery University of Wisconsin-Madison

Improving Water Quality Management: Use of Earth Observations in SPARROW Resources for the Future

Project Nile: Distributed hydrological information for water management in the Nile basin Johns Hopkins University

Satellite Earth Image Products Applied to Development of Regulatory Water Quality Standards USEPA

Det. the feasibility of mapping and monitoring the extent of Cladophora in the Laurentian Great Lakes with multi-scale remote sensing Michigan Technological University

Estuary Variance Map for In Situ Sample Station Placement NASA

Near Real-time Flood Detection and Mapping NASA

The feasibility of combining NASA satellite data, general circulation models, and hydrologic model to inform decision making for flood mitigation on the Devils Lake basin of North Dakota University of North Dakota

The potential impacts of climate change on the seasonal snowpack, reservoir storage, and dam and hydroelectric operations AECOM

IEEE Water Project-Outreach IEEE

Water Resources Management Support - SW US – CA DWR

Improving Flash Flood Prediction Through a Synthesis of NASA Products, NWP Models, and Flash Flood Decision Support Systems NOAA

Rangeland Decision Support System: Improving the decision making process at the USDA by incorporating grassland canopy cover estimates derived from MODIS observations and a web-based geospatial data delivery tool Applied Geosolutions, LLC
• In coordination with the U.S. Drought Monitor and NIDIS meetings
• http://www.watercycleforum.com

Workshop on Evapotranspiration Information and its application in agriculture and water management, Silver Spring MD on April 5 – 7, 2011.
• Co-sponsored by USDA
• http://www.watercycleforum.com/
Welcome

The Applied Sciences Program promotes and funds activities to discover and demonstrate innovative uses and practical benefits of NASA Earth science data, scientific knowledge, and technology. The Program's portfolio of projects deliver results in applying NASA Earth science to support improvements in aviation safety, malaria early warning, agricultural productivity, water management, earthquake response, and many other important topics.

Earth Science Serves Society

The Applied Sciences Program partners with public and private organizations on ways to apply data from NASA's environmental satellites and scientific findings in their decision-making activities and services, helping to improve the quality of life and strengthen the economy.

Applied Sciences Program Areas

Applications Areas:

- The Program focuses on economic, health, natural resources, and other themes to support both applied research and targeted, decision-support projects in 8 areas of national priority.

Capacity Building:

- The Program sponsors specific activities to improve skills and capabilities in the US and developing countries on how to access and apply environmental satellite data, including DELOS, SERVIR, and the Gulf of Mexico Initiative.

NASA Partnership Sends Earth Science Data to Africa

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