WORLD WATER DAY - March 22, 2011:

A sample of what is happening in **NASA's Water Resources Program**

Litho for Printing: (see file: Water Management.INTERNATIONAL LITHO.pdf)

Soil Moisture and Agriculture Impacts for Global Food Supply Assessments:

A NASA-sponsored project is aiming to improve USDA World Agricultural Outlook Board's monthly World Agricultural Supply and Demand Estimates, by incorporating NASA remote sensing precipitation and soil moisture data. Currently, WAOB uses analog year comparisons, between a given year and historical years with similar weather station data patterns, as one method for estimating the given year's crop yields. Project results from retrospective analyses of analog year comparisons have shown that satellite data are complementary to weather station data, in identifying analog years. Though preliminary, these results point to the possibility of "calibrating" the analog analysis methodology in station-rich areas, to be then applied in station-poor areas of the world or in areas where station data exist but are not available.
Dr. William Teng, Wyle Information Systems

Related links:
Conference poster:
http://disc.sci.gsfc.nasa.gov/additional/publications/year-2010
Teng, W., and Shannon, H. *Retrospective Analog Year Analyses Using NASA Satellite Precipitation and Soil Moisture Data to Improve USDA's World Agricultural Supply and Demand Estimates*. [View poster]

A NASA-sponsored research project employed 9 years of MODIS data to characterize global cropland probability at a spatial resolution of 250m. This product is the finest resolution map to be generated using a globally applied algorithm. A discrete cropland/non-cropland indicator map was then derived using data from the USDA-FAS (Foreign Agricultural Service) Production, Supply and Distribution (PSD) database describing per-country acreage of production field crops. This map has been incorporated into the FAS's Global Agricultural Monitoring (GLAM) project for improved analysis of growing season trends within croplands.
Dr. Matthew Hansen, SDSU

Pittman, K., Hansen, M.C., Becker-Reshef, I., Potapov, P.V., and Justice, C.O., 2010, Estimating global cropland extent with multi-year MODIS data, *Remote Sensing*, 2, 1844-1863.
http://www.mdpi.com/2072-4292/2/7/1844/pdf

Through a partnership with USDA and University of Maryland, NASA has developed a Global Agriculture Monitoring (GLAM) system that integrates the latest NASA satellite imagery and integrates it with the USDA's Office of Global Analysis data and processes. This information is used daily to help develop the international monthly global crop production estimates (U.S. Principle Federal Economic Indicator) which is the official U.S. response to the economic impact of drought and other water-agriculture impacts on food production. This effort developed the tools and products that moved USDA's global observations from superseded weather satellites to the latest NASA observations with transition plans to upcoming next-generation NOAA satellites.

Dr. Chris Justice, UMD

Related link: http://www.pecad.fas.usda.gov/glam.cfm

Water Availability Impacts on U.S. Agriculture and More:

In collaboration with the California Department of Water Resources, the Western Growers Association, USDA, California universities, California growers and other partners, NASA is demonstrating how satellite observations can improve water supply forecasting and agricultural efficiency in the drought-stricken west. For water supply forecasting, NASA data provide improved information about snowpack water storage across the major watersheds of the Sierra Nevada as well as monitoring surface water extent in wetland regions. Remote sensing observations are utilized to quantify uncertainties in regional climate model projections, and the use of radar data is shown to be a promising new method for monitoring groundwater recharge and discharge. To improve agricultural efficiency, NASA is integrating data from satellites, weather networks, and soil moisture sensor networks to map crop water demand in near real-time. The project is applying NASA's satellite monitoring and computing capabilities to provide growers with a new source of information for use in irrigation scheduling, to assist growers in maximizing the benefits of the water resources they have available.

Key articles and websites for more information on the Satellite Irrigation Management Support (SIMS) component of the ARRA project:

http://thepacker.com/Peering-down-on-California-s-water-problems/Article.aspx?oid=1257469&aid=676&fid=PACKER-HANDLING-AND-DISTRIBUTING
http://www.technologyreview.com/computing/27035/
http://ecocast.arc.nasa.gov/sims

Water resources website and article on the groundwater management component:

http://www.science.calwater.ca.gov/publications/sci_news_0410_grace.html

http://water.jpl.nasa.gov/

Authors of the U.S. Drought Monitor are challenged each week to map drought severity across the country, even where rain gages and other surface observations are few and far between. A NASA-sponsored project , carried out by USGS and the University of Nebraska, has upgraded production of the Vegetation Drought Response Index (VegDRI) to 7-day frequency with MODIS imagery. VegDRI blends satellite vegetation index images with soil characteristics, land cover, precipitation, and temperature data to reveal areas of vegetation stress due to drought. It is especially useful for assessing the condition of rangelands, rainfed crops, and forests. VegDRI maps were previously produced every 14 days using NOAA AVHRR imagery, which is better suited for monitoring atmospheric conditions than the land surface.
Dr. James Verdin, USGS

There is a related USGS fact sheet available on line at http://pubs.usgs.gov/fs/2010/3114/.

A survey with stakeholders indicates that improved forecasts will affect farmers' decision making if the statistical confidence is increased to at least 75-80%. However, currently, the forecast skills are at 67% for maximum daily temperature, 66% for minimum daily temp, and 33% for total daily precipitation. Meanwhile, a decision modeling exercise shows that NASA's remote sensing products can improve short and mid-term forecasts. Aptly applied, such improved forecasts can increase farmers' net profit by **25-40%** (Cai et al., 2011; Ryu et al. 2010).
Dr. Ximing Cai, UIUC

Ryu et al. (2010), Finding Potential Extents for ENSO-Driven Hydrologic Drought Forecasts in the United States, *Climatic Change*, Climatic Change, 101(3),575-597. in press.
Cai et al. (2011), The value of probabilistic weather forecasts–An assessment by real-time optimization of irrigation scheduling, J. of Wat. Resou Plan. and Managt., in press.

A NASA-sponsored project is developing methods to apply Earth science satellite data and geospatial web service technology for providing timely and accurate information on weekly crop progress in U.S. The information is essential to a dynamic agricultural industry in the U.S. and the world and will complement the statistic-based information provided by the National Agricultural Statistics Service (NASS) of the U.S. Department of Agriculture (USDA)- http://www.nass.usda.gov.
Dr. Liping Di, GMU

Details about the project can be found at http://csiss.gmu.edu/dss/

NASA efforts in supporting drought prediction shows that large-scale land models can translate meteorological forcing data (such as precipitation and radiation) into soil moisture and snow estimates that can, in turn, provide valuable input in seasonal stream flow forecasts. The positive impact of soil moisture on forecast skill bodes well for the usefulness of products from SMAP, an upcoming NASA satellite-based soil moisture mission.
Dr. Randy Koster, NASA

Editorial describing the usefulness of this study: "Hydrology: Soils, Snow, and Streamflow" by T. C. Pagano, Nature Geoscience, 3, 591-592, 2010. See Link at - http://www.nature.com/ngeo/journal/v3/n9/full/ngeo948.html

Monitoring Water Stored in the Worlds Lakes and Reservoirs:

A NASA/USDA sponsored program is monitoring in near-real time the water level of the world's largest lakes and reservoirs using a suite of NASA, NOAA and European agency satellites. The measurements reveal both high water and drought stricken conditions and enable resource analysts to assess irrigation potential in their crop analyses.
Dr. Charon Birkett, UMD

Web reference:
http://www.pecad.fas.usda.gov/cropexplorer/global_reservoir/index.cfm

Article:
2009, Birkett, C.M., Reynolds, C., Beckley, B and B. Doorn, From Research to Operations:

The USDA Global Reservoir and Lake Monitor, Chapter 2 in 'Coastal Altimetry', eds. S. Vignudelli, A.G. Kostianoy, P. Cipollini and J. Benveniste, Springer Publications, ISBN 978-3-642-12795-3.

Support for the Globe's Water Poor:

The NASA sponsored "Project Nile" is skillfully merging satellite observations with advanced hydrological models to improve understanding of the movement and storage of water across the Nile basin. This approach will provide the most complete estimates to-date of the water balance across this extensive, and at times contentious, 10-nation watershed. Also, this effort will provide our regional partners with tools to evaluate the sensitivity of the Nile to changes in climate, land management, and water use.
Dr. Ben Zaitchik, JHU

In late July and early August 2010, Pakistan experienced the worst flooding it has seen since 1929. Estimates indicate that over two thousand people died and over a million homes were destroyed in flooding and landslides caused by several weeks of almost continuous torrential rain. NASA supported Pakistan with other international support agencies by estimating precipitation from NASA satellites using the real time Precipitation Estimation from Satellite Observation using Artificial Neural Network with Cloud Classification System (PERSIANN-CCS).
Dr. Soroosh Sorooshian, UC-Irvine

Related links:
EO Observer: http://eospso.gsfc.nasa.gov/eos_observ/pdf/Nov_Dec_final.pdf
A major international Prize for our work on the PERSIANN for the benefit of water resources management: http://www.uci.edu/features/2011/01/feature_sorooshian_110110.php

Helping our Nation's Coastal Populations:

A NASA-sponsored project is applying Earth science satellite data to assist in the development of water quality standards for estuarine and coastal waters of the Gulf of Mexico. The goal of this effort is to construct multi-decadal retrospective time-series of water quality constituents that may be observed by satellites and demonstrate how such data are useful to water quality managers. If successful, this project may lead to the routine integration of remote sensing products into coastal water quality management decisions.
Dr. John C. Lehrter, USEPA

Schaeffer, B., R. Conmy, J. Hagy, and J. Lehrter. Use of SeaWiFS to support development of numeric criteria for Florida coastal waters. Environmental Science and Technology (In Review)

Blonski, S., K. Holekamp, and B.A. Spiering. 2009. NASA satellite monitoring of water clarity in Mobile Bay for nutrient criteria development. Proceeding of Oceans '09 MTS/IEEE Biloxi.