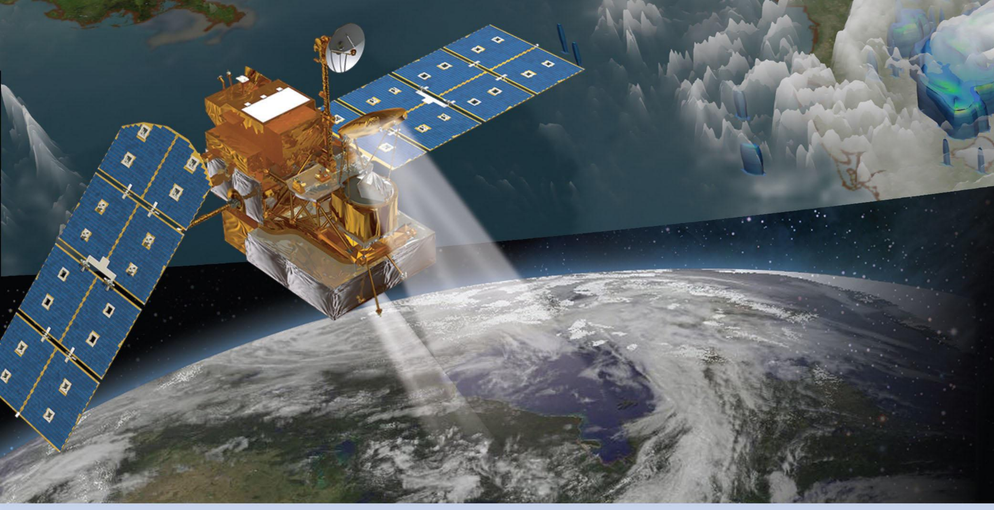

NASA Water Resources Program for Improved Water Management

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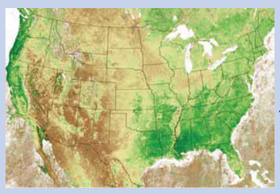
NASA Resources Element Within the Applied Sciences Program

The Water Resources Element within NASA's Applied Sciences Program delivers satellite-based and modeled data to water managers, researchers, & communities addressing both national & international water availability &quality issues.

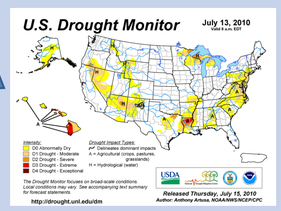
- Approximately $1.9B of the FY09 NASA budget supports Earth science technology, research, and applications.
- Infusing NASA and Earth observing remote sensing based observations into decision support systems provides an integrative approach to managing our water resources in the future.
- NASA strongly supports a free and open exchange of its Earth science and satellite data primarily through partnerships with U.S. state and federal agencies, such as NOAA, USDA, EPA, USAID &the California Department of Water Resources.
- NASA Water Resources Program is currently funding 21 active projects. Most projects are awarded through NASA solicitations (http://nspires.nasa.gov). Examples of funded projects are given in this poster. For more information see http://wmp.gsfc.nasa.gov & http://science.nasa.gov/earth-science/applied-sciences/.
- NASA Water Resources structures its programs around 5 functional themes to apply NASA data to Water Resource management challenges:
  1) Drought
  2) Streamflow and Flooding (includes snowpack)
  3) Water Delivery and Irrigation (includes evapotranspiration)
  4) Water Quality
  5) Water Resources and Climate Impacts

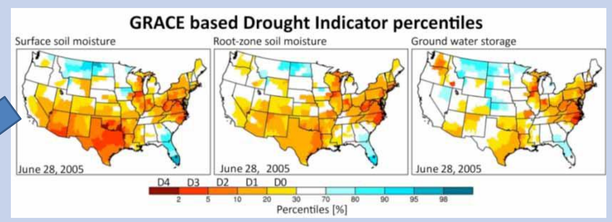
Drought Monitoring and Prediction

The USGS, JPL, and the National Drought Mitigation Center are developing a hybrid drought indicator (Left) for the U.S. Drought Monitor (USDM) (Center) known as the Vegetation Drought Response Index (VegDRI). This approach rapidly incorporates NASA satellite observations (primarily MODIS vegetation index data), climate data, and biophysical indicators, meeting finer resolution needs. NASA/GSFC is developing a novel technique deriving terrestrial water from NASA's GRACE gravimetric satellite that is assimilated into a land surface model for a blended drought product quantifying groundwater, soil moisture and snowpack for all of North America (Right).



NASA MODIS & AMSR- E in to USDM
J. Verdin (USGS) & S. Nghiem (JPL)



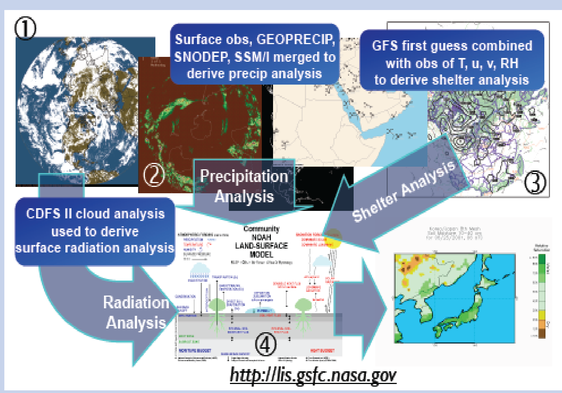


Gravimetric derived terrestrial water storage for USDM
M. Rodell/NASA-GSFC

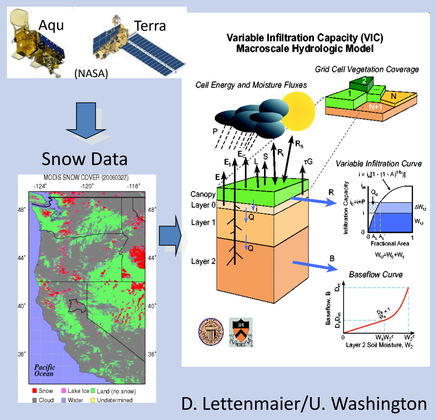
Streamflow & Flood Forecasting

NASA Applied Sciences Program supports projects in monitoring and predicting streamflow and floods through satellite observations to estimate hydrologic variables (i.e., snow water equivalent, soil moisture, aquifer volumes, reservoir storages, etc.) and model derived products (i.e., evapotranspiration, precipitation, runoff, ground water recharge, and other data assimilation products, etc.).

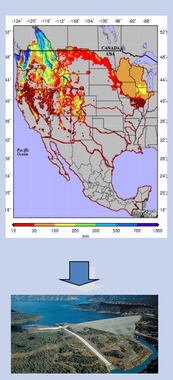
NASA Land Information System – Integrating Satellite, Modeling and Ancillary Data for Water Availability and Applications



University of Washington Remotely Sensed Based System for Improving Water Resources Management



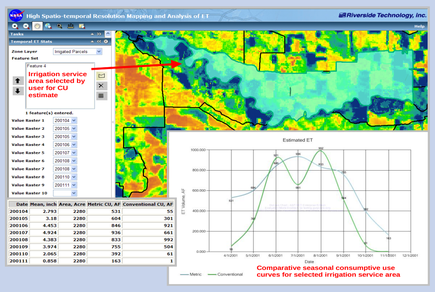
D. Lettenmaier/U. Washington



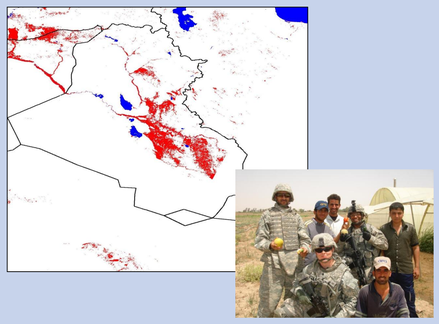
Reservoir Regulation

Water Delivery & Irrigation (Includes Evapotranspiration)

Over 40% of U.S. freshwater withdrawals are used for agriculture. NASA supports remote sensing and modeling data to assess the water loss from the land surface. ET maps (left) originally developed for Bureau of Reclamation and the South Platte Water Conservancy District can now be derived for local decision makers from an energy balance method ('METRIC'). NASA is working with the University of Wisconsin, USDA and the US Army to assess irrigation capacity using remote sensing in Iraq (right).



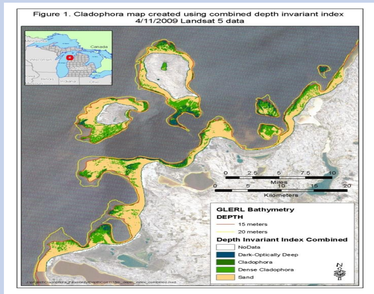
Agriculture and Land Cover ET Mapping
Martin/Riverside Technologies



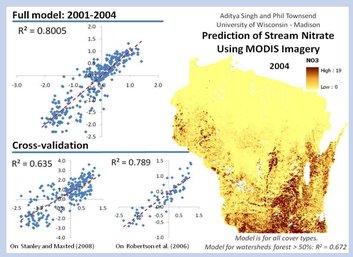
Mapping Irrigated Ag Lands in Iraq
Ozdogan/U. Wisconsin

Water Quality

NASA is supporting over 10 water quality projects to use remote sensing and modeling approaches to address issues of direct estimation (e.g., nutrients and sediments in water bodies) of quality and non-point source pollution effects (e.g., increase agriculture, urbanization, vegetation stress, etc.). The figure to the left shows Landsat and GeoEye satellite data used in a new approach to map the extent of Cladophora (nuisance algae) in support of EPA's Great Lakes activities . In the figure to the right, MODIS and Landsat derived indices for disturbed forests and mixed forests (>50%) disturbances were successfully shown to predict nitrogen concentrations in streamflow discharge.



Mapping Cladophora with satellite data
Shuchman/MTU

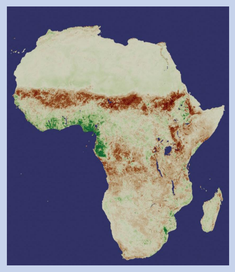


Prediction Streamflow Nitrate Export Using Remote Sensing Townsend/U. Wisc.

International Water

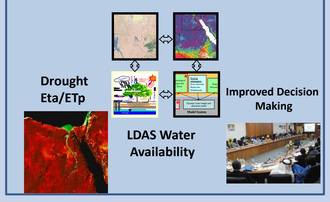
Famine Early Warning Network (FEWSNET)

NASA provides critical information such as near real-time precipitation, lake level, and vegetation information to the USAID-sponsored Famine Early Warning Systems Network relevant to crop production, rangeland condition, and food security. NASA products and technology are helping FEWS NET expand its service from 21 countries to numerous additional developing countries.



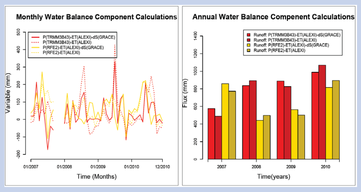
1984 Drought Anomaly

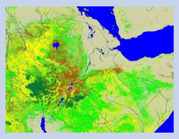
WISP Nodes
Water Information System Platforms
NASA, in collaboration with the World Bank and USAID is developing remote sensing and Earth Science data platforms in water critical parts of the world, i.e., the Middle East and North Africa. These will address a multitude of issues dealing with water resources, aquifer monitoring, streamflow, transboundaries, agriculture planning, drought/flood management and early warning, and overall water availability. With these data, decision makers will be better able to address these issues in the future.



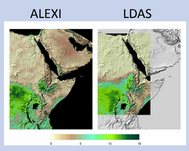
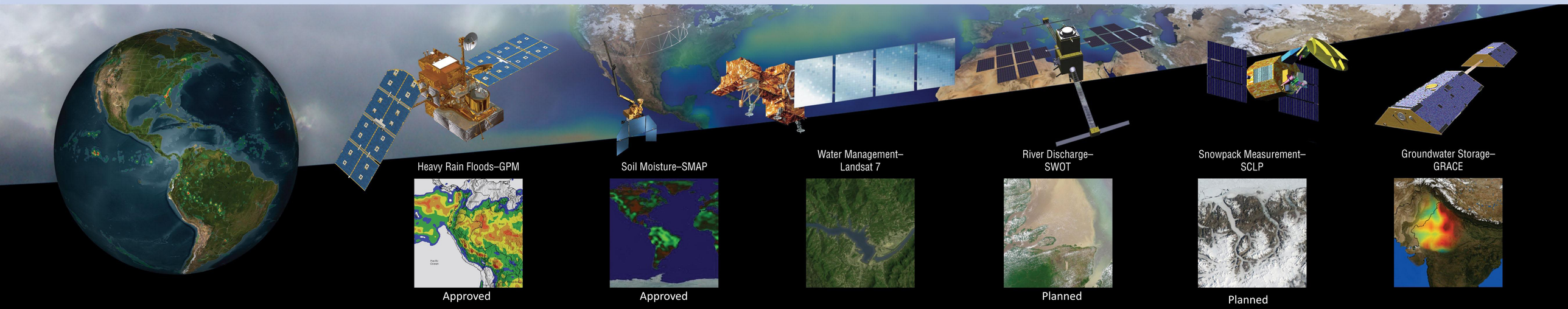
Project Nile

The objectives of Project Nile are to provide improved hydrometeorology information for research, planning and water management. Components include land cover mapping, satellite derived evapotranspiration, optimized models for water availability and improved decision support for policy makers





MODIS Land Cover Mapping



ALEXI Satellite Evapotranspiration