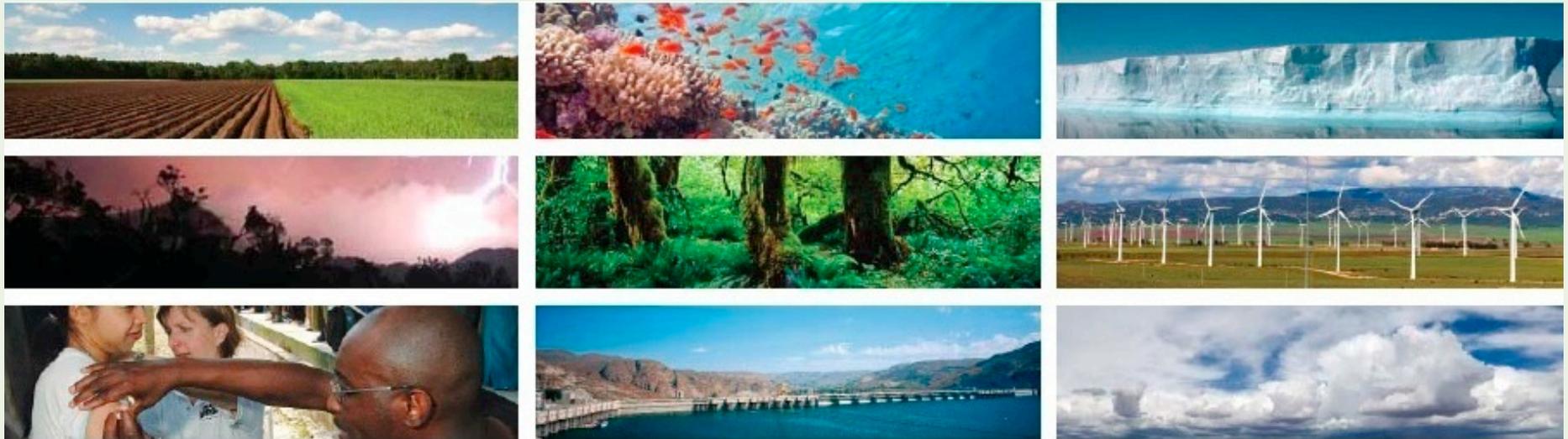


NASA Science Mission Directorate Earth Science Division Applied Sciences Program



Water Resources Applications Area

Bradley Doorn

23 Sep 2016



Water Resources Applied Research



The Water Resources program addresses concerns and decision processes that are related to water availability, water forecasts, 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.

Examples of Water Resources Projects

PARTNER	APPLIED WATER INFO
State of California	Ag Water Use
Colorado Basin River Forecast Ctr	Snow Water Equivalent
US Drought Monitor	Ground Water Estimates
USDA	Soil Moisture Indicators
G20 Ag Ministers	Crop Yield Monitoring
Raleigh, NYC, and Denver	Water Quality Indicators
NOAA-NESDIS	Flash Drought Triggers
USDA, US Foreign Services	Global Reservoir Hts.

RECENT SOLICITATIONS

- ROSES 2011 – Drought
 - ✓ 9 Projects (\$9M over 3 years)
- ROSES 2013 – In-Season Forecasting of Water Resource Anomalies
 - ✓ 9 Projects (\$12M over 4 years)
- ROSES 2016 – Water Quality and Agriculture Water Use
 - ✓ Awards expected Dec 2016 (\$9M over 3 years)



NASA Satellite Irrigation Management Support: Mapping Crop Water Requirements to Assist Growers in Optimizing Water Use



PROJECT TEAM: NASA Ames Research Center, California Dept. of Water Resources, Western Growers Association, California State University, Univ. of California Cooperative Extension, Desert Research Institute, USDA Ag. Research Service, USGS, Booth Ranches, Chiquita, Constellation Wines, Del Monte Produce, Dole, E & J. Gallo, Farming D, Fresh Express, Pereira Farms, Ryan Palm Farms



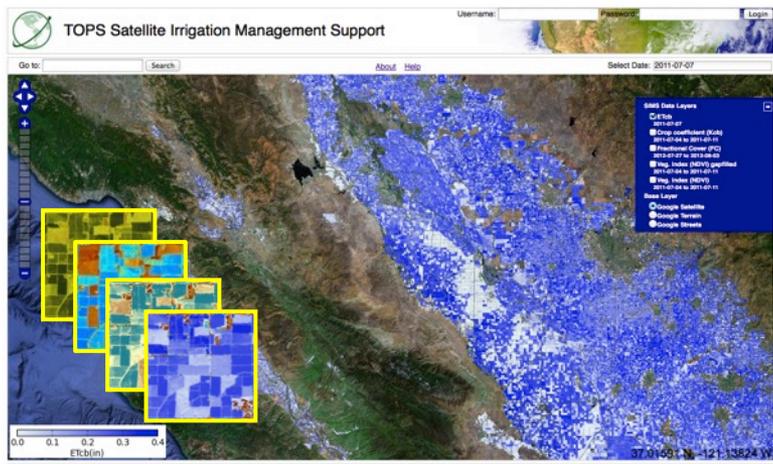
Terra Satellite



Landsat 8



California agricultural sector produced \$46.4b In 2013



NASA SIMS web and mobile data services puts irrigation demand across 8 million acres of farm land directly into the hands of farmers and water managers

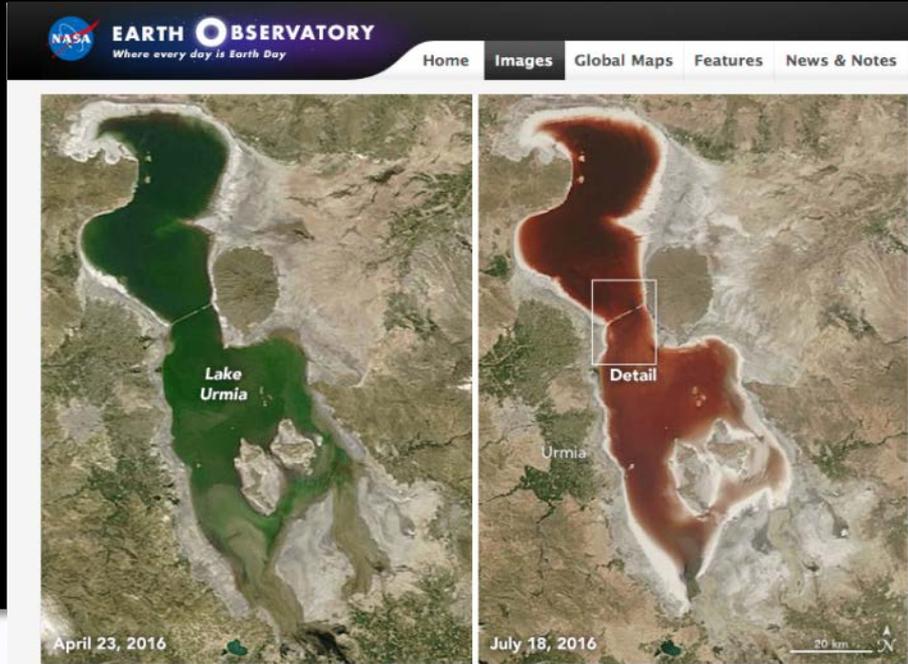
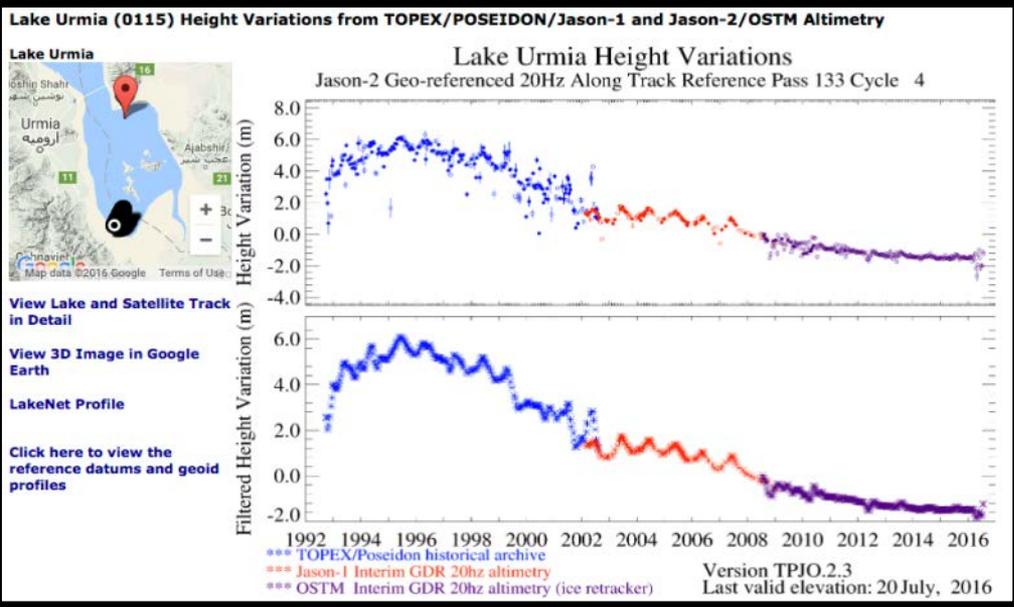


Students work hand in hand with growers to validate the system and quantify benefits

For more information, contact forrest.s.melton@nasa.gov, or visit <https://c3.nasa.gov/water/projects/1/>



Lake Heights and Water Quality



Lake Heights from Radar Altimetry (Lake Urmia, NW Iran)

G-Realm Project, Charon Birkett, University of Maryland

MODIS (UR images) and Landsat 8 (LR images) to detect water quality changes.
Red coloration due to microorganisms (algae or bacteria) changing color due to lack of fresh water inflows.

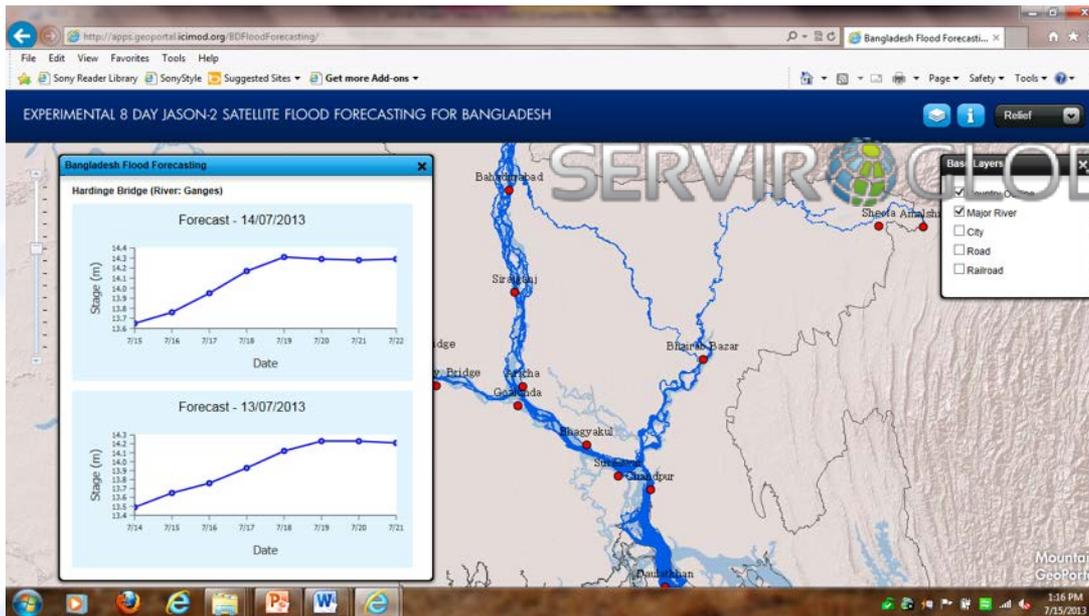
NASA Earth Observatory Article: dtd 26 Jul 2016
http://earthobservatory.nasa.gov/IOTD/view.php?id=88395&eocn=home&eoci=iotd_previous



SERVIR: Flood Forecast Development



- **What was the problem?** Bangladesh's severe flooding problems affect millions of residents. The Institute of Water Modeling (IWM) in Bangladesh generates flood forecasts **3 days in advance** (which is insufficient time for families and farmers to prepare).
- **What did SERVIR do?** SERVIR PI linked JASON-2 altimetry data to flood forecasts. SERVIR-Himalaya helped IWM develop capacity to generate flood forecasts **8 days in advance** using this near real time satellite data.



- **What came of it?** IWM generated experimental 8-day forecasts accurately representing river levels for the 2013 monsoon season. The Ministry of Water Resources now incorporates the 8-day forecasts in the official Bangladeshi forecasting system, providing 160 million citizens with longer lead time for disaster preparedness.

Earth Science Missions and Instruments



Allimetry-FO (Formulation in FY16; Sentinel-6/Jason-CS)

Earth Science Instruments on ISS:
RapidScat, CATS,
LIS, SAGE III (on ISS), TSIS-1, OCO-3,
ECOSTRESS, GEDI,
CLARREO-PF



★ Active Mission
★ Water Resources
★ Applications
★ Activities
★ Contributing to
★ Water Cycle Studies

OCO-2

GPM

Landsat 8 (USGS)

Suomi NPP (NOAA)

SMAP

CloudSat

Aqua

Terra

ICESat-2

CYGNSS

GRACE (2)

Aura

CALIPSO

GRACE-FO (2)

ICESat-2

OSTM/Jason 2 (NOAA)

GRACE (2)

GRACE-FO (2)

JPSS-2 (NOAA)
RBI, OMPS-Limb

EO-1

QuikSCAT

NISTAR, EPIC (NOAA's DSCOVR)

SORCE, TCTE (NOAA)

ISS

SWOT

TEMPO

NI-SAR

PACE

Landsat 9, TIR-FF



- Western Federal Advisory Support Team (WestFAST)
 - WestFAST is a collaboration between 12 Federal agencies with water management responsibilities in the West. WestFAST was established to support the Western States Water Council (WSWC) and the Western Governors Association in coordinating Federal efforts regarding water resources.
- Active Memorandum of Agreements/Understandings related to water research with
 - USAID
 - USDA
 - EPA
 - NGA (Pending)

International Engagements



- Group on Earth Observations(GEO)

- GEO GLObal Water Sustainability Initiative (GEOGLOWS)

- Framework for addressing international water resource challenges and the Earth observation requirements to fulfill these needs

- GEO Global Agriculture Monitoring (GEOGLAM)

- Framework for addressing international food security and food production challenges and the Earth observation requirements to fulfill these needs



- SERVIR

- a joint venture between NASA and the USAID, provides state-of-the-art, satellite-based Earth monitoring, imaging and mapping data, geospatial information, predictive models and science applications to help improve environmental decision-making among developing nations in eastern and southern Africa, the Hindu-Kush region of the Himalayas and the lower Mekong River Basin in Southeast Asia.



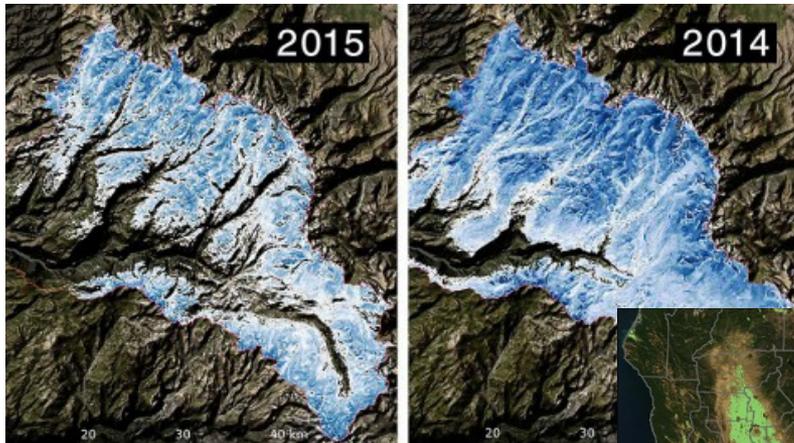
NASA's Western Water Applications Office

The "WWAO"

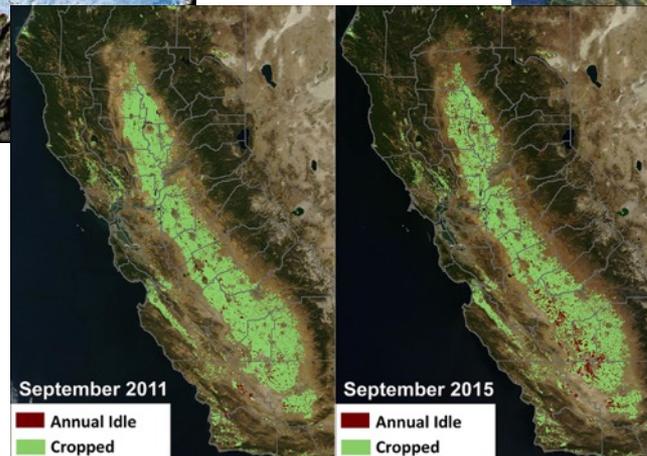
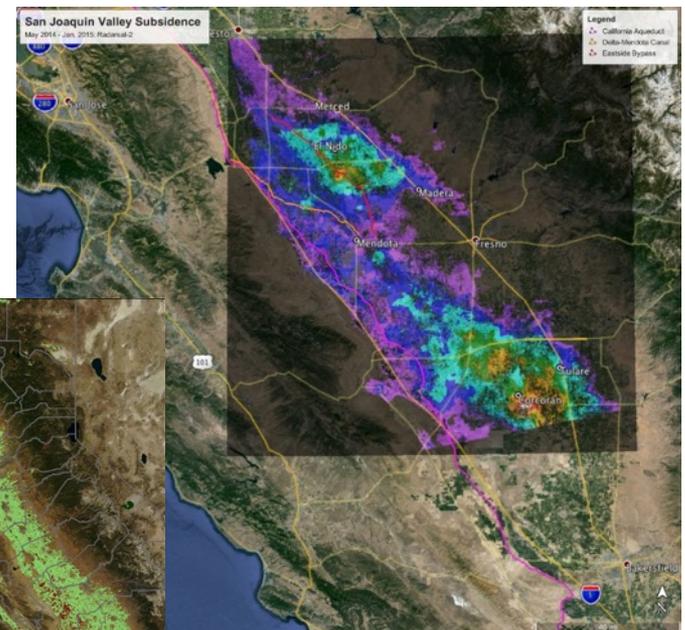
Accelerating the application of NASA Observations and scientific analysis techniques to tangible, important, and timely water management problems

A new NASA-wide program office located at JPL and sponsored by NASA Applied Sciences of the Earth Science Division

ASO Snow Water Equiv. Mapping, Tuolumne



UAVSAR – CA Central Valley Surface Subsidence



LANDSAT, Terra, AQUA Followed Land Mapping

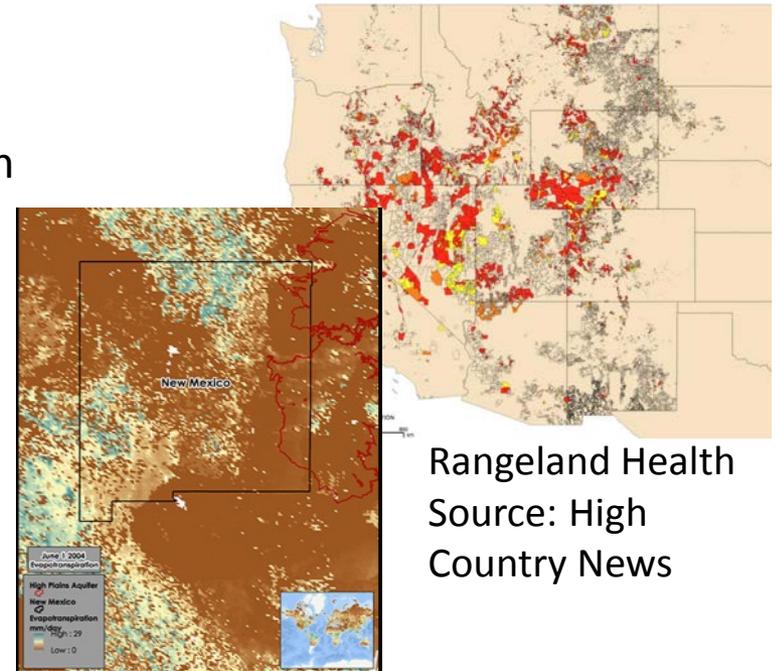


GOALS

Identify: WWAO will identify and address Western water management applications in which NASA's unique capabilities can have an impact

Deliver: It will foster and support cost-effective projects which bring NASA's Earth science results to Western water management organizations in an understandable and actionable format

Off-Ramp: WWAO will strive to have its projects advancing to the point where projects and products are handed off to the stakeholder.



Rangeland Health
Source: High
Country News

ET New Mexico
Source: NASA –
DEVELOP



**NASA Science Mission Directorate
Earth Science Division
Applied Sciences Program**



QUESTIONS

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