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G-REALM: A Lake/Reservoir Monitoring Tool for Water Resources and Regional Security Assessment

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ABSTRACT

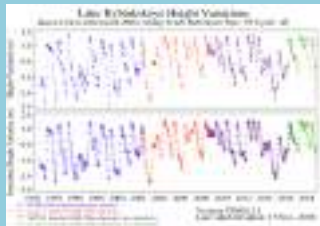
G-REALM is a NASA/USDA funded operational program offering surface water-level products for lakes and reservoirs. These products are derived from a sustained multi-agency series of satellite radar altimeters. These products are being created in response to the lack of access to global in situ data, which is often considered sensitive information. Although in the public domain the main project stakeholders are the USDM Foreign Agricultural Service (FAS) and various US agencies with interests relating to regional security. The FAS utilizes the products within their CropExplorer Decision Support System (DSS) to help assess water storage (for irrigation potential), and to monitor both short-term (agricultural) and longer-term (hydrological) drought conditions. Other agencies look to the product to supply information critical to the timing of water resource, and to highlight increasing flood potential due to natural causes or poor infrastructure. There is increasing demand for a new global monitoring system that is particular, captures the variations in the smallest (1 to 100km) reservoirs and water holdings, inland and semi-arid regions. Here, water resources are critical to both agriculture and regional security. A next-generation product upgrade has allowed for more accurate lake level products to be released and a greater number of water bodies can now be monitored as a result of improved instrumentation. To note is the particular capability of capturing reservoir in-fill after dam completion, especially in complex or mountainous terrain. The monitoring system will also soon contain a new element, the monitoring of surface water level inversions. This aims to satisfy research and stakeholder requirements with interests in inland fisheries, catch potential and deducing water levels, and to the monitoring of the delicate balance between water resources, agriculture, and fisheries management in arid basins.

PRODUCTS and SERVICES



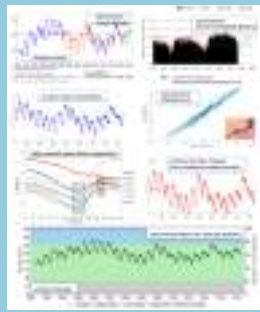
Global distribution of lakes and reservoirs for operational water level monitoring.

solid circles = reservoirs
open triangles = lakes
Blue = Jason-3
Black = Sentinel-3A
Pink = Sentinel-3B



Surface Water Level variation product from the NASA/CNES Topex/Poseidon Jason-1, Jason-2, Jason-3 suite of radar altimeter instruments. Example for the 2,800km² Rybinskoye reservoir in the Russian Federation. A 25yr hydrological and climate record at 10-day resolution.

Top plot = minimally processed
Bottom plot = smoothed and filtered



(Left) Future Water-Watch products suite focusing on higher-level lake storage products and a range of water body "Status" indicators that will indicate anomalous conditions. Example for Lake Nasser. Over the last 25yrs the reservoir rarely exceeded 80% of its total capacity but 1998-2001 and 2007 were "High Flood" potential years.

(Below) (Left) Derived reservoir bathymetry (1m contours) from the SRTM DEM, example for the 360km Casartasso reservoir in Brazil which began operations in 2004. (Right) elevation profile behind the dam, and the water body rating curve. (Figures courtesy of Prof. Vipin Kumar, UMN, 2018)



Two web-based portals for satellite-based lake and reservoir data products. Special focus on altimeters for surface water level variations.



1) The USDA/FAS CropExplorer **G-REALM** Web Portal
https://ipad.fas.usda.gov/cropexplorer/global_reservoir/

2) and the new prototype **WATER-WATCH** web site
<http://water-watch.sgt-inc.com>



Resources & Regional Security

The collage contains several key elements:

- Top Left:** A map titled "Lake Level Variations" showing fluctuations over time.
- Top Middle:** A line graph titled "Lake Level Variations" showing data for different lakes.
- Top Right:** A line graph titled "Lake Level Variations" showing data for different lakes.
- Middle Left:** A line graph titled "Lake Level Variations" showing data for different lakes.
- Middle Right:** A map titled "Lake Level Variations" showing the spatial distribution of water levels.
- Bottom Left:** A screenshot of the USDA/FAS CropExplorer G-REALM Web Portal.
- Bottom Middle:** A screenshot of the WATER-WATCH web site.
- Bottom Right:** A map titled "Lake Level Variations" showing the spatial distribution of water levels.