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G-REALM

The NASA/USDA Global REservoir And Lake Monitor and the TPJO.2.3 Product Upgrade

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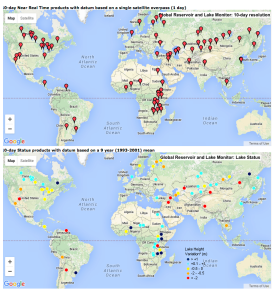
Introduction

G-REALM provides altimetric surface water level variation products for large lakes and reservoirs. It serves the US Dept. of Agriculture and other *.gov, *.org, *.edu, *.mil, *.com stakeholders. Near real time and archival products help supplement sparse *in situ* data in un-gauged or poorly-gauged basins.



G-REALM currently offers two product types:

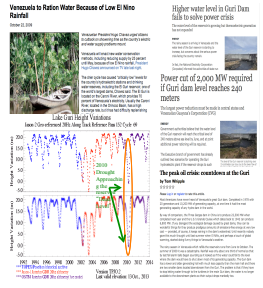
TPJO.2 (Top) water level variations based on a single satellite overpass during the Jason-2/OSTM mission. USDA utilize this product as a general indicator of short-term (agricultural drought) observed over seasonal time-scales.

TPJO.1 (Bottom) water level variations based on a long-term mean (9yrs T/P data 1993-2001). USDA utilize this product to generate a "Lake Status Indicator", to highlight longer-term trends, such as hydrological drought or re-charge.

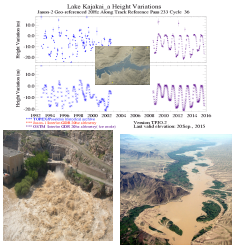
Product Applications

G-REALM product applications include irrigation potential, impoundment effects, energy resources, fish productivity, regional security, and vegetation ecology. Researchers have also utilized the products for hydrological modeling and for studies of climate change with particular relevance to drought and flood events.

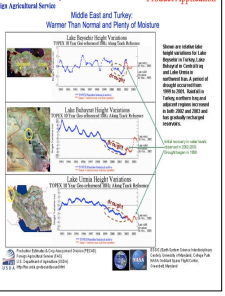
(Below left)) Monitoring of Lake Guri , Venezuela. Severe drought in 2010 led to the decline of the water levels such that the situation started to approach the "reservoir dead level" a point beyond which the reservoir would cease to operate and provide electricity.



(Below center) Excessive 2007 snowmelt led to water release out of the Kajakai Reservoir spillway which resulted in large scale inundation of the floodplain. From 2008, the NASA 10-day products are aiding water managers via supplementing the often-sporadic fall/winter in situ data (no 35day ground tracks exist across Kajakai). (Right) The merger of satellite water levels with historical *in situ* measurements for Lake Victoria, East Africa. USDA/FAS regional analysts were able to assess the current situation with respect to the variability during the pre-1960s major flood incident.



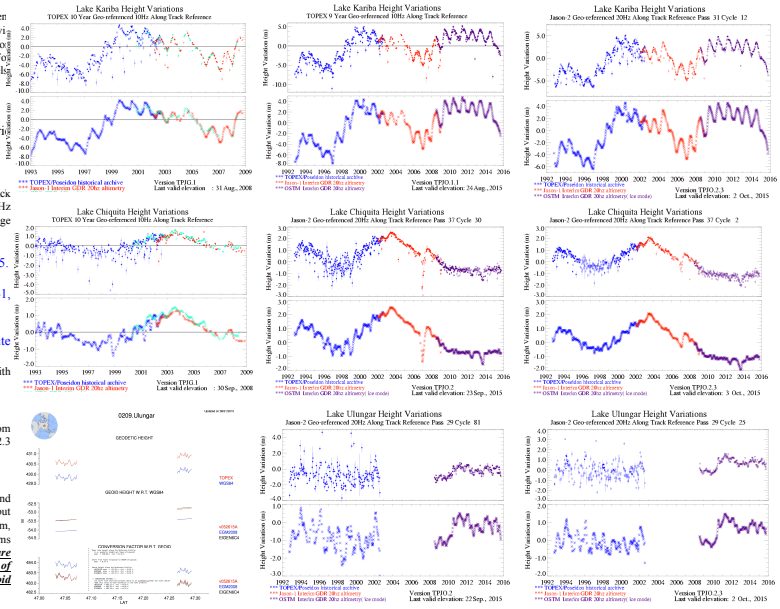
(Below right) Monitoring of several water bodies in the Middle East. Drought caused declining water levels across the region with an effect on wheat production. A reprieve of the situation in 2002 caused a lake/reservoir recharge.



2015 Product Upgrade – the new TPJO.2.3

The G-REALM project is tasked to continuously upgrade existing products, output additional products, and look to expand on product type. Recently the 10-day resolution products, formed by the merger of T/P, Jason-1, and Jason-2/OSTM GDR/IGDR data sets, were upgraded from TPJO.1 to TPJO.1.3, and from TPJO.2 to TPJO.2.3. With few exceptions, the improvement to Jason-1 products enabled the GFO-related products (TPJG.1) to be dropped from the system. The version 2.3 upgrade included:

TPJG.1 TPJO.2 TPJO.2.3



• Revisions to the G-REALM time-tagged altimetric database

Which included improved NASA/GSFC std1204 satellite orbits (with most recen ITRF ref frame) for T/P and J-1 GDR, and improved atmospheric corrections vi the RADS database for the J-2/GDR-D, J-1/GDR-C, T/P/MGDR-B. Priority is g radiometer corrections if valid, otherwise on the ERA wet/dry trop corrections, Fo the iono correction priority is on the GIM (post 1998) and nic09 (pre 1998) models Operational products utilize atmospheric corrections as found in the IGDR.

• A change in product format

Which includes notation to highlight the source of the atmospheri corrections for each cycle and mission.

• Revisions to the lake-specific reference datum

Which included a re-examination of the selection of satellite overpass, ground track selection limits, and choice of reference cycle. TPJO.2.3 products utilize a 20Hz datum from the Jason-2/OSTM mission with emphasis on ice-retracker range values.

• The replacing of Jason-2/OSTM IGDR with GDR or cycles 001-225

• Updated inter-mission bias estimates regarding the merger of T/P, J-1, and J-2 results.

• The identification of additional lakes/reservoirs with satellite overpasses.

The lakes/reservoirs catalogue now contains 2,300 large water bodies with improved identification of satellite overpass, dam location, and water usage.

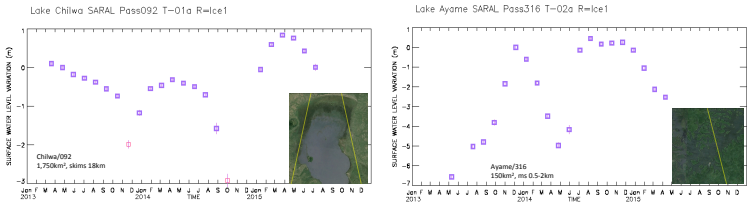
• A change to the 9-year mean datum

Specifically for the TPJO.1 products, the 9yr mean datum is now formed from consideration of the 1993-2001 water level anomalies observed in the TPJO.2.3 product (to be released November 2015)

• Additional datum conversion factors

Now found in the TPJO.2.3 product headers, these factors assist end users and stakeholders in the merger of the satellite-based products with their existing (but sporadic) *in situ* data. The conversions enable a transformation from relative datum, to the T/P and WGS84 geodetic datums, and to a variety of orthometric datums including EGM2008, EIGEN6C4, and the latest research models. ***Future validation with in situ data will enable the team to not only assess the accuracy of these conversion factors but also highlight differences and errors in the geoid models.***

Future Upgrades and Expansion - Retrackers, SARAL and Sentinel-3



In early 2016, G-REALM will release ISRO/SARAL based 35-day products for a USDA-selected set of lakes and reservoirs. With SARAL/ENVISAT/ERS datasets in mind, the radar waveforms will also be added to the altimetric database and a suite of published retrackers tested to improve product quality/quantity. Focus will also be on Jason-3 which will provide continuity to the existing TPJO.2.3, and TPJO.2.3 products, and these will be output for an additional ~200 lakes/reservoirs. Depending on USDA and other Stakeholder interests, the team may also look to the incorporation of ESA/Sentinel-3 data with its 27day re-visit period, and to the incorporation of wetland regions for consideration of improved decision support regarding inland fisheries and conservation applications.