



Near-Real Time Monitoring of Global Lakes and Reservoirs: Water Resources, Irrigation Potential and Agriculture

A semi-automated system with global outlook, utilizing the NASA/CNES Jason-1, TOPEX/POSEIDON and NRL GFO satellite radar altimeter data sets.



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http://www.pecad.fas.usda.gov/cropexplorer/global_reservoir

ABSTRACT: Satellite radar altimetry has the ability to monitor variations in surface water height (stage) for large lakes and reservoirs. A clear advantage is the provision of data where traditional gauges are lacking or where there is restricted access to ground-based measurements. A USDA-funded program is performing near-real time altimetric monitoring of the largest lakes and reservoirs in the world. Data ingestion and manipulation follows the path of the NASA Ocean Altimeter Pathfinder although extra provisions have to be made regarding these smaller targets. The near-real time stage measurements are derived from incoming data from the Jason-1 mission (IGDR data, <10cm orbit accuracy, delivery time <4days after satellite overpass). Archived data from the TOPEX/POSEIDON mission is also utilized to provide historical time series variations from 1992-2002. The database currently holds around 70 lakes with stage product accuracies ranging from a few centimetres to many tens of centimetres depending on the target size and mission dataset. The database contains simple graphic and text products, which are available via a clickable map interface on an internet web site http://www.pecad.fas.usda.gov/cropexplorer/global_reservoir. This enables free public access as well as the delivery of information to the USDA for irrigation potential estimates and observation of potential drought or high-water conditions. With continued funding from NASA, USDA and potentially from the NGA, data from the NRL GFO satellite is being ingested and analyzed to a) increase the number of observation targets and b) to replace some missing results (data processing problem) pertaining to the Jason-1 (2002-current) data set.

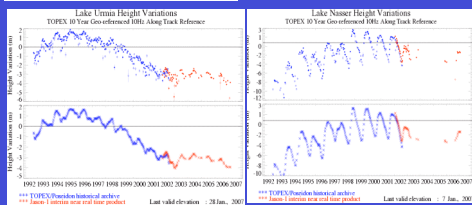
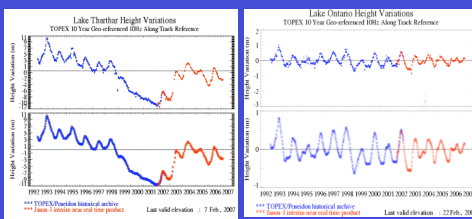
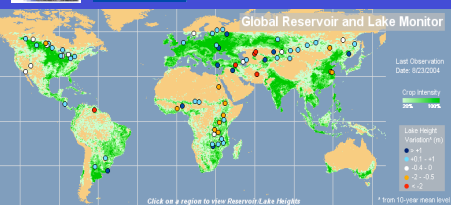
Introduction

This project centers on the proven ability of satellite radar altimeters to monitor the variation of surface water height for large inland water bodies. It utilizes both archived and near-real time altimetric data to monitor the changing elevations of lakes and reservoirs.

On a weekly basis, a semi-automated data ingestion and analysis system gathers near real time altimetric data. It constructs elevation parameters and updates time series products in a lakes database. The updated products, in graph and text format, are collected by the United States Department of Agriculture. They become part of the Crop Explorer system, with unrestricted viewing, at a world wide web site.

The Foreign Agriculture Service utilizes the products for observation of general flood and drought conditions. The Precipitation Estimation Crop Assessment Division (PECAD) will additionally utilize the data for the determination of reservoir storage and irrigation capacity.

The project is unique in the way it utilizes near-real time altimeter data over inland water in such an operational manner.



Lake Products
 Lake elevation products from the NASA/CNES TopeX/Poseidon altimeter mission. 2 cm accuracy. These lakes are located within or adjacent to cropland areas. To which irrigation has recently reduced inflows. To which inflows have recently been reduced due to damming. Lake Victoria (Africa), Lake Tanganyika (Africa), Lake Chad (Africa), Lake Mead (USA) and Reservoir at Lake Mead (USA) (Africa) are examples of the missing Jason-1 data products.

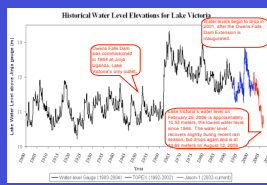
- SPONSORS**
1. USDA/EAS/PECAD, For routine operational weekly product updates
 2. NASA NN-HL-04-Z-YO-010-C Decision Support, For the inclusion of NRL/GFO data set post 2000.
 3. NASA NRA-03-OES-05 Ocean Surface Topography Team, For enhancement of existing Topex/Poseidon and Jason-1 products and for longer-term expansion elements relating to the inclusion of ESA ERS and ENVISAT mission data

Phase I and II

Phase I commenced October 2002 with the aim of monitoring only those lakes and reservoirs found on the African continent, but Phase II (October, 2003) expanded the objectives to a more global outlook. The project concentrated on utilizing the NASA/CNES Topex/Poseidon and Jason-1 datasets which spanned over 10years of observation. With products derived from these missions the database became on-line and operational in January, 2004 with additional lakes added throughout 2004-2005.

Phase III and IV

Additional USD and NASA funding from October, 2005 ensures the expansion and enhancement of the current database. This includes the incorporation of lake products derived from the GFO mission. Roughly 200 lakes will be on-line by the end of 2007. In addition improvement of existing products is continually being sought.



Example Application
 Lake Victoria, regional drought, successive water releases after 2001 for power generation, and low completion of rainy.

