Calibration of Orbital Microwave Measurements of River Discharge Using a Global Hydrology Model

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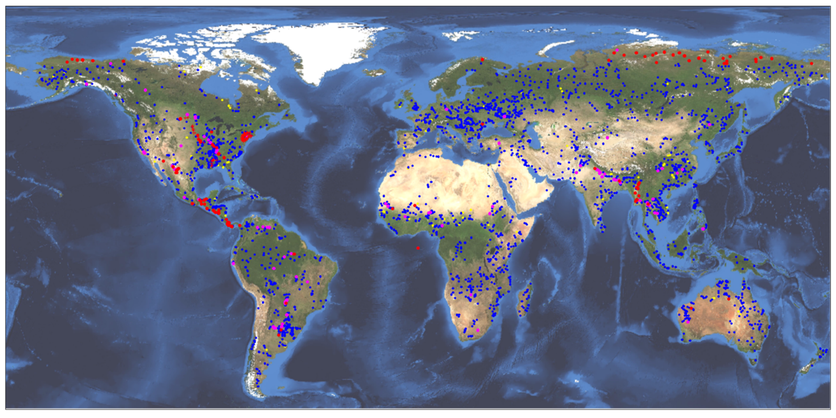
Introduction

- Reliable and frequent measurement of river discharge is crucial for calculating terrestrial water cycle budgets. It also has numerous practical applications in water resources management for an expanding global population.

- Previous work demonstrates that orbital passive microwave instruments (such as AMSR-E – now out of operation – and TMI) have the capability to measure river discharge variation on a daily basis.

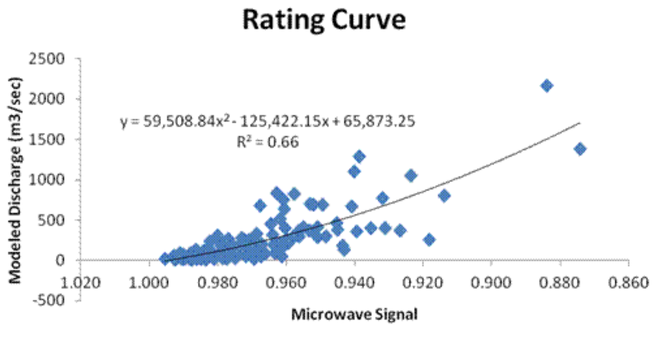
- As future satellite missions are being planned to retrieve more-precise, but less frequent, discharge measurements, via altimetry, on an experimental basis, for a limited mission duration, the data from the present international constellation of orbital microwave sensors should be fully utilized.

- Here we use existing orbital passive microwave data that directly monitor discharge, and couple this information to a global hydrology model (WBM). This allows for the needed calibration of remote sensing signal to discharge units (m^3/s) or to catchment runoff (mm).



River measurement sites, where optical remote sensing (2001-2010) detects surface water area variation within the site reaches (10 km in length). Near-daily time series of passive microwave signal have been obtained and archived for each site since July 1, 2002.

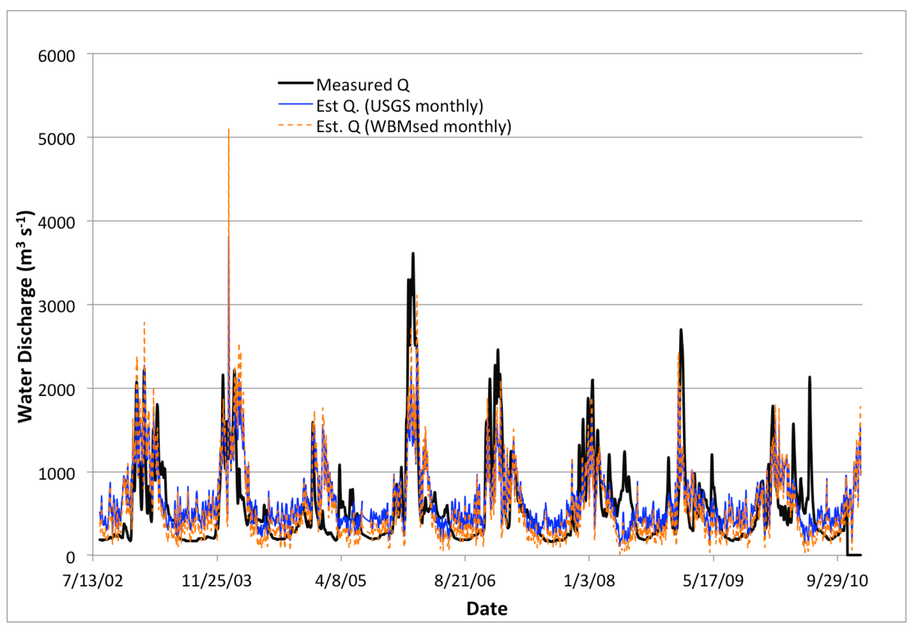
Methodology



Plot of microwave discharge estimator signal for a site on the White River USA (site number 516) versus WBM-predicted monthly daily mean, max and min discharge. Without ground-based information, we calibrate the remote sensing signal to discharge.

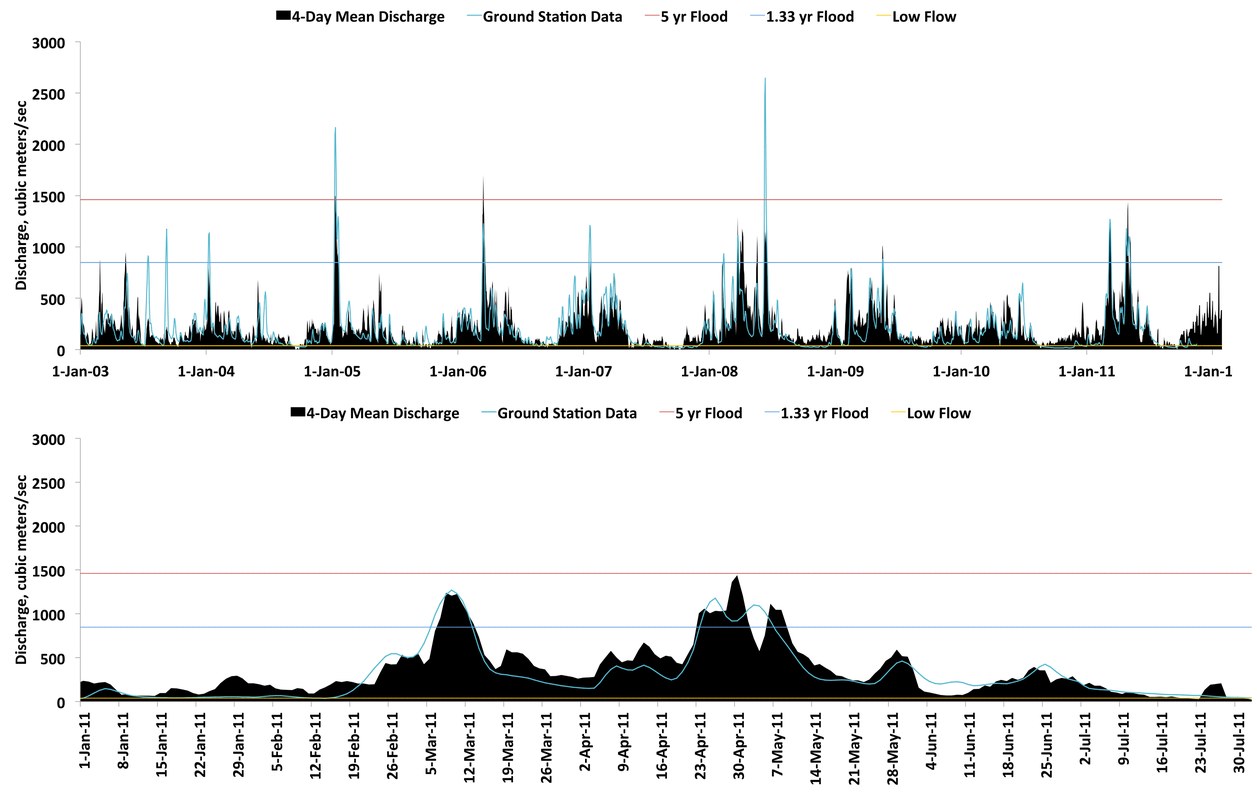
Results

Analysis of 6 measurement sites in the USA indicate that using model-predicted discharge for calibration of the microwave signal produces results that are nearly as accurate as when using gauged discharge.



Satellite discharge measurements for a site on the Willamette River in north-west USA using model-predicted (orange) and gauged (blue) discharge as calibration. Gauged discharge from a co-located USGS station is the black line.

We have hereby developed an algorithm to automatically calibrate microwave remote sensing over 1000's of river measurement sites to discharge values.



River discharge measurements (black) for a site on the White River, southern Indiana, USA using model-predicted discharge as the rating curve calibration (no ground-based information was used). The blue line is gauged discharge from a co-located gauging station (USGS 03360500 White River at Newberry, IN).

Relevant Publications

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Brakenridge, G.R., Nghiem, S.V., Anderson, E., Mic, R., 2007. Orbital microwave measurement of river discharge and ice status. Water Resources Research, 43(W04405, doi:10.1029/2006WR005238).

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De Groeve, T., 2010. Flood monitoring and mapping using passive microwave remote sensing in Namibia. Geomatics, Natural Hazards and Risk, 1(DOI: 10.1080/19475701003648085): 19-35.

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