Remote sensed water discharge to analyze flood frequency

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Historical and current information regarding river discharge is essential, not only from a water management, energy, or global change perspective but also to better analyze, control and forecast flooding. However, globally the number of ground-based gauging stations declines, and data that is measured by ground-based gauging stations is often not, or shared with a considerable delay.

It has been demonstrated that existing satellite sensors can be utilized for useful discharge measurements without requiring ground-based information. The DFO – Flood Observatory uses the Advanced Microwave Scanning Radiometer band at 36.5 GHz (e.g. TRMM, AMSR-E, AMSR2, GMP), pre-processed by the Joint Research Center (JRC) to estimate discharges. With a nearly-daily repeat interval, this microwave signal has been successfully applied to measure water discharge at a global scale, where the calibration of the microwave discharge signal to discharge units is accomplished by comparison to results from a global hydrological numerical model, the Water Balance Model (WBM), for a calibration period. Once calibrated, daily discharge can be back-calculated to January 1998, providing a daily discharge record for more than 20 years.

Here we present the methods used to utilize remote sensing to measure discharge. We indicate the challenges and how to overcome these when using a multiple sensor approach to capture daily discharges for over a 20-year period. And we show an example for the Amazon river, comparing the remote sensed discharge data with ground observations for multiple locations. Additionally, applications are shown on how this discharge can be combined with flood extent maps to analyze flood frequency.