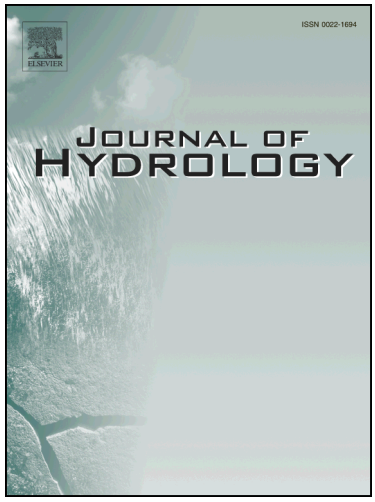

Research papers

Satellite Remote Sensing Estimation of River Discharge: Application to the Yukon River Alaska

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Satellite Remote Sensing Estimation of River Discharge: Application to the Yukon River Alaska

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ABSTRACT

A methodology based on general hydraulic relations for rivers has been developed to estimate the discharge (flow rate) of rivers using satellite remote sensing observations. The estimates of discharge, flow depth, and flow velocity are derived from remotely observed water surface area, water surface slope, and water surface height, and demonstrated for two reaches of the Yukon River in Alaska, at Eagle (reach length 34.7 km) and near Stevens Village (reach length 38.3 km). The method is based on fundamental equations of hydraulic flow resistance in rivers, including the Manning equation and the Prandtl-von Karman universal velocity distribution equation. The method employs some new hydraulic relations to help define flow resistance and height of the zero flow boundary in the channel. Estimates are made both with and without calibration. The water surface area of the river reach is measured by using a provisional version of the U.S. Geological Survey (USGS) Landsat based product named Dynamic Surface Water Extent (DSWE). The water surface height and slope measurements require a self-consistent datum, and are derived from observations from the Jason-2 satellite altimeter mission. At both reach locations, the Jason-2 radar altimeter non-winter heights consistently tracked the stage recorded at USGS streamgages with a standard deviation of differences (error) during the non-winter periods of less than 7%. Part of the error may be due to differences in the gage and altimeter crossing locations with respect to the range of stage change and the response to changes in discharge at the upstream and downstream locations. For the