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Comparison of different automatic adaptive threshold selection techniques for estimating discharge from river width

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The importance of river discharge monitoring is critical for e.g., water resource planning, climate change, hazard monitoring. River discharge has been measured at in situ gauges for more than a century. Despite various attempts, some basins are still ungauged. Moreover, a reduction in the number of worldwide gauging stations increases the interest to employ remote sensing data for river discharge monitoring. Finding an empirical relationship between simultaneous in situ measurements of discharge and river widths derived from satellite imagery has been introduced as a straightforward remote sensing alternative.

Classifying water and land in an image is the primary task for defining the river width. Water appears dark in the near infrared and infrared bands in satellite images. As a result low values in the histogram usually represent the water content. In this way, applying a threshold on the image histogram and separating into two different classes is one of the most efficient techniques to build a water mask. Beside its simple definition, finding the appropriate threshold value in each image is the most critical issue. The threshold is variable due to changes in the water level, river extent, atmosphere, sunlight radiation, onboard calibration of the satellite over time. These complexities in water body classification are the main source of error in river width estimation.

In this study, we are looking for the most efficient adaptive threshold algorithm to estimate the river discharge. To do this, all cloud free MODIS images coincident with the in situ measurement are collected. Next a number of automatic threshold selection techniques are employed to generate different dynamic water masks. Then, for each of them a separate empirical relationship between river widths and discharge measurements are determined. Through these empirical relationships, we estimate river discharge at the gauge and then validate our results against in situ measurements and also intercompare them. Finally, in respect to the level of error in the discharge estimation, the most efficient threshold selection technique to define water mask will be identified.