River Ice monitoring over the Susquehanna River Basin using remote sensing data

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The main goal of this study is to implement an automated multi-satellite based technique for the detection and monitoring of ice in the Susquehanna River. The timely detection of ice jams and ice breakups along the river is crucial because of the rapidity of these processes.

Satellite images in the visible and infrared wavelengths are sensitive to ice and offer a frequent revisiting time and large spatial coverage. They are therefore very useful in achieving the goal of this study. Their main limitation, however, is that they cannot penetrate clouds. The simultaneous use of multi-satellite data and the development of daily and weekly composited images mitigate the cloud impact and permit for a better detection of ice. For this purpose, data from MODIS Terra, MODIS Aqua and AVHRR satellites are used. MODIS Terra and MODIS Aqua data are available since 1999 and 2002, respectively. They provide observations in the visible, near infrared and infrared at spatial resolution of 250 m, 500 m and 1 km. A more comprehensive archive of almost 30 years of AVHRR data at 1 km of spatial resolution exists and will be processed.

The proposed approach is based on an image fusion concept. This technique assigns red, green and blue colors to two different co-registered images which coincide in space but not in time. One of the two images corresponds to the visible data and the second image corresponds to the near infrared data. MODIS cloud mask product MOD35/MOD09 at the spatial resolution of 1 km will be used as a first guess. Recall that MODIS cloud mask was developed and tuned to perform reasonably well on a global scale. We will work on the implementation of cloud detection technique which performs better locally with respect to the MODIS cloud mask.

The proposed approach is tested first using MODIS data. The white color over the cloud-free pixels in the obtained false color composited image indicates the presence of ice. The open water appears in dark blue in the image. A classification technique will be applied to assess the extent of ice coverage. Time series of observed reflectance as indicators of ice conditions will be analyzed and ultimately change in ice coverage in the river will be automatically detected. Further preliminary results will be presented.