New tools for basin scale river ice characterization from radar data

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In recent years, a number of river ice services have been developed to support flood forecasting and ice jam early warnings, using radar satellite imagery. Some approaches are already used operationally by water or public safety authorities for river ice monitoring. However, there is still a need to further improve these services by enhancing the classification accuracy and the characterization of river ice dynamics and by making better use of the image-derived information.

This aspect is investigated within the STSE North Hydrology project (Support To Science Element - European Space Agency), which global objectives is to exploit earth observation technology, models and in situ data to improve the characterization of river and lake ice processes and their contribution to the Northern Hydrology system. The river ice work builds on the expertise of the FRAZIL system, developed at INRS. Improvements are made to the IceMAP algorithm (Ice Mapping Automated Procedure) for use with dual polarization ASAR data. Ambiguities in the presence of water surface roughness (wind or rapids) are reduced. New tools are developed to automatically derive added-value information from the radar ice maps: 1) the Ice Cover Profiler gives a longitudinal view of the ice surface concentrations; 2) the Ice Change Detector detects signs of melting, signs of break-up, signs of freeze-up and signs of consolidation and 3) the ice front monitor indicates the probable location of the ice front. Output information is evaluated for use with breakup date forecasting models and other needs of the Finnish Environment Institute (SYKE).

The primary testing site for this project is the Tornionjoki/Torne älv River, a river at the border between Finland and Sweden. But other sites were included as well (Koksoak, Chaudiere and Peace Rivers (Canada) as the main challenge remains the availability of both images of river ice and validation data over various conditions. Archived and new ASAR images were used for calibration and validation. RADARSAT-2 images were also used to extend the dataset.