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MONITORING FREEZING AND BREAK-UP OF RIVERS AND SHALLOW LAKES WITH HIGH RESOLUTION POLARIMETRIC SAR DATA

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ABSTRACT:

The high-latitude regions of the earth are characterized by a vast number of water bodies, mostly lakes. Depending on the location the areal coverage of lakes in the arctic and sub-arctic regions ranges from 15 to 40% (Duguay, 2003). Water in general and lakes in particular have the ability to store heat. The monitoring of the ice-cover variability of lakes in high latitudes is therefore a good indicator for changes related to global warming and its effects on the polar regions.
The monitoring of freeze-up and break-up of ice is important to help manage flow releases from hydroelectric generation facilities as they can influence the risk of ice jam related flooding, even up to several 100s of kms downstream of the dams. Furthermore frozen lakes and rivers are used as transportation routes for connecting local communities.
Remote Sensing has the capacity to provide accurate high resolution information of the sea and land surface in an automated and standardized way. In particular satellites equipped with Synthetic Aperture Radars (SAR) enable regular mapping and monitoring. Their all-weather and day and night observation capability are important advantages in the Arctic due to high cloud coverage rates and low illumination during the winter period.
In 2007 the German Earth Observation satellite TerraSAR-X was launched that provides high resolution SAR data. Since 2010 it is flying together with its twin satellite TanDEM-X in close formation enabling single pass interferometry. The primary mission goal is the generation of a global digital elevation model in outstanding quality and resolution that allows classifying the shoreline and land's topography at an unprecedented level of detail.
RADARSAT-2 was launched in December 2007. It can be operated in multiple modes and polarization combination. Of particular interest of the current is investigation is the quad pol capability.
Objective of the presented work is to test the applicability of higher level products of polarimetric SAR data. Based on these products an automized and transferable technique shall be developed for lake and river ice monitoring.
In the current study a time series of dual polarimetric TerraSAR-X (HH/VV) data was processed and analysed. A Kennaugh decomposition was applied. The TerraSAR-X data were radiometrically and geometrically calibrated. Time series of different rivers and lakes where acquired, that cover at least one complete freezing and thawing period.

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