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Ice regime of the Ob' river from multi-satellite active/passive microwave measurements

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For large and remote arctic regions a better understanding of water cycle is crucial for improved water resource management. One of important component of water cycle is extensive river network. In situ observations of various hydrological parameters are rather sparse in these remote environments. Fortunately, information from satellite sensors (e.g., satellite altimetry systems, active and passive radiometers) can successfully complement in situ observations and in some cases fill the information gaps, serving as virtual gauging stations or providing other types of hydrological and meteorological data.

Among all the Arctic rivers Ob' is the biggest one by the watershed area and the third biggest by the runoff amount (after Lena and Yenisey). The ability to monitor dates of formation/break-up of ice cover on the river and dates of the beginning of spring flood using satellite data is very valuable for various scientific and practical purposes. We present results of study of ice regime in the Ob' river basin based on satellite remote sensing observations from radar altimetry altimetry (TOPEX/Poseidon, Jason, ERS-1, -2 and ENVISAT satellites) and SSM/I radiometry.

The Ob' hydrological cycle is strongly influenced by the ice cover that forms every winter over large parts of the river system. Satellite microwave data provide the mean to study temporal variations of dates of ice formation/break-up for Ob' itself and its main tributaries. A method using combination of both active (backscatter coefficient from radar altimeter) and passive (brightness temperatures from radiometer) microwave measurements is proposed and applied to provide information necessary

to estimate type of surface cover over the river and distinguish between ice and open water. This information was complemented by more than twenty years-long (since 1978) passive microwave data from the SMMR and SSM/I instruments. Combination of various data makes it possible not only to assess presence of ice, but also to estimate the depth of snow on ice We compare the satellite-derived data with the existing in situ observations of ice cover and snow on ice and presents benefits and drawbacks of using multi-satellite active/passive microwave measurements for studies of ice regime of Arctic rivers.

Using combined data from these two sources of satellite data, we have provided assessment of spatial and temporal variability of the dates of ice formation/break-up for the Ob'. The ice break-up dates are closely related with the beginning of the spring flood, what gives us not only information on variability of climatic parameters, but also provides additional data on variability of this important phase of hydrological regime.