EGU21-13440, updated on 17 Oct 2021
https://doi.org/10.5194/egusphere-egu21-13440
EGU General Assembly 2021

Satellite remote sensing of the Oka-Volga confluence zone during the ice melting

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The river confluence is one of the most complex processes in river morphology, which plays an important role in riverbed deformation, mixing processes, pollution transport, etc. The area of river confluence can be often visually observed as the relatively thin transition region or mixing zone (MZ) separating two parallel weakly mixing flows. The mixing zone characteristics, in particular width, are important indicators of the turbulent mixing intensity and momentum and substance exchange between two flows, therefore, understanding the physical mechanisms affected on the mixing zone formation and manifestation is an important task in ecological remote monitoring. A typical example of a river confluence is the merging of the Volga and Oka rivers (Russia). In this work satellite radar and optical images of the Oka -Volga MZ during the active ice cover melting were analyzed. The mixing zone of rivers as the formation of wet snow at the initial stages of melting, which further contributes to the formation of open water patches in the area of rivers confluence zone is shown. Such manifestation of the mixing zone can be presumably associated with factories / thermal power plants emissions and turbulent mixing of river flows. An increase of the radar signal backscattering of wet snow was observed, and it can be associated with the predominance of surface scattering (an increase of affection of surface roughness) with an increase of snow and ice cover moisture. In conditions of positive average daily temperatures, intense ice melting led to the appearance of open water patches, which were partially covered with fragmented ice. Although the wind velocity during the observation period was about 3-5 m/s, which significantly exceeds the threshold of wind waves excitation, the latter, was rather weak, in particular, due to the wind wave damping on the water covered with the floes. This led to the manifestation of the MZ as an extended dark band, and also presumably caused weak radar backscattering after the ice opening of the Volga part.

The research was funded by the Russian Foundation for Basic Research (Projects RFBR № 18-45-520004 and № 20-05-00561)