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Theme -Theme 2: Observing in Support of Adaptation and Mitigation

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Poster title (brief) Hydrologic Response to Changes in the Active Layer and Permafrost Conditions over the Russian Arctic Drainage Basin

Abstract - text box

It is well documented that dramatic changes have occurred in the Arctic and Subarctic in recent decades. Permafrost is realized as an important component in the arctic hydrological system because changes in runoff over the Russian Arctic drainage basin cannot be well explained by changes in precipitation or precipitation minus evapotranspiration. However, current understanding of the hydrological response to permafrost dynamics is insufficient. This study investigated long-term changes in the active layer and permafrost conditions and their potential hydrologic effects over the Russian Arctic drainage basin. Over the past decades, soil temperature has increased about 1.4°C over the Ob, 1.5°C over the Yenisei, and 1.8°C over the Lena river basin, possibly resulting in significant thawing of permafrost. Active layer thickness generally increased in the permafrost regions, although the magnitudes of changes varied in using different methods. Rapid changes happened since the 1970s. The volume of the active layer increased 28, 142, and 228 km³ (equivalent to 5±1, 26±3, and 45±7 mm of runoff depth) over the Ob, Yenisei, and Lena basins, respectively, since the 1970s. Melting ground ice caused by changes in the active layer may be a limited contribution to annual runoff. Seasonal peak runoff showed a negative correlation to changes in active layer thickness over these three basins but freeze season runoff showed a positive correlation to active layer thickness. These results imply that a thicker active layer has a greater soil water storage capacity, hence would reduce runoff in summer, and perhaps contribute to winter runoff increase.