

Hydrological Variability and Changes in the Arctic Circumpolar Tundra and the Three Largest Pan-Arctic River Basins from 2002 to 2016

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The Arctic freshwater budget is critical for understanding the climate in the northern regions. However, the hydrology of the Arctic circumpolar tundra region (ACTR) and the largest pan-Arctic rivers are still not well understood. In this paper, we analyze the spatiotemporal variations in the terrestrial water storage (TWS) of the ACTR and three of the largest pan-Arctic river basins (Lena, Mackenzie, Yukon). To do this, we utilize monthly Gravity Recovery and Climate Experiment (GRACE) data from 2002 to 2016. Together with global land reanalysis, and river runoff data, we identify declining TWS trends throughout the ACTR that we attribute largely to increasing evapotranspiration driven by increasing summer air temperatures. In terms of regional changes, large and significant negative trends in TWS are observed mainly over the North American continent. At basin scale, we show that, in the Lena River basin, the autumnal TWS signal persists until the spring of the following year, while in the Mackenzie River basin, the TWS level in the autumn and winter has no significant impact on the following year. As expected global warming is expected to be particularly significant in the northern regions, our results are important for understanding future TWS trends, with possible further decline.

Reference:

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