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FORCING, VARIABILITY, AND PATHWAY OF A SIBERIAN BUOYANCY-DRIVEN CURRENT AND ITS IMPLICATIONS FOR ARCTIC FRESHWATER VARIABILITY

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Siberian river water is a first-order contribution to the Arctic freshwater budget. The Ob and Yenisey discharge into the Kara Sea, and the Lena into the Laptev Sea, which in combination provide the largest contribution of riverine freshwater. However, few details are known regarding where, when and how the freshwater traverses the vast Siberian shelf seas. This paper investigates the mechanism, variability and pathways of the fresh Kara Sea outflow through Vilkitsky Strait (VS) towards the Laptev Sea. We utilize a high-resolution ocean model and recent shipboard observations to characterize the freshwater-laden Vilkitsky Strait Current (VSC), and shed new light on the little-studied region between the Kara and Laptev Seas, characterized by harsh ice conditions, contrasting water masses, straits and a large submarine canyon. The VSC is 10-20 km wide, surface-intensified, and varies seasonally (maximum from August-March and nearly absent in April-June) and interannually. Average freshwater (volume) transport is 500 ± 120 km^3 a^{-1}(0.53 ± 0.08 Sv), with a baroclinic flow contribution of 50-90%. Interannual transport variability is explained by a storage-release mechanism, where blocking-favorable atmospheric summer pressure patterns hamper the outflow and cause accumulation of freshwater in the Kara Sea. The year following a blocking event is characterized by enhanced transports driven by a baroclinic flow along the coast set up by increased freshwater volumes. Eventually, the VSC merges with a slope current and provides a major pathway for Eurasian river water towards the Western Arctic along the Eurasian continental slope. Our results underline the regional importance of the VSC and further suggest implications for the larger-scale Arctic Ocean freshwater storage and variability.