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# Impacts of riverine discharges on the overturning circulation and material circulation in the Sea of Okhotsk and the North Pacific Ocean

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The Sea of Okhotsk is a semi-closed marginal sea adjoining the Eurasian Continent, with a substantial water exchange with the North Pacific Ocean through the Kuril Straits. The Okhotsk Sea collects a large amount of freshwater from the Amur River, one of top 10 largest rivers in the world, as well as from other rivers and local precipitation. Further, rivers carry a lot of nutrients and materials, such as iron, and discharge to the ocean. It is now well known that high primary production in the Oyashio region is attributed to iron transport from the Sea of Okhotsk. In this talk, we present results of ocean modeling that simulates the impacts of the riverine discharge on the overturning circulation and material circulation in the Sea of Okhotsk and the western North Pacific. Specifically, we focus on the 2 issues: (1) Impact of the riverine freshwater discharges to the dense shelf water (DSW) produced over the northern continental shelves due to brine rejection, which ventilates the intermediate layer of the Sea of Okhotsk and the North Pacific Ocean; (2) Circulation of materials discharged from the Amur River, paying attention to iron, an essential micronutrient for the phytoplankton growth.

The first issue concerns the DSW salinity, which controls strength of the ventilation of surface water to the intermediate layer. Before conducting numerical modeling, we analyzed hydrographic data in the Sea of Okhotsk collaboratively with Russian scientists which were collected by a Russian institute, the Far Eastern Region Hydrometeorological Research Institute. It was found that the DSW salinity is correlated significantly with a remote salinity anomaly originating in the Bering Sea and the subarctic North Pacific. Further, the precipitation over the Kamchatka Peninsula, not only over the ocean but also over the land, exhibits significant correlation with the DSW salinity variations. Motivated by these observations, we conducted numerical experiments with and without riverine freshwater discharge. We have found that the riverine discharge from the Kamchatka Peninsula has substantial influences on the DSW salinity. On the other hand, freshwater discharge from the Amur River does not give much impact on the DSW salinity because its river mouth locates downstream of the DSW production area.

The second issue concerns material circulations, where we pay attention to circulation of iron from the Amur River. Iron concentration is extremely high in the Amur River, since it flows through vast wetlands. However, most of iron is sedimented at the river mouth area where the riverine water meets the sea water. Nevertheless, the DSW entrains sediment, which contains a lot of iron, and carries it from the northern shelf in the Sea of Okhotsk to a vast area of the North Pacific Ocean through the intermediate layers. This intermediate-layer iron transport was successfully reproduced in our numerical model. Further, another route, a surface route, of the iron transport is suggested. Iron is carried by a coastal current along the Sakhalin together with sea ice, and flows out to the North Pacific as the Coastal Oyashio adjacent to the east coast of Hokkaido, where primary production is particularly high during spring season.

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