How does the Amur River discharge spread over the northwestern continental shelf in the Sea of Okhotsk?

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Iron is a micro-nutrient that is necessary for photosynthesis of the phytoplankton. It is now well known that the iron transported by the Amur River is deposited on the continental shelf in the northwestern shelf of the Sea of Okhotsk, and is then transported out to the intermediate layer of the Sea of Okhotsk; it further spreads to the western North Pacific and supports phytoplankton bloom there. Despite their significance in transporting dissolved and particulate iron, however, the paths of the Amur River discharge on the continental shelf in the Sea of Okhotsk are still unknown. In this study, we conduct a coupled ice-ocean simulation for the northern Sea of Okhotsk from June 1998 to September 2000 to answer a question: Can the Amur River discharge deposit materials to the pathway of the dense shelf water? In a series of numerical experiments, we identified two routes (the western and eastern routes) that could transport the river water more than 100 km offshore over the northwestern continental shelf. The two routes share the clockwise gyre in the Sakhalin Gulf and the northeastward flow on the northwestern continental shelf. These features are connected through the westward jet along the slope from the Sakhalin Gulf (the western route), and the northward transport over the shelf break canyon (the eastern route). The river water, the dense shelf water, and the easterly wind are in a fine geophysical balance for those features, and all are required for the formation of the two routes. The model results show these unique joint effects in the Sea of Okhotsk that allow the Amur River discharge to be effectively transported over the northwestern continental shelf, unlike a general river discharge that flows along the coast, and can deposits materials into the pathway of the dense shelf water.

Keywords: Amur River, Sea Ice Formation, Dense Shelf Water, Coastally Trapped Waves

