

Analysis of water exchange processes at the Subarctic Boundary of the North Pacific using particle tracking method

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The Mixed Waters Region (MWR) of the North Pacific are thought to be an important region for climate change and ecological fluctuations. In the MWR, two quasi stationary jets are formed away from the Western Boundary [Isoguchi et al., 2006]. Mitsudera et al. [2018] showed the relationship between the jets and the topography of only 500 m near the jets.

Contours of the average sea surface height indicates bifurcation between the subarctic and the subtropical circulation on the west coast of the North American continent. The boundary passes through J2 that is the eastern quasi stationary jet [Isoguchi et al., 2006] and coincide with the latitude line of 40°N near 160°E which is known as the Subarctic Boundary. Focusing on the area of 38 - 42°N, 155 - 165°E (referred to as Box), we set particles in Box and tracked them.

J2 is a noticeable flow in the vicinity of the Box, which is formed due to the presence of a low topography at 43°N 167°E north east of Box. Particle pathways are greatly affected by J2. Nevertheless, a majority of the water that passes south of 40°N in the Box goes to the subtropical region and is not affected by J2.

The water of Kuroshio origin (Kuro) is accounted for the majority of the water entering the Box, and the water of Oyashio origin (Oya) is a little. Kuro that enters the Box exceeds 60% in south of 40°N in the Box. Most of Kuro flowed out from the southern side of the Box goes to the subtropical circulation, but Kuro flowed out from north of 40°N in the Box enters the subarctic circulation. Since particles emanated from the northern side of the Box is thought to be susceptible to J2, J2 would play a great role in transporting Kuro to the subarctic region. The proportion of Oya coming into the Box is about 10% to the south of 40°N, while 30 to 40% to the north of 40°N. Therefore, Oya also changes its proportion at 40°N as a boundary. Oya is likely to return to the subarctic circulation, but Oya entering subtropical circulation is also seen.

J2 therefore plays a role of carrying water out from the Box, which has high temperature and high salinity derived from subtropical circulation, to the subarctic circulation where temperature and salinity is low. It is thought that the topography of only 500m in the North Pacific, where the depth is about 6000m, affects the ocean circulation.