Surface water pathways in the subtropical-subarctic intergyre frontal zone of the western North Pacific

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The Transition Domain in the western North Pacific, extending zonally at approximately 40°N, is a boundary region between the subtropical and subarctic gyres, where a peculiar water mass forms as a result of mixing between the waters of the Kuroshio origin and the Oyashio origin. The Transition Domain is a very important area not only for oceanographic processes such as the inter-gyre exchange of the water masses, but also for mid-latitude climate and biological processes. It is not known, however, how the Kuroshio and Oyashio waters are transported to the Transition Domain and mix. This paper clarifies pathways of the Kuroshio water and the Oyashio water from a Lagrangian point of view, by conducting drifting buoy observations in 2015 and 2017, as well as by particle tracking using a geostrophic surface flow field derived from an absolute sea surface height product. Here we show that the Kuroshio water is carried to the Transition Domain through a narrow path with a width of ~ 50 km via a quasi-stationary jet in the western North Pacific (so called the J1). Time variations likely have important role in supplying the Kuroshio water to the Transition Domain; if a steady climatological flow field were used, the Transition Domain would be occupied by the Oyashio water. Much of the Kuroshio water is supplied at the Oyashio Second Branch and a large-scale meander of the J1, where the eddy strength shows local maxima.Eddy formation mechanisms are also discussed in relationship with the low bottom topographic features.

Keywords: the Transition Domain, Subtropical-Subarctic water exchange, bottom topography