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Thermostat Distribution in the North Pacific Subtropical Gyre: The Central Mode Water and the Subtropical Mode Water

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ABSTRACT

The upper thermal structure of the midlatitude North Pacific is studied with the use of all the bathythermograph data compiled in the global ocean temperature and salinity profiles released by the National Oceanographic Data Center. Climatological temperature data are prepared for each $2.5^\circ \times 5^\circ$ (latitude \times longitude) rectangle. The upper layer of the subtropical gyre is characterized by two types of thermostads or mode waters: one in the western basin known as North Pacific subtropical mode water (NPSTMW) and the other in the central basin to be named North Pacific central mode water (NPCMW). The NPCMW thermostat lies centered around 160°W between the Kuroshio Extension and the Kuroshio bifurcation front. Its local core temperature ranges from 10° to 13°C with a somewhat zonally elongated pattern, in contrast to the more uniform core temperature at 16° – 17°C of the NPSTMW thermostat lying centered at 150° – 160°E south of the Kuroshio Extension.

The climatological map of the wintertime mixed layer thickness together with sea surface temperature distribution indicates that the NPCMW formation area is likely situated south of the Kuroshio bifurcation front and at 175°E – 160°W extending as far south as about 37°N around 170°W . The climatological geostrophic flow field suggests that the NPCMW thermostat is spread from its formation area by the North Pacific Current flowing primarily eastward with relatively small southward velocity, which is contrasted with the NPSTMW thermostat spread within the anticyclonic Kuroshio recirculation region and explains the rather zonally elongated temperature distribution of NPCMW. The NPCMW formation can be fit into the recent estimation of the subduction rate of the main thermocline, coinciding with the region of the moderate subduction rate dominated by the lateral induction term.

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