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Decadal Changes in the Mode Waters in the Midlatitude North Pacific

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ABSTRACT

Temporal changes in the properties of the North Pacific subtropical mode water (NPSTMW) and the North Pacific central mode water (NPCMW), which occurred around the mid-1970s, are investigated using temperature data composited for the two decades bounded by the mid-1970s: 1966–75 and 1976–85. Properties of these mode waters changed greatly after the mid-1970s. The colder NPCMW was formed and widely distributed during 1976–85. In the NPSTMW formation area, warmer water occupied the southwestern part, and colder water occupied the northeastern part during 1976–85. The cause of this change is discussed with regard to the heat flux and wind stress data. The cooling can be explained as a result of changes in surface heat flux and heat divergence in the Ekman layer, that is, a larger amount of heat released from the ocean surface and an increased southward Ekman transport of cold water due to intensification of the westerlies. In particular, the latter plays a dominant role in the observed cooling. On the other hand, the warming in the southwestern part of the NPSTMW area cannot be explained by the above mechanism alone. Time series of the Sverdrup transport, the Kuroshio transport, and the thermal structure of the upper ocean reveal that the subtropical gyre intensified after the mid-1970s, suggesting that increased advection of warm water by the Kuroshio from lower latitudes to the south of Japan contributed to the observed warming.

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