

Relationship between upper ocean heat content in the Japan Sea and volume transport through the Tsushima Strait

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This study investigates the relationship between the upper (0-300m) ocean heat content (OHC) in the Japan Sea and the volume transport of the Tsushima Warm Current passing through the Tsushima Strait to the Japan Sea. We analyze a new high-resolution long-term ocean reanalysis data named FORA-WNP30 (Four-dimensional variational Ocean ReAnalysis for the western North Pacific over 30 years), in which the realistic ocean variation is reconstructed by an eddy-resolving 4DVAR ocean data assimilation system in the Meteorological Research Institute (MRI). Both the OHC and volume transports through the straits, that connect the Japan Sea to neighboring seas (the East China Sea and the Okhotsk Sea) and the Pacific Ocean, exhibit positive trends during recent 30 years. The spatial pattern of the trend in the OHC has three local maxima in the eastern part of Japan Sea, northeast of the Oki Islands in the southern part of the Japan Sea, and east of the Korea Peninsula. This feature is consistent with previous observational studies. The local maxima of the trend in the OHC are associated with changes in the flow pattern of the Japan Sea. In particular, the OHC signal at the northeast of the Oki Islands accompanies a warm eddy structure. Variation of low-pass filtered volume transport through the Tsushima Strait is largely in phase with variations of the OHC in the Japan Sea on interannual to decadal time scales, implying that the volume transport through the Tsushima Strait is one of causes for the OHC variations. However, the phase of variation of heat content at the northeast of the Oki Islands does not match with that of the volume transport well. Warm and cold eddy structures tend to appear alternately at the northeast of the Oki Islands on interannual time scale. It implies that the variation of the OHC at the northeast of the Oki Islands is affected by not only that of the volume transport but also dynamical adjustment related to the eddy structures.

Keywords: Japan Sea, Ocean Heat Content, volume transport, interannual variation, decadal variation