



## **Change in the relationship of Kuroshio transport and North Pacific Oscillation and its impact on East Asian marginal SST**

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The marginal sea around East Asia is one of the regions where has the largest tendency of sea surface temperature (SST) increase. The marginal SST in East Asia is influenced by the western boundary current, such as Kuroshio current. In addition, the variability of atmospheric circulation is also able to cause the SST variability in East Asia marginal sea. In this study, we investigate the relationship between the oceanic circulation associated with the Kuroshio currents and the atmospheric circulation, in particular, North Pacific Oscillation (NPO). We use the Kuroshio transport index (KTI), which is defined as the sea surface height averaged in 31-36°N, 140-165°E from the GODAS dataset. And the NPO is defined as the second EOF mode of sea level pressure obtained from the NCEP/NCAR reanalysis data for 1980-2015. And then, we analyze how the changes in the relationship of KTI and NPO are associated with the East Asian marginal SST variability during boreal winter. It is found that the relationship between the KTI and the NPO is dramatically changed before and after the late 1990s. This indicates that the NPO forcing differently acts to the Kuroshio currents before and after the late 1990s, leading to different SST response in East Asian marginal sea. We find that the center of NPO is shifted to the eastern Pacific after the late 1990s, which might be associated with the changes in tropical SST forcing. We further discuss why the center of NPO is shifted after the late 1990s, and how such changes are associated with the changes in the relationship of KTI on the low-frequency timescales.