Millennial-scale hydrographic changes in the northwestern Pacific during marine isotope stage 19: Teleconnections with ice melt in the North Atlantic

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Marine isotope stage (MIS) 19 has been suggested as one of the best orbital analogs for present interglacial, because of the similarity of the orbital configurations between both interglacial periods. Therefore, paleoenvironmental reconstructions of MIS 19 will provide valuable knowledge to evaluate the anthropogenic impacts for present and future climate changes. Additionally, the abrupt climate changes associated with the iceberg melting in the North Atlantic are globally documented in the paleoceanographic and paleoclimatic records during the MIS 20–19 transition and late MIS 19, suggesting global climatic teleconnection during the periods. The Kuroshio Current, the largest western boundary current of the North Pacific ocean, transports a large amount of heat and water poleward strongly influences the East Asian climate, however, responses of the Kuroshio Current to the ice melting in the North Atlantic remains unknown. Here, we reconstruct detailed paleoceanographic variations in the northwestern Pacific during MIS 19 using stable oxygen isotope ($\delta^{18}O$) records from the Chiba composite section (CbCS), central Japan. Spectral and wavelet analyses were conducted in order to assess periodicity of our new $\delta^{18}O$ records. Vertical water temperature structure and their gradient (ΔT) exhibit latitudinal displacements of the Kuroshio Extension Front (KEF) on multi-millennial scale across the MIS 20–19 transition and during late MIS 19 (MIS 19b to 19a). Results of the spectral and wavelet analyses for the $\delta^{18}O$ records show periodicities of approximately 3,000–6,000 year during late MIS 19. Similarities of timing and periodicity between paleoceanographic records from the CbCS and North Atlantic indicate that disruption of the Atlantic meridional overturning circulation due to freshwater discharge into the North Atlantic caused the southward displacements of the KEF via atmospheric dynamic. A power of the 9,700 year-periodicity in surface planktonic $\delta^{18}O$ and ΔT is stronger during MIS 19c, which probably originates from tropics caused by equatorial insolation at equinoxes with the orbital perihelion. This result indicates the seasonality of the insolation at low-latitudes paced the sea surface condition at the CbCS throughout MIS 19 and this low-latitude influence became larger especially when the North Atlantic forcing by freshwater discharges and AMOC variability was low.

Keywords: marine isotope stage 19, oxygen isotope, climatic teleconnection, foraminifera, Kuroshio Extension Front, Chiba composite section

