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Northwest Pacific mid-depth ventilation changes during the Holocene and their link to atmospheric circulation

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The oxygen content of North Pacific Intermediate Water (NPIW), a water mass in the subtropical North Pacific that at present extends between ∼300 and ∼800 m depth and primarily originates in the Okhotsk Sea, has declined during the last several decades suggesting decreased ventilation, the consequences of which are not well understood. It is therefore of high interest to elucidate the oceanic history of mid-depth waters in the Northwest Pacific, which can be variably influenced by deep waters and NPIW, during the last ∼11000 years (the Holocene), when climatic boundary conditions were relatively similar to the present. However, such efforts have been hampered so far by the lack of appropriate sediment cores with high Holocene sedimentation rates. Core CK05-04, recovered in 2005 from ∼1180 m water depth off Shimokita peninsula, Japan, shows sedimentation rates of ∼80 cm/kyr during the Holocene and therefore presents a good opportunity to reconstruct for the first time the Holocene ventilation history of the Northwest Pacific Ocean. We employ Accelerator Mass Spectroscopy radiocarbon analysis of co-existing benthic and planktonic foraminifera to conclude on the ventilation age and radiocarbon activity of the mid-depth water. A comparison of our results with identical variables from deeper layers suggests considerable NPIW influence during the Mid-Holocene Thermal Maximum, while advection of deep waters was more important during the Neoglaciation. We link these changes to regional and global climate history, atmospheric circulation patterns, and the atmosphere-ocean carbon cycle.