



## **Dominant role of atmospheric dynamics for North Pacific Holocene SST trends: Validating models**

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The Pacific Decadal Oscillation (PDO) is one major mode of modern climate, masking the global warming trend. The long-term Holocene development of the PDO is, however, not well known. Reconstructed SST trends in the North Pacific Ocean indicate a heterogeneous tendency, largely reflecting a transition from a more negative to a positive PDO-like pattern. We compare the upper ocean temperature evolution of the Holocene, as simulated by climate models and reconstructed from marine sea surface temperature proxies for the Northern Hemisphere. In contrast to most climate models participating in PMIP, which have difficulties in explaining the spatial heterogeneity in the North Pacific Ocean, our new climate model ECHAM6-FESOM captures most of the large-scale structures in Northern Hemisphere temperature trends. These are associated with orbital forcing, in conjunction with a deepening of the winter Aleutian Low and a pronounced weakening of the summer subtropical high pressure system. The simulated sea level pressure trend that is responsible for the heterogeneous pattern in the North Pacific provides a significant natural background evolution and suggests that atmospheric dynamics play a dominant role in modulating long-term climate. A similar feature is found for the CMIP5 models in future climate scenarios.