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Rapid Climatic and Oceanographic Changes in the Okhotsk Sea during the Holocene

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We report on rapid centennial- to millennial-scale climatic changes in the Okhotsk Sea and the adjacent continental Amur river watershed, confirming the significant potential of this realm for paleoclimatic reconstructions. High biogenic productivity, delivery of Ice-Rafted Debris (IRD), highly variable hydrographic conditions, and terrigenous sediment supply by the Amur's drainage system closely interact in this region and form the depositional environment. Average sedimentation rates in the hemipelagic sediment cores vary between 30 and 160 cm/kyr. Accordingly, our study provides insight into rapid climatic changes on millenial and shorter timescales for the last deglaciation and the Holocene. Biogenic opal and chlorines serve as biogenic productivity proxies, elemental compositions derived from XRF-scanning as indicators for riverine sediment supply and sea-ice action. Stable isotope data of benthic and planktic foraminifera as well as IRD data supplement our results on lower temporal scales.

The last deglaciation is characterized by repeated pronounced maxima in IRD and according element concentrations, pointing to a highly variable supply conditions of terrigenous siliciclastics. During the Holocene, high-frequency variations in Amur river discharge can be correlated to the oxygen isotope record of the Greenland NGRIP ice core. From ca. 6.5 kyr BP, we recognize a Holocene climatic optimum in various proxy records, while starting at about 4 kyr BP, slightly deteriorating colder climatic conditions prevail. We observe a significant mid-Holocene shift in the proxy records, partly known from other low-latitudinal, monsoonal reference records. These results support the notion of a transmission of low latitude climate forcing in the Pacific

basin to the higher latitudes, possibly via freshwater discharge and latent heat transport. Planktic and benthic foraminiferal stable isotope data from the Sakhalin margin suggest high hydrographic variability in discharged freshwater. This in turn influences the stratification of regional surface water masses and the average thermocline depth, as well as the formation of intermediate waters that precondition the ventilation and hydrographic properties of the subarctic North Pacific.