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Millennial- to Centennial-Scale Climatic and Oceanographic Changes in the Okhotsk Sea during the past 15,000 Years

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Our work within the Project KOMEX features records of interdecadal- to millennial-scale cyclic climatic changes in the Okhotsk Sea and the adjacent continental Amur river drainage area, thereby confirming the significant potential of this realm for paleoclimate reconstructions. During past KOMEX cruises, we recovered a set of gravity cores along transects east off Sakhalin. High biogenic productivity, delivery of Ice-Rafted Debris (IRD) and terrigenous sediment supply by the Amur river drainage system closely interact in this region and form the depositional environment.

Our age models mainly consist of a couple of AMS radiocarbon control points fit by higher order polynomial regressions, tested and supported by lithostratigraphic correlation. According to this stratigraphic framework, average sedimentation rates vary between 30 and 160 cm/kyr, typically exceeding 60cm/kyr during the past 8000 years. Thus to date our investigations allow insight into short-term climatic changes on timescales of millennia to decades for the late Pleistocene and Holocene, while gaining an maximum temporal resolution of 20-50 years average sample spacing for the Holocene. Contents and accumulation rates of opal and chlorines serve as proxies for primary biogenic productivity while minor elemental compositions and the amount of the terrigenous fraction serve as indicators for riverine sediment supply. These datasets are accomplished by counts of IRD to account for the influence of

seasonal sea ice cover on our records. Whereas these datasets provide high-resolution records, stable isotope data of benthic and planktic foraminifera as well as countings of terrestrial pollen supplement our results on lower temporal scales.

Our results show distinct increases in surface producitvity (biogenic silica) during warmer periods. The last deglaciaton is characterized by repeated pronounced maxima in IRD and trace element concentrations pointing to a high supply of terrigenous siliciclastics. Furthermore, higher frequency oscillations in Amur river discharge can be correlated to the oxygen isotope record of the Greenland GISP II ice core record. Spectral and wavelet analysis performed on the elemental analysis time series reveal several centennial to multidecadal periodicities with a maximum power of a 940-year cycle in the Holocene interval of 8500–4000 years. In the youngest interval of 0–4000 years, though, a transition towards a 1200-year cyclicity appears, yet to be explained. On shorter time scales we observe significant cyclicities within the centennial and interdecadal range (e.g. at ca. 280, 86 or 60 years). As these periodicities are partly known from other low-latitudinal, monsoonal reference records, these findings support the notion of a transmission of low latitude climate forcing to the Okhotsk Sea via the amount of freshwater discharge by the Amur. Results from pollen analysis show significant changes of vegetation patterns. During the onset of Termination Ib, *Betula*-/*Alnus*-shrubs began to expand in a previously herb-dominated landscape. Though interrupted by a short cooling event with return of herb plantcommunities, shrub-dominated vegetation spread on. From ca. 6.5 kyr BP on, we recognize a Holocene climatic optimum in dominance of dark needled forest assemblages together with increased values of broadleaved (*Quercus*) trees. From ca. 3.6 kyr BP onwards, increase in *Pinus* abundances indicates slightly deteriorating climatic conditions. Planktic and benthic foraminiferal oxygen isotope data from the Sakhalin margin suggest a high variability in the formation of OSIW during Holocene possibly due to fluctuations in the discharged freshwater volume influencing the stratification of local surface water masses.