Project: 965 Title: Our way to Europe - Palaeoclimate and Palaeoenvironmental reconstructions Report for period 01.01.2018-31.12.2018

During the year 2018, different research questions have been addressed by using computing time in the granted project. Two peer-reviewed publication in scientific journals were published. Additionally, collaborations with people from the PALMOD-project have been intensified and new contacts have been made with AWI concerning paleoclimate simulations with high resolution ocean model FESOM (see request for next allocation periode).

a) The Last Glacial Maximum and Heinrich event I on the Iberian Peninsula: A regional climate modelling study for understanding human settlement patterns

In this study (already started in 2016) in collaboration with people from geography and archaeology, the climate conditions for the Last Glacial Maximum (LGM) and the following Heinrich Event 1 (H1) over Iberia have been analyzed with mid-to-high resolution (50 km to 12.5 km horizontal resolution) regional paleoclimate simulations. This time period (approx. 23ky – 16ky ago) played an important role for population dynamics at the end of the Pleistocene. In this study we focus on the population dynamics and distribution of settlement areas during LGM and H1 in the Iberian Peninsula (IP). Global paleoclimate model data form the MPI-ESM-P LGM experiment is used as boundary conditions for a dynamical downscaling approach to obtain climate data (30 years of RCM simulations) with a horizontal resolution of 12.5 km over the IP. The regional climate modeling approach reveals that changed climate conditions between LGM and H1 might have played a crucial role on the population dynamics in the IP. Modelling results for H1 suggest colder and much drier conditions compared to LGM particularly over southeastern parts of the IP. This leads to an increase of aridity in this region, which corresponds to a decrease of archaeological sites (and thus population density) for the H1 period.

P Ludwig, Y Shao, M Kehl, GC Weniger (2018): The Last Glacial Maximum and Heinrich event I on the Iberian Peninsula: A regional climate modelling study for understanding human settlement patterns. Global and Planetary Change 170, 34-47



Figure 1. Probability of site occurrence based on the best performing logistic regression models with 4 environmental predictors (MAT, ELV, RRstd3, Io3) for a) WRF-LGM and Solutrean sites, b) for WRF-H1 and Magdalenian sites.

b) Response of ice-sheet dynamics based on different regional climate model simulations

Ongoing work: In cooperation with M. Prange (MARUM, Palmod project WP 1.1), we created a small ensemble of 30-year time slices of LGM-like climate conditions over the Fenno-Scandian ice sheet. The simulations were forced by different boundary conditions and serve as input data for the ice-sheet model at MARUM to evaluate the influence of different climate conditions on ice-sheet dynamics. Results are not yet available but will be addressed in the report next year.

c) Perspectives of Regional Climate Modelling in the Paleoclimate context

The performed regional paleoclimate simulations on the DKRZ cluster offered the opportunity to wrote a paper on the perspectives of regional climate modelling in the paleoclimate view. The first studies performed in the project 965 reveals the importance and opportunities of applying regional climate models to paleoclimate conditions.

P Ludwig, JJ Gómez-Navarro, JG Pinto, CC Raible, S Wagner, E Zorita (2018): Perspectives of regional paleoclimate modeling. Annals of the New York Academy of Sciences

d) Regional Paleoclimate Simulations for mid-holocene conditions over Europe

During the "Workshop on the comparison of paleoclimate data and simulations over time periods up to the last glacial cycle" in April 2018 in Hamburg, several activities have been initiated. One study will focus on mid-holocene climate variability in Europe, were first regional climate simulations have been initialized on mistral at DKRZ. Simulations will continue next year; a publication is planned.

N Weitzel, S Wagner, J Sjolte, M Klockmann, O Bothe, H Andres, P Ludwig et al (2018): Diving into the past–A paleo data-model comparison workshop on the Late Glacial and Holocene. Bulletin of the American Meteorological Society