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The Last Interglacial climate: Patterns, Thresholds, Feedbacks

Gerrit Lohmann (1,2), Xuezhu Wang (1,3), Johannes Sutter (1,4), Saeid Bagheri (1), Jan Streffing (1), Christian Stepanek (1), Hartmut Hellmer (1), Thomas Felis (2), Paul Gierz (1), Will Brocas (2), and Rüdiger Stein (1)

(1) Alfred Wegener Institute, Helmholtz Center for Polar & Marine Research, Climate System, Bremerhaven, Germany (gerrit.lohmann@awi.de), (2) University of Bremen, Marum, Bremen, Germany, (3) College of Oceanography, Hohai University, Nanjing, China, (4) University of Bern, Environmental Physics and Climate, Bern, Switzerland

Understanding the dynamics of warm climate states has gained increasing importance in the face of anthropogenic climate change. During the Last Interglacial (LIG, ∼128 to 116 ka), greenhouse gas concentrations and high latitude insolation were higher than pre-industrial levels, causing a high-latitude warming (Turney and Jones, 2010; Pfeiffer and Lohmann, 2016). We present a suite of climate model results (COSMOS, MPI-ESM, AWI-CM, EC-Earth) to evaluate the patterns and compare the simulations with the above-mentioned surface temperature reconstructions, seasonal archives (Felis et al., 2015; Brocas et al., 2017), and sea ice reconstructions (Stein et al., 2017).

As a result of this modestly warmer climate, polar ice sheets were smaller and estimates report that the global mean sea level was 6-9 meters higher than today (Dutton et al., 2015). The sensitivity of the Antarctic Ice sheet is related to the local temperature around the West Antarctic Ice Sheet (WAIS) (Sutter et al., 2016). Our ice sheet model experiments indicate that a 2-3°C local warming causes already a partially collapsed, irreversible WAIS. A pronounced subsurface oceanic warming can destabilize the WAIS, resulting in an oceanic gateway between the Ross and Weddell Seas. A sensitivity study using the new oceanic gateway between the Atlantic and Pacific Oceans as a bathymetrical boundary condition indicates that this region would be covered by sea ice. Mixing due to sea-ice formation prevents a pronounced warming around the WAIS and would stabilize the WAIS. Thus, the disintegration of the WAIS is probably related to non-local influences like in Hellmer et al. (2017) where the shelves of West Antarctica are warmed from below by Circumpolar Deep Water.

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