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Global hydroclimate of the Last Interglacial: precipitation, river discharge, floods

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Reconstructing precipitation, hydrology and flooding under different climatic states has multiple benefits: it informs us on the history of the climate system and its subcomponents; it allows assessing the capacity of current modeling tools to capture key features of climate and the hydrological cycle under a set of different forcings; in the case of warmer past periods, it can offer a perspective of possible changes in a future warmer climate. We present our study of the hydroclimate of the Last Interglacial (LIG; ca. 125,000 years ago), a period that was slightly warmer than the present. We show that an ensemble of climate models of the latest generation (PMIP4/CMIP6) is broadly able to reproduce a wetter LIG climate (compared to the pre-industrial) in vast areas of the boreal hemisphere, as reconstructed from existing proxies from different types of archive. Based on the results of those climate simulations, we forced a global hydrological model (PCR-GLOBWB), and therefore a global river routing model (CaMa-Flood), to reconstruct the hydrology and river hydrodynamics of the Last Interglacial. We show that runoff and river discharge anomalies of the LIG are generally larger where precipitation is higher, but that in many regions the warmer temperatures imply decreased runoff and discharge also where precipitation is higher. Many main river basins show changes in the seasonality of discharge, and a slight anticipation in the day of the year when half of the water mass is discharged. Unfortunately, comparison to geological evidence of discharge is limited by the low availabilty of proxy data. Finally, we report changes in the global patterns of flooding for several return periods, and suggest mechanisms by which the LIG climate impacted those patterns.

Last Interglacial Floods: Bakker, Pepijn; Guo, Chuncheng; Stepanek, Christian; Zhang, Qiong; Braconnot, Pascale; Cao, Jian; Guarino, Maria-Vittoria; Prange, Matthias; Coumou, Dim; Ward, Philip; Renssen, Hans; Kageyama, Masa; Otto-Bliesner, Bette; Eilander, Dirk; Sutanudjaja, Edwin; Hikeuchi, Hiroaki; Hoch, Jannis; Yamazaki, Dai; Muis, Sanne; Veldkamp, Ted; Aerts, Jeroen