



Simulation of the Greenland ice-sheet deglaciation constrained by past and present observables

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The Greenland Ice Sheet (GrIS) has experienced accelerated mass loss in recent decades and is expected to become a major contributor to global sea-level rise over the coming century. Understanding its response to climate forcing in a global warming context has become critical, particularly for the adaptation of coastal communities worldwide.

The last deglaciation of the GrIS offers valuable insights into ice-climate interactions, as extensive paleoclimatic records document its retreat through a period of major climate changes. During this interval, the GrIS retreated from its extensive Last Glacial Maximum (LGM) configuration to its present state, passing through the Holocene Thermal Maximum (HTM) when temperatures exceeded present-day values and may have overshoot the GrIS tipping point. Despite the large amount of paleoclimatic data available, ice-sheet models struggle in reproducing key aspects of the observational record, and the magnitude of the GrIS contribution to sea level during the HTM remains highly uncertain.

In this study, we evaluate an ensemble of 3000 ice-sheet simulations performed with the ice-sheet model Yelmo against different observational constraints. These include: (1) LGM ice-sheet extent, (2) ice-core-derived surface elevations, (3) relative sea-level records, (4) retreat chronology based on the PaleoGrIS dataset, and (5) the present-day ice-sheet configuration (ice thickness, ice velocity, and bedrock uplift rates). By identifying the simulations that best match these constraints, we provide a geologically-constrained reconstruction of the GrIS during the last deglaciation.