On the Late Saalian glaciation (160 - 140 ka): a climate modeling study

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Abstract

This thesis focuses on the glaciation of the Late Saalian period (160 -140 ka) over Eurasia. The Quaternary Environment of the Eurasian North (QUEEN) project determined that during this period, the Eurasian ice sheet was substantially larger than during the entire Weichselian cycle and especially than during that of the Last Glacial Maximum (21 ka, LGM). The Late Saalian astronomical forcing was different than during the LGM while greenhouse gas concentrations were similar. To understand how this ice sheet could have grown so large over Eurasia during the Late Saalian, we use an Atmospheric General Circulation Model (AGCM), an AGCM coupled to an oceanic mixed layer and a vegetation model to explore the influence of regional parameters, sea surface temperatures (SST) and orbital parameters on the surface mass balance (SMB) of the Late Saalian Eurasian ice sheet.

At 140 ka, proglacial lakes, vegetation and simulated Late Saalian SST cool the Eurasian climate, which reduce the ablation along the southern ice sheet margins. Dust deposition on snow has the opposite effect. The presence of a Canada Basin ice-shelf during MIS6 in the Arctic Ocean, does not affect the mass balance of the ice sheet. According to geological evidences, the Late Saalian Eurasian ice sheet reached its maximum extent before 160 ka. Northern Hemisphere high latitudes summer insolation shows a large insolation peak near 150 ka. The simulated climate prior to 140 ka is milder and ablation is larger along the southern margins of the Eurasian ice sheet although the mean annual SMB is positive. The Late Saalian Eurasian ice sheet may have grown large enough to generate its own cooling, thus maintaining itself over Eurasia.