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Exploring the nature and timing of glacial climate transitions

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The causes for major climate transitions in the Upper Pleistocene are based on the assumption that orbital forcing, i.e. the increase in northern hemisphere summer insolation (NHSI), initiates glacial ice sheets to melt away leading to the formation of warm interglacials. Good examples are plentiful available, e.g. major glacial terminations (T) such as T1, 2, or 5. Besides these major climate transitions there are also other glacial terminations across marine substage boundaries that, although seemingly of minor scale, had nevertheless massive climate impacts either globally (MIS4/3, MIS7d/7c) or regionally (MIS5b/5a). While an interglacial decrease in NHSI seems to run in parallel with early glacial inception - as can be noted for the later Holocene and MIS5e - the onset of T2 vs. T1 has long been controversially discussed with respect to its orbitally forced timing. This study therefore explores the involvement of other mechanisms. Primarily, these have to do not so much with internally produced feedback processes but are the consequence of temperature changes to be found in the low-latitudes. Transferred northward through the atmosphere and ocean these changes then feed ice sheet growth and determine its geographical configuration of different magnitudes, also eventually leading to a glacial maximum. During the past, climate transitions from a glacial into an interglacial world therefore did not start with the end of a glacial maximum. It is the time just prior to that particular maximum when the major change occurred.