High sensitivity of northern hemisphere tropospheric oxidants to major climate transitions

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The abundance of tropospheric oxidants determines the lifetimes of most reduced trace gases in the atmosphere. High reactivity of oxidants precludes their direct preservation in geological archives, inhibiting our understanding of if and how they have varied in the past, with implications for our understanding of the budgets of reduced trace gases such as methane. We present observations of the oxygen-17 excess of nitrate from a Greenland ice core over the last glacial-interglacial cycle and over two Dansgaard-Oescher (D-O) events during the last glacial period that show a high sensitivity to climate change. We use results from a global chemistry climate model to investigate the cause of the observed change in oxidant abundances over past climate transitions. Based on our analysis, we hypothesize that the large observed changes in oxidant (O_3/HO_x) abundances is likely driven by changes in the large-scale Brewer Dobson Circulation of the atmosphere, with a smaller influence from changes in surface emissions. As the BDC has implications for the oxidation capacity of the global atmosphere and the stratospheric thermal and mass balance, the coupling of climate and the BDC may thus represent an important feedback mechanism during major climate transitions.