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N_2O and CH_4 variations during the last glacial epoch

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The concentrations of both greenhouse gases N_2O and CH_4 generally vary in parallel to the abrupt glacial climate variations of the northern hemisphere, with higher concentrations during the warm climate states, the so called Dansgaard-Oeschger (D-O) events and lower concentrations during the cold climate states. However, the magnitude and shape of the response of the two greenhouse gases to individual D-O events differ. While the amplitude of CH_4 has a strong imprint of the precession cycle, the N_2O amplitude is larger for the longer lasting D-O events preceded by a Heinrich event, than for the shorter D-O events. Additionally for the longer D-O events, N_2O starts to increase several hundred years before the main CH_4 rise and temperature increases recorded in Greenland, but more than 1000 years after the beginning of the warming in Antarctica. The primary cause of CH_4 and N_2O concentration variations in parallel with abrupt climate changes are thought to be changes in climatic conditions in the source regions. CH_4 concentration changes are mainly a result of changes in the tropical and northern hemisphere wetland extent and productivity. N_2O variations are most probably a combination of changes in the terrestrial and in the oceanic sources. So far it has not been possible to narrow the source regions responsible for changes in the concentration of the two greenhouse gases.

This talk will give an overview of N_2O and CH_4 records over the last glacial period and will include new high resolution datasets measured along the NorthGRIP ice core (Greenland). Different hypotheses on the origin of the glacial N_2O and CH_4 variations will be discussed in combination with model output of simulated D-O like events from the 3D ocean-atmosphere-sea ice model ECBILT-CLIO.