Geophysical Research Abstracts
Vol. 15, EGU2013-10232, 2013
EGU General Assembly 2013


# Modelling the methane emissions from wetlands during the last interglacial period: potential impact on the atmospheric concentrations

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Present-day atmospheric methane concentrations have reached unprecedented levels over the whole 800,000 years recorded in the Antarctic ice core. Due to its high global warming potential, it is crucial to understand its sources and sinks. Whereas the present-day high anomaly is attributable to an increase in anthropogenic emissions, a large natural variability has been observed during the glacial-interglacial cycles, from ∼360 ppbv for the cold glacials to ∼700 ppbv for the warm interglacials. The origin of this natural variability of methane has been widely debated, suggesting a more plausible source driven variability (i.e. wetlands, representing 20 - 40% of global sources) while the oxidation capacity of the atmosphere (sinks) has remained roughly constant over the ice ages. Nevertheless, most previous studies rely on the use of simplified models of methane surface emissions (non-process based) and/or simplified models of atmospheric chemistry, with simple parametrisation of important processes, such as vegetation dynamics or isoprene chemistry in the atmosphere. We address this issue with state-of-the-art models, both for surface processes and for atmospheric chemistry.

Ice core records provide insights of the past state of the atmosphere. From Antarctica's ice core studies, we believe that during the Last Interglacial (LIG), the atmospheric methane concentrations were similar to pre-industrial ones. However, due to strongly different orbital forcings than present-day, the climate at this time is suspected to have been largely different. For example, there is evidence of a +4 to +5°C warming in summer at high northern latitudes compared to pre-industrial (CAPE members, 2006). This could lead to considerable changes in wetland dynamics, however this is not evident in ice core records. The LIG period is used here as a case study for the models, to understand the mechanisms behind the natural variability of the methane atmospheric concentrations.

To do so, we recently implemented a sophisticated process-based model of methane emissions (Walter and Heimann, 2000) into a Dynamic Global Vegetation Model (DGVM, Hybrid8). In order to move from surface emissions to atmospheric concentrations, we used a complex atmospheric chemistry model (Met Office UM - UKCA). We report an important sensitivity of the amplitude, seasonality and geographical pattern of the simulated emissions during the LIG. These sensitivities could explain the similar atmospheric methane concentrations between the LIG and the pre-industrial with a drastically different climate.