Abstract

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ABSTRACT

The past variations of the atmospheric methane (CH_4) concentration is observed to be generally in phase with the insolation cycle. However, in the mid-Holocene this regularity breaks down, and atmospheric CH4 starts to rise again while the northern summer insolation continues to decline. To date, there is no clear explanation for the evolution of the atmospheric methane concentration during the Holocene.

Here we present records of methane and both its stable isotopes ($\delta^{13}C$ and δD) measured on polar ice cores from both Greenland (NGRIP) and Antarctica (EDML and TALDICE) over the period of the Holocene. These data allow us not only to draw conclusions about the hemispheric imbalance of the ancient sources and sinks of methane, but due to the different isotopic fractionation also about the importance of the individual processes involved in the past methane cycle.

A two-box model approach enables us to calculate the mean hemispheric CH_4 emissions and their isotopic signatures analytically.

The results indicate that more than half of the additional methane that led to the change in the CH_4 trend 6,000 years ago was emitted in the southern hemisphere mainly by isotopically heavy methane sources. This may contradict the much debated hypothesis, attributing this rise to the increase in rice agriculture in China at this time, thus causing the observed divergence between the atmospheric CH_4 concentration and insolation.