Geophysical Research Abstracts,
Vol. 11, EGU2009-2388, 2009
EGU General Assembly 2009

The contribution of northern peatlands to the late-Holocene rise of atmospheric CH4

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Northern peatlands represent the biggest wetland complex in the world releasing 20 to 45 Tg CH4 to the atmosphere annually. Recent research on the relationship between wetlands and past atmospheric concentrations of methane (ACM) over the Holocene, as revealed by ice-cores, has focused on the aerial extent of peatlands. Based on the frequency distribution of the basal peat radiocarbon dates it has been suggested that the rapid early initiation of northern peatlands very likely contributed to the sustained peak in ACM during the early Holocene. However, a vigorous debate about the causes of the late-Holocene increase of ACM of around 100 ppbv has been underway for years. It has been argued that the role of northern peatlands in the more recent rise of ACM after 5 ka was most likely negligible because new peatland initiation was then relatively modest, and the peatlands had already transformed from early minerotrophic fens to drier ombrotrophic bogs, which are typically weaker sources of CH4 than are fens. Based on a new circumpolar data set of 784 basal peat radiocarbon dates that accounts for more properly horizontal growth dynamics of peatlands (by containing only sites with multiple basal dates per site), we demonstrate here that the most extensive lateral expansion of northern peatlands occurred only after 5 ka, parallel with the rise of CH4 in the ice cores. This lateral extension took place at a time when the mires were still largely moist minerotrophic fens that emit high amounts of CH4. Hence, northern peatlands are a strong candidate when seeking cause(s) for the late-Holocene rise in ACM.