Geophysical Research Abstracts,
Vol. 10, EGU2008-A-06271, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-06271
EGU General Assembly 2008

Modelling CH_4 emissions from arctic wetlands: from a regional to a global scale

A.M.R. Petrescu (1), L.P.H. van Beek (2), J. van Huissteden (1) and A.J. Dolman (1)

(1) Vrije Universiteit, Faculty of Earth and Life Sciences, Department of Hydrology and Geo-Environmental Sciences, De Boelelaan 1085, 1081 HV, Amsterdam, The Netherlands, (rpetre@falw.vu.nl), (2) Utrecht University, Centre of Geosciences, Department of Physical Geography, Heidelberglaan 2, 3508 TC, Utrecht, The Netherlands, (r.vanbeek@geo.uu.nl)

CH_4 emissions from arctic wetlands constitute potentially a positive feedback to global climate warming. Many process-based models have been developed but high uncertainties in estimating the amount of CH_4 released from wetlands at the global scale still exist.

This study tries to improve estimates of CH_4 emissions by upscaling a plot-based model, PEATLAND-VU (based on the Walter-Heimann model), to the global scale over the period 2000-2006. It is well known that hydrology influences CH_4 emissions and, therefore, it was coupled to a global hydrological model, PCR-GLOBWB that was forced with daily ECMWF operational archive forecasts over that period. This coupling was based on the circum-arctic distribution of wetlands and floodplains which was derived from the Global Lake and Wetland Database of Lehner and Döll (2004) that encompasses all cells identified as either 'peat, bog and mire' and 'floodplain' above 50˚N.

For each of these cells, four parameter files were created that specified the relevant conditions as simulated by PCR-GLOBWB to be evaluated by PEATLAND-VU (oxic and anoxic conditions respectively for both the floodplain and the wetland areas). Associated with these parameter files were daily time series of snow cover as simulated bt PCR-GLOBWB and air temperature from the ECMWF operational archive forecasts. In addition, time series of volumetric soil moisture were added for the oxic

conditions and those of water depth for the anoxic conditions. The latter was based on direct runoff for the wetland area, taken equivalent to the saturated area of the improved Arno Scheme of Hagemann and Gates (2003), and on the area flooded given the sub-grid variation in floodplain elevation and river stage for the floodplains.

Processing of these parameter files and associated time series yielded four time series of daily CH_4 emissions. These time series were subsequently aggregated to monthly maps of average CH_4 emission by taking the fractional cover of wetlands and floodplains into consideration. This study shows the feasibility of high resolution modelling of CH_4 emissions using a hydrological and CH_4 emission process models. The results show increased spatial variability of CH_4 fluxes compared to analysis that ignore the spatial distribution of hydrological processes.

We conclude that adequate understanding of hydrology in modeling the CH_4 emissions is very important in quantifying the total emissions from global arctic wetlands and requires understanding of the sub-grid variability in wetland area and floodplain extent.