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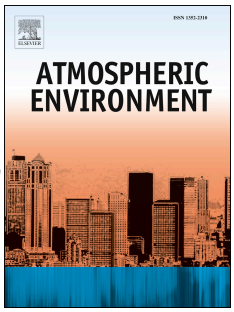

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Carbon dioxide and methane supersaturation in lakes of semi-humid/semi-arid region, Northestern China

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Abstract Understanding concentrations of carbon dioxide (CO_2) and methane (CH_4) in lakes is an important part of a comprehensive global carbon budget. We estimated data on the partial pressure of CO_2 (pCO_2) and CH_4 (pCH_4) from sampling with 95 lakes in semi-humid/semi-arid region of Northestern China during ice-free period. Both pCO_2 and pCH_4 varied greatly among the study sites. $p(CO_2)$ values in these lakes ranged from 21.9 to 30152.3 μatm (n=403), and 91% of lakes in this survey were supersaturated with CO_2. $p(CH_4)$ values ranged from 12.6 to 139630.7 μatm with all sites in this study of CH_4 sources to the atmosphere during the ice-free period. The collected urban lakes samples exhibited higher pCO_2 and pCH_4 than wild lakes samples. Either the mean value of $p(CO_2)$ or $p(CH_4)$ in saline waters is higher than in fresh waters. Correlation analysis implied that the partial pressure of the GHGs (CO_2 and CH_4) showed statistically correlations with water environment indicators like pH, dissolved organic carbon (DOC), total nitrogen (TN), total phosphorus (TP), and chlorophyll a (*Chla*). However, the most of the relationships showed a high degree of scatter, only pH might be used as the predictor of the gas partial pressure based on the result of this study (r_{pCO2}=-0.437, p<0.01, n=382; r_{pCH4}=-0.265, p< 0.01, n=400). Furthermore, salinity could be a good predictor for $p(CO_2)$ and $p(CH_4)$ in 83 freshwater lakes in our study (r_{pCO2}=0.365, r_{pCH4}=0.323, p< 0.01, n=348). The mean CO_2 flux increased with the decreasing lake area size. The calculated annual areal carbon emission rate is 560.2 g C m^{-2} from 95 lakes in Northestern China. We could not extrapolate carbon emission from these lakes to the boreal region or a wider scale because of the change of environmental conditions.

Keywords: carbon dioxide, methane, carbon cycling, lakes

1. Introduction