Geophysical Research Abstracts
Vol. 14, EGU2012-13655, 2012
EGU General Assembly 2012

Soil Greenhouse Gas Flux Measurements in a Pacific Northwestern Douglas-fir Forest

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Forests and forest soils are dynamic sources and sinks for greenhouse gases (GHG). Climate and management practices can impact the GHG balance of a forest. Motivated by the contemporary scientific understanding of climate change, carbon (C) cycle studies to date have largely been concerned with carbon dioxide (CO_2) fluxes. Methane (CH_4) and nitrous oxide (N_2O) are less abundant trace gases, but with large greenhouse warming potentials and differing lifetimes in the atmosphere, CH_4 and N_2O are also significant global warming contributors, warranting careful consideration when trying to determine complete GHG balances. Soil fluxes of CO_2, CH_4 and N_2O were measured at a Pacific Northwestern Douglas-fir forest on Vancouver Island, BC, Canada (49^o 52' N, 125^o 20' W). Samples were syringe collected (0, 3, 10, 20, 30 min) and transferred to pre-evacuated 12-ml vials (Exetainers, Labco Limited, Buckinghamshire, UK) once a month (Oct-Dec, 2011) from each of 16 closed-chambers in order to determine soil GHG flux rates. Samples were analysed using an Agilent 7890A Gas Chromatography (GC) system for CO_2 and CH_4 using a Flame Ionisation Detector (FID) with methanizer, and for N_2O using an Electron Capture Detector (ECD). Resulting data were analysed using the HMR package implemented with the R language for statistical computing to determine the best fit for flux estimation considering linear and non-linear Hutchinson and Mosier models. The presence of outliers and questionable features in the data resulted in the need for careful data screening. Initial results suggest that the CH_4sink strength of these soils decrease during the cooling and increasingly wet autumn to winter months (3.6-2.6 μmol $m^{-2}hr^{-1}$). Low concentrations of N_2O made it difficult to quantify any emissions (0.15-0.05 μmol $m^{-2}hr^{-1}$), while CO_2 was emitted to the atmosphere (2.05-0.75 μmol $m^{-2}s^{-1}$). Monthly results for Jan-Mar 2012 will be included. Results of CO_2 fluxes measured by GC using the closed-chambers compared with a portable flow-through (4 L min^{-1}) chamber with a LI-COR Inc LI 840 infrared gas analyzer using collars installed in close proximity will be presented. Developments made on a flow-through chamber design for CH_4 will be discussed.