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Water table change differently affects CO2 and N2O fluxes in a bio-energy poplar plantation

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We are continuously monitoring O3, CH4, CO2, H2O and N2O fluxes from a fast-growing high-density poplar (Populus) plantation with eddy covariance from June 2010. In this contribution we present a selection of the data from the first field season when an intense precipitation event (∼80 mm rainfall in 48 hours) occurred after a prolonged fairly dry summer period. This first extreme precipitation caused peak N2O emissions (up to 2200 μg N2O-N m-2 h-1). However successive rainfall events and similar soil moisture and water table fluctuations did not lead to N2O emissions of the same magnitude of these first peak emissions, probably because of depletion of the soil nitrogen substrate. In contrast, CO2 fluxes, both net ecosystem exchange (NEE) and ecosystem respiration (ER) did not respond to any of these rain events, contrary to what has been observed for various other ecosystems. This was probably caused by the N availability to microorganisms that exceeded C availability at our site.
Overall the data presented provide important insights in the complexity of the environmental controls on CO2 and N2O emission, and the variability in their response to hydrological changes. We present some of the preliminary analysis of the water table and soil moisture effects on CO2 and N2O fluxes, and we quantify the overall global warming potential, GWP, of the first growing season for this highly productive ecosystem.