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Biogeosciences Discussions

Interactive comment on "Impact of extreme precipitation and water table change on N_2O fluxes in a bio-energy poplar plantation" *by* D. Zona et al.

Anonymous Referee #1

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The manuscript is focusing on a pulse emission event of N2O from a poplar plantation following an unusual high rainfall event. Flux measurements were done with EC technique using a Los Gatos N2O analyzer. Though the measurements itself and the data processing is convincing, the paper let one wondering if one can draw any conclusions from the presented dataset. The data show that N2O fluxes increased largely following an intensive rainfall event (not new), which also led to a significant increase in the water table (not new too). Due to correlations with temperature and somewhat with μ* and windspeed the authors claim that transpiration fluxes was a major source for N2O emissions. However, there is no experimental evidence for that, e.g. by additional chamber measurements for soil and plant fluxes. Also a rough calculation if indeed soluble N2O in transpiration water would provide a meaningful quantity is not presented. Furthermore, existing literature on plant mediated N2O fluxes is not explored at all. I

also wonder that possible correlations to transpiration and CO2 fluxes is not explored. In addition, the finding that N2O emissions following a second rainfall event did not led to a new peak in N2O emissions is not astonishing. Possibly one should consider the depletion of N (and C) substrates. Also the possibility that the production layer of N2O shifted towards deeper soil laers is not discussed or experimentally explored. The provided hypothesis "The main objective of this study was to investigate the impact of soil hydrological changes (e.g. WFPS and water table change) on N2O emission in a high-density bioenergy poplar plantation, recently converted from cropland and pasture. We hypothesized that increases in water table and WFPS connected to rain events lead to increases in N2O emissions. We also hypothesized that increases in soil temperature stimulate N2O production and thus increase N2O emissions if adequate water is available in the soil." was obviously formulated following the measurements. Otherwise, the authors would have performed some meaningful measurements of soil and environmental parameters such as changes in soil mineral N concentrations, redox potential, soil chamber and plant chamber measurements for elucidating N2O emission pathways, microbial activity, soil gas concentrations etc. to strengthen their case. In conclusion, I liked the dataset, but I found that the discussion is mostly speculative and not confounded by measurements. Furthermore, the paper has severe shortcomings with regard to a) a full dataset exploration (not shown: CO2 and water fluxes!), b) necessary measurements (e.g. changes in soil N concentration, microbial activity), c) exploration of existing literature and d) the interpretation of cited literature (e.g. Boeckx and van Cleemput). I am somewhat doubtful if these short comes can be solved in a revision.

Page 2072, line 1 The average N2O emission from arable land in Europe was 5.6 kg N2O-N ha-1 cultivated land per year in the study of Boeckx and Cleemput (2001) and not approx. 15! Page 2072, line 5 following Pure speculation not substantiated by any measurements Page 2073, line 22 follow. I do not see any evidence that N2O emission via transpiration was a significant N2O emission pathway. Just provide a back to the envelope calculation using measured transpiration rates and maximum N2O solubility

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in water. Also check existing literature on N2O emissions via plant transpiration (e.g Pihlatie et al., 2005, New Phytologist). I am doubtful that transpiration N2O fluxes are indeed significant. The entire discussion here is speculation (wind pumping effect, a more aerobic layer in 20-40 cm). Where is experimental evidence?

Page 2075 conclusions I do not see any compelling evidence for pressure pumping or increasing gas flow through the soil. What is clearly missing is measurements of auxiliary data such as changes in soil mineral N concentrations, redox potential, soil chamber and plant chamber measurements for elucidating N2O emission pathways, microbial activity, soil gas concentrations . . ...Also I cannot understand why relationships between CO2, H2O and N2O fluxes are not explored or data is not shown

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Interactive comment on Biogeosciences Discuss., 8, 2057, 2011.