



Hydrology controls methane and nitrous oxide fluxes in swamp and bog forests

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We used data from a global soil, and N₂O and CH₄ gas sampling campaign. The objective was to analyse N₂O and CH₄ emissions related to peat conditions in swamp and bog forests. Altogether, we studied 21 swamp and bog forest sites under various climates: 3 alder swamps and 3 artificially drained bog pine forests in Estonia (Jan.-Dec. 2009), 2 bog forests in Transylvania/Romania (Apr. 2012 & June 2014), 3 cypress swamps in the Everglades (Apr. & Dec. 2013), 2 bog forests in West Siberia (July 2013) and a bog forest in Tasmania (Jan.-Feb. 2014). The N₂O and CH₄ effluxes were measured during 5-6 days with 8-10 opaque static chambers per site. Soil samples were taken for further analysis of pHKCl, NO₃-N, NH₄-N, soluble P, K, Ca and Mg, totN and C. Groundwater was measured from sampling wells.

The most significant independent factor for site average CH₄ fluxes was groundwater depth – an exponential relationship; R²=0.42; p=0.0007; n=21. The N₂O fluxes showed a decreasing (power) relationship with the C/N ratio – R²=0.53; p<0.0001; n=21. Related to groundwater level, the N₂O fluxes peak at around -40cm. Variation in greenhouse gas fluxes was largest at the more favourable conditions - at optimal water table (+5 to -20cm) for CH₄ and at low C/N for N₂O. The results agree with previous literature but they are the first to draw such conclusions from a global campaign following a uniform protocol.