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# Response of N2O emissions to microirrigation method and implications for upscaling measured emissions

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Accurate upscaling of nitrous oxide (N2O) surface flux point measurements to orchard based N2O flux estimates requires knowledge of spatial patterns in the N2O surface fluxes. This work aimed to isolate the main factors which enable simple yet accurate base for upscaling point measurements of N2O emissions into the orchard scale under micro-irrigation (drip and microsprinkler). Static chamber measurements of surface N2O flux emissions were taken at different distances from the emitters covering most of the wetted area. In accordance with the surface N2O measurements, subsurface (7.5, 15, 30, 45 and 60 cm) pore space N2O concentration, water filled pore space (WFPS), soil temperature and extractable soil ammonium (NH4+) and nitrate ($NO_3$-) concentrations were evaluated. Overall N2O emissions around the drip emitters were higher than the emissions around microsprinklers, probably due to higher N concentrations in the wetted area. Under the microsprinkler irrigation, N2O flux was strong and positively correlated with the WFPS at all distances down to 15 cm depth. Areas which received high relative water application depths showed strong correlation to extractable NH4+ and subsurface N2O concentrations down to 60 cm depth, and to extractable $NO_3$- concentrations at 45 and 60 cm depth. Under drip irrigation, N2O flux was strongly and positively correlated with the WFPS at all distances down to 60 cm depth, with strongest correlations at a distance of 10 cm. Strong correlations were also observed with the extractable NH4+ concentrations up to 47 cm away from the dripper and with the measured subsurface N2O concentrations. Extractable $NO_3$- concentrations were mostly negatively correlated with the surface N2O flux without a clear trend. All the correlations between the measured soil parameters and the surface N2O flux did not enable aaccurate upscaling of the point measurements into the orchard scale. Nonetheless, the emission pattern around the drip emitter could be predicted by a sinusoidal function, which in turn allowed accurate upscaling tool for estimating emissions at the orchard level, by measuring only the peak emission and the radius of the wetting pattern. Under microsprinkler irrigation linear correlation between the relative water application depth distribution at each distance from the microsprinkler and the surface N2O flux allowed accurate upscaling tool for estimating emissions at the orchard level. These results improve understanding of dynamics of N2O production in orchards irrigated with micro-irrigation systems in arid and semi-arid ecosystems and might contribute to modeling of N2O emissions using less rigorous methods.