Drainage losses of N_2O and NO_3^- in Ferralsol is a major N-loss pathway

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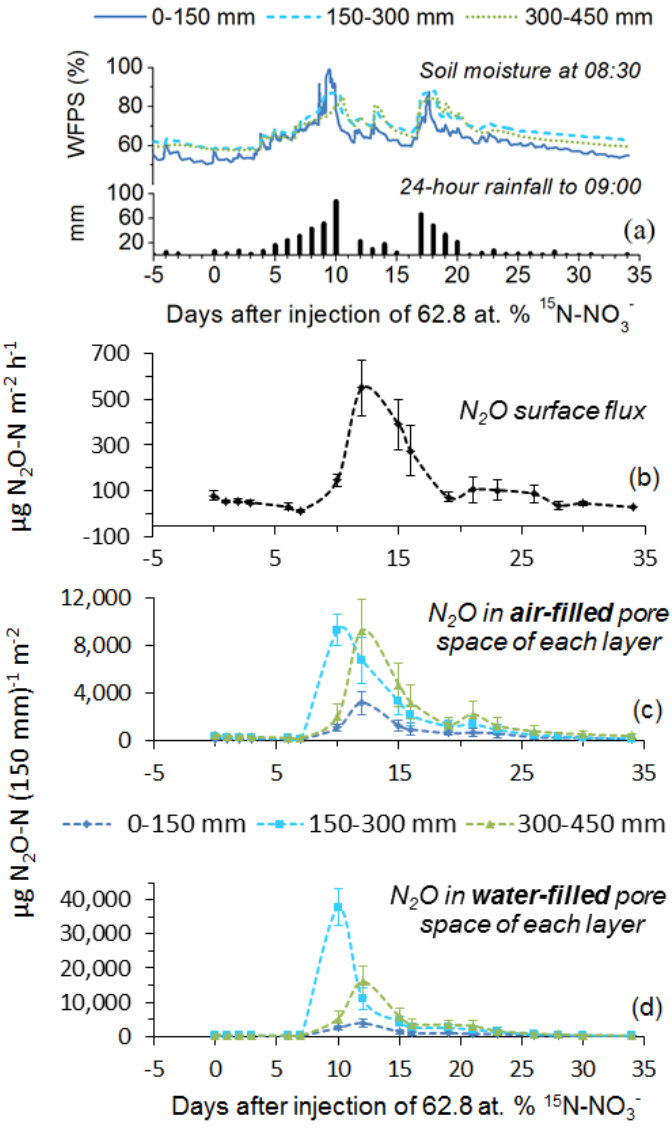
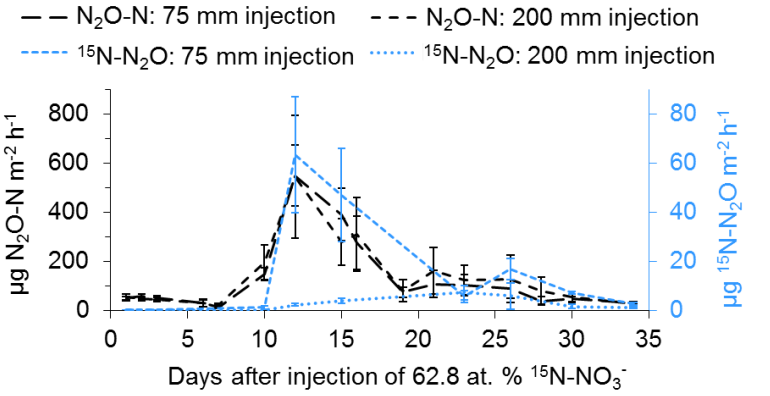
In a field repacked columns of Ferralsol had 62.8 at. % $^{15}NO_3^-$ applied at a depth of 75 mm or 200 mm on Day 0. Negligible soil NH_4^+, so N_2O was from denitrification. Surface flux and in-soil gas measured frequently, soil moisture and temperature half-hourly (all at 3 depths). All samples analysed for N_2O, some for $^{15}N_2O$ and $^{15}N_2$.



Results for columns with NO_3^- applied at a depth of 75 mm – *very* similar for NO_3^- applied at a depth of 200 mm.



Surface fluxes for period of most emissions.

- Total direct emissions (Days 1–23) of excess $^{15}N_2O$:
  - From 75 mm depth = 0.50 % and from 200 mm depth = 0.065 %, *of total NO_3^- injected*
  - Below IPCC default of 1 %
  - No emitted $^{15}N_2$ detected
- Highest in-soil content of N_2O and $^{15}N_2O$ coincided with period of high hydraulic conductivity (K_{sat} = 71 mm h^{-1}).
- N_2O very soluble in water, so potentially leaching $^{15}N_2O$ from 75 mm (×155) and 200 mm (×125) respective surface fluxes at the time (Day 10).
- The default IPCC indirect emissions by leaching and runoff does **not** include dissolved N_2O.
- May help explain discrepancy between 'top-down' estimates of 3-5 % of applied N emitted as N_2O, compared with IPCC default 'bottom-up' total emissions of 1.3 % (indirect = 0.325%).

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