Response letter

Reviewer comment 1: *Consider revising the figures using shading to indicate depth so that they are all either bottom-up (e.g. Fig. 3) or top-down (e.g. Fig. 5) to avoid confusion.*

Response: Thank you for your comment. Both figures (Fig.3 and 5) using shading to indicate depth already use top-down from dark (higher soil layers) to lighter colors (lower soil layers). Therefore, no changes were made. In case we misunderstood the comment, please let us know.

Reviewer comment 2: *I am still lacking a bit more consideration about the organic N pool and its contribution to the inorganic N dynamics. A sentence or two about this when discussing the dynamics would be good (there are some indications, but not very clearly pointed out to what extent organic N mineralization by microbes must have contributed to the increased inorganic N at T14, especially in the dry treatment).*

Response: Thank you for this helpful comment. We agree that the contribution of organic N mineralization to the observed inorganic N dynamics was not sufficiently explicit in the previous version. We have therefore expanded Sect. 4.2 at two locations while retaining the caveat that organic N pools and gross N transformation rates were not measured directly.

First, following the discussion of the short-term Birch-effect response (former lines 505–512), we now explicitly state that the observed mineral N pulse requires mobilization and mineralization of organic N and may involve both labile soil organic N and N released from drought-stressed or lysed microbial biomass. We also clarify that drying–rewetting can enhance the availability of such organic N substrates and stimulate net N mineralization, although the contributions of individual organic N pools cannot be quantified from our measurements. We support this interpretation with Maxwell et al. (2022) and Schimel (2018).

The added text reads:

> "This mineral nitrogen pulse necessarily implies mobilization and mineralization of organic nitrogen, potentially including labile soil organic nitrogen and nitrogen released from drought-stressed or lysed microbial biomass. Drying–rewetting can increase the availability of such organic nitrogen substrates and stimulate net nitrogen mineralization after rewetting, although the contribution of individual organic nitrogen pools cannot be quantified from the present measurements (Maxwell et al., 2022; Schimel et al., 2018)."

Second, we revised the discussion of the increase in inorganic N in the dry control plots between T0 and T14 (former lines 541–547). We now explicitly point out that, because atmospheric N inputs were too small to explain the observed increase, part of the additional inorganic N must ultimately have originated from net mineralization of soil organic N and/or microbial biomass N. The concurrent accumulation of NH_4^+ and particularly NO_3^- is therefore consistent with continued organic N mineralization followed by nitrification. At the same time, we emphasize that neither mineralization nor nitrification rates can be quantified from the observed pool-size changes alone. We additionally cite Appel (1998), which specifically discusses organic N as a source of N mineralization flushes following soil drying and rewetting.

The added text reads:

> “As atmospheric nitrogen inputs were too small to account for this increase, part of the additional inorganic N must ultimately have originated from net mineralization of soil organic nitrogen and/or microbial biomass nitrogen (Appel, 1998). The simultaneous accumulation of NH_4^+ and particularly NO_3^- is therefore consistent with continued organic nitrogen mineralization followed by nitrification, although neither process can be quantified from the observed pool changes alone.”

We believe these additions now make the role of the organic N pool in the observed inorganic N dynamics considerably clearer without implying process-level resolution beyond that supported by our measurements.