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Organic and inorganic nitrogen dynamics in soil - advanced Ntrace approach

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Depolymerization of soil organic nitrogen (SON) into monomers (e.g. amino acids) is currently thought to be the rate limiting step for the terrestrial nitrogen (N) cycle. The production of free amino acids (AA) is followed by AA mineralization to ammonium, which is an important fraction of the total N mineralization. Accurate assessment of depolymerization and AA mineralization rate is important for a better understanding of the rate limiting steps.
Recent developments in the 15N pool dilution techniques, based on 15N labelling of AA's, allow quantifying gross rates of SON depolymerization and AA mineralization (Wanek et al., 2010; Andersen et al., 2015) in addition to gross N mineralization. However, it is well known that the 15N pool dilution approach has limitations; in particular that gross rates of consumption processes (e.g. AA mineralization) are overestimated. This has consequences for evaluating the rate limiting step of the N cycle, as well as for estimating the nitrogen use efficiency (NUE).
Here we present a novel 15N tracing approach, which combines 15N-AA labelling with an advanced version of the 15N tracing model Ntrace (Müller et al., 2007) explicitly accounting for AA turnover in soil. This approach (1) provides a more robust quantification of gross depolymerization and AA mineralization and (2) suggests a more realistic estimate for the microbial NUE of amino acids. Advantages of the new 15N tracing approach will be discussed and further improvements will be identified.

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