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Facing the ^{15}N tracer technique with the process of codenitrification

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It was first reported by Tanimoto et al.[1] and Shoun et al.[2] that beside the commonly known denitrification process N_2O and N_2 can be also produced by a unique reaction of soil fungi species, a process which they called codenitrification. During this reaction both gaseous N compounds evolve thereby as hybrid species, where two N atoms of two different educts will be combined to form either N_2O or N_2 (i.e. NH_4^+ and NO_2^-)[1,2]. Laughlin & Stevens[3] recently showed that at least for microbial soil N_2 release (acid brown earth; Typic Dystrochrept) codenitrification might account for up to 92 %. However, a simultaneous production of N_2O or N_2 in soils due to denitrification and codenitrification violates the assumptions of current ^{15}N based mathematical approaches[4−7]. Thus, novel ^{15}N based equations were derived to permit a calculation of soil N_2 and N_2O release in the course of both processes. The calculation is based on a single isotopic analysis of a sampled N_2 or N_2O mixture and the determination of the ^{15}N abundance of nitrite and nitrate (simplified approach) or of ammonium, nitrite, and nitrate (comprehensive approach). Calculations are even processable under conditions where all basal nitrogen educts (ammonium, nitrite, and nitrate) are enriched in ^{15}N. An additional determination of concentrations of dissolved N compounds is unnecessary.

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