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WANDA, a regional dynamic nitrogen model (With Aggregated Nitrogen DynAmics) for nitrate leaching from forests

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Abstract. Nitrate concentrations in recently infiltrated groundwater in forested areas in the Netherlands are slowly increasing towards the EU limit of 50 mg NO_3 l^{-1}. The origin of this nitrate is thought to be leaching from nitrogen (N) saturated semi-natural ecosystems in these areas. To simulate nitrate leaching on a regional scale, the empirical model WANDA (a regional nitrogen model With Aggregated Nitrogen DynAmics) is introduced. The model is built around the concept that in forests the C:N ratio of the organic layer is indicative of the amount of nitrate leaving the system in drainage. WANDA was tested on a regional dataset of an infiltration area of 10 km^2. This infiltration area consisted of 350 forest stands draining to the catchment "Edese Bos" used by a drinking water company. In 75 of the 350 forest stands the C:N ratio of the organic layer was measured. In 30 of these 75 stands, the nitrate concentrations below the rooting zone were measured. A hydrological model calculated water fluxes. The C:N ratio of the 75 stands ranged from 15.7 to 31.3 g C g^{-1} N. Scots pine stands had the highest C:N ratios in the organic layer. Nitrate concentrations varied in the 30 stands from 0.6 to 70 mg NO_3 l^{-1}. The nitrate concentrations in the Douglas fir stands were higher, and in the beech stands lower, than those observed in the locations with other tree species. WANDA predicted nitrate concentrations well, but improvements are required to simulate nitrate fluxes. The simulation of the water fluxes in WANDA is probably where more focussed modelling effort is now required.

Keywords: nitrogen, nitrate, forest, model, WANDA, C:N ratio, organic layer

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