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Modelling the seasonal Dynamics of hydrologically induced Nitrate flushing

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The variability of hydrologically induced flushing of nitrate from a forested watershed during sequences of hydrological events in different seasons was observed through high-frequency measurements of streamwater nitrate concentrations accompanied by a detailed hydrometeorological monitoring system. The study was carried out in 2006 and 2007 within the 42 km^2 forested Padez watershed in the southwestern part of Slovenia, which is characterized by distinctive flushing, an almost torrential hydrological regime influenced by impermeable flysch geological settings. 30 recorded hydrographs which, in the hydrological and biogeochemical sense, differed substantially, disclosed a highly variable but at the same time a strong linkage between hydrological and biogeochemical controls of nitrate exports from the spatial perspective of a watershed. Based on our domain knowledge of the nitrate hydrological mobilization and observed responses obtained through high frequency measurements, we have created a list of attributes used for description and prediction of the nitrate flushing in different hydrological and seasonal biogeochemical settings. The attributes included data about the preceding rainfall and values of the antecedent precipitation index which were used to characterize the hydrological state of the watershed in periods preceding the observed rainfall events. The seasonal biogeochemical background was considered through air and water temperature conditions during periods preceding the rainfall events. Using a M5 data mining algorithm we have obtained a set of classification rules which successfully predicted streamwater nitrate concentration based on the observed hydrological and seasonal biogeochemical settings. The model was most successful in describing streamwater concentrations in the range 1–4 mg/l-N, covering

a large proportion of the dataset. The model performance was poorer during the short periods of high streamwater nitrate concentration oscillations (up to 7 mg/l-N during the summer hydrographs and 14 mg/l-N during the extreme November hydrograph) related to highly variable hydrological conditions. The classification rules were applied to predict the streamwater nitrate concentration in 2006 and 2007, which differ both, in the hydrological and seasonal biogeochemical conditions causing differences in the annual fluxes of nitrate from the observed watershed.