

Interactive comment on “Determination of vadose and saturated-zone nitrate lag times using long-term groundwater monitoring data and statistical machine learning” by Martin J. Wells et al.

Anonymous Referee #1

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The paper by Wells et al. with title: "Determination of vadose and saturated-zone nitrate lag times using long-term groundwater monitoring data and statistical machine learning" provides an interesting study regarding the application of Random Forest Statistical method using data to estimate vadose and saturated-zone vertical velocities (transport rates) for the determination of subsurface lag times. The authors use Random Forest Regression to leverage existing long-term groundwater nitrate concentration (referred to as [NO₃-] hereafter). The study area is located in the western Nebraska counties in which the crop area is increased over the years. Hence, reg-

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ulators and stakeholders in agricultural landscapes are increasingly in need of more precise and local lag time information to better evaluate and apply regulations and best management practices for the reduction of groundwater nitrate concentrations. The authors use R programming packages adding 15 predictors to estimate the vadose (unsaturated zone) and groundwater (saturated zone) transport rates and lag times for an intensively monitored alluvial aquifer at Dutch Flats area. The manuscript is well written and the innovation of the study is clear. However, the geological/Hydrogeological information is missing a deeper analysis of the dynamic and static predictors as well. My recommendation is publication after major revisions.

General comments - Geology/Hydrogeology is missing. Provide a hydrogeological map, cross section, hydraulic characteristics of the aquifer etc. - Add more information about nitrate and its processes. - Fig1. Change the maps. The figure needs to be more attractive. Add coordinate system. - The literature is out of date. - Discuss the role of Nitrate isotopes for future contribution in this concept. Recent article provide the interaction between surface and groundwater bodies using nitrate isotopes which might be helpful in future works.

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