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Interactive comment on "Predicting the denitrification capacity of sandy aquifers from in situ measurements using push-pull ^{15}N tracer tests" *by* W. Eschenbach and R. Well

Anonymous Referee #1

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General Comments. Groundwater denitrification research is moving beyond merely measuring rates to determining what electron donors contribute to denitrification and how long can the electron donor supplies last. This paper considers both, but emphasizes the latter. Determining the denitrification capacities of aquifer materials is an important and pragmatic goal. Herein, Eschenbach, Well, and Walther make a novel contribution by trying to predict the denitrification capacities of sandy aquifers using push-pull tracer tests with 15N, a scientific issue within the scope of this journal.

Specific Comments. The paper is ordered properly and the text is clear; the scientific methods are clearly outlined and the use of mass spectrometry in the field application was documented. Page 16532, line 10 and following: Perhaps push-pull studies may

be used to estimate SRC; however, collecting aquifer material for analysis should always be considered as a way to "ground-truth" these estimates. Page 16545, Section 3.2, and Page 16548 Section 4.1: These sections include regional comparisons and also comparisons with other push-pull tests; however they should also include information from other in situ denitrification tests so that this work appeals to a larger audience. Tesoriero and Puckett (2011) reviewed the published rates of denitrification and concluded that denitrification by sulphide oxidation was faster than with carbon oxidation. They considered studies that used monitoring-well transects along hypothesized groundwater flow paths. Green et al. (2010) showed that non-Gaussian dispersion influenced apparent denitrification reaction rates and isotopic fractionation along flow paths. Such mixing would influence the results discussed herein about pull-push tests; a discussion of these influences would be appropriate. Korom et al. (2012) argued that such mixing would apparently not influence rates measured by their in situ mesocosms (Korom et al., 2005) because advection and mechanical dispersion are minimal. Issues influencing apparent denitrification rates and fractionation are currently important in the groundwater denitrification literature and the authors need to better explain their results in this context.

References. Green, C.T., Böhlke, J.K., Bekins, B.A., Phillips, S.P., 2010. Mixing effects on apparent reaction rates and isotope fractionation during denitrification in a heterogeneous aquifer. Water Resources Research 46, W08525, doi: 10.1029/2009WR008903, 1-19.

Korom, S.F., A.J. Schlag, W.M. Schuh, and A.K. Schlag (2005), In situ mesocosms: denitrification in the Elk Valley aquifer. Ground Water Monit. R. 25(1), 79–89.

Korom, S.F., W.M. Schuh, T. Tesfay, and E.J. Spencer (2012), Aquifer denitrification and in situ mesocosms: modeling electron donor contributions and mesasuring rates. J. Hydrol. 422-423, 112-126, doi:10.1016/j.jhydrol.2012.02.023.

Tesoriero, A. J., and L. J. Puckett (2011), O2 reduction and denitrification rates in

shallow aquifers, Water Resour. Res., 47, W12522, doi:10.1029/2011WR010471.

Technical Corrections. Page 16540, line 21: Change “were” to “where.” Page 1651, line 24: Change “begin” to “initiation.” Page 1652, line 6: The meaning of the sentence beginning on this line is unclear. Page 16533, line 13: “North” should be “north.” Page 16536, line 21: Change the sentence beginning on this line to, “The multilevel wells in the FFA were sampled every 12 h during the night and every 3 to 4 h during the day to investigate more detailed temporal patterns.” Page 16536, line 24: Change “maximal 72 h” to “a maximum of 72 h.” Page 16536, line 27: Change “sampling” to “sample” and “form” to “from.” Page 16544, line 11: Change “sub data sets” to “subsets.”

Interactive comment on Biogeosciences Discuss., 11, 16527, 2014.