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Discussions

Interactive comment on "Modeling nitrate from land-surface to wells' perforations under agricultural land: success, failure, and future scenarios in a Mediterranean case study" *by* Yehuda Levy et al.

Anonymous Referee #2

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The manuscript is interesting and deals with a topic of great relevance around the world and some ideas are promising. However, the methodology seems to me a Little deficient so the results and the conclusions are compromised. Some specific comments are listed below, indicating the letter 'L' the line in the original manuscript: L35-45: The sentences in this paragraph are true all of them but all of them are really strong statements and sometimes a little bite unconnected between them. L46-50: Even when it is true, different crops and different regions present different efficiencies. I recommend you to try to explain this variability but also conclude with some results for Israel (or other semiarid regions) with some management more similar to your region (trees,

vegetables (not in green houses),...) L51: urea is mainly considered a synthetic fertilizer. L53: the importance of mass transport process is usually referred to NO3, but NH4 uptake usually occurs by diffusion. L55: consider changing light soils by aerated, dry,... L55: define 'relatively thin', because you are considering in your calibration at least 45 cm, and it could be even deeper. L58: denitrification to N oxides could be negligible in aerated soils, but complete denitrification to N2 is not so negligible and it is very difficult to measure, so there are a lack of real data. L59: this sentence is partially true, because nitrate leaching is not only the result of the nitrification, it is also the result of the poorly fixation of the nitrate molecule (negative charge) to the soil complex, mostly dominated by negative charges (clay and organic matter), whereas the ammonium (positive charge) presents a stronger retention to the soil and leaching is more difficult. L83-86: These two sentences fit better in the introduction. L86: if it is unconfined, do you know how much water and nitrate leave the system? It is important in order to predict if the new entries are greater or smaller. L100: Do you know if all the wells are extracting at the same depth? In some aquifers has been reported nitrate stratification, suggesting contamination from different time periods. L118-120: how is the irrigation applied? Is not the same if is homogeneous (surface, furrow, sprinkle) or if it is drip irrigation. L119: and what happen with the citrus? L120: please, define the size of the plastic tunnels, because there are many kinds. Moreover, the rainfall over the plastic should go somewhere, perhaps is draining with a reduced amount of nitrate, so this could lead to a reduction of the nitrate concentration in the aquifer. Please, discuss or consider it. L125: was it the same fertilizer rate when the petrol was cheaper some years ago? N fertilizers use to be highly related to energy price. L128: I do not understand why each crop should be correlated to each soil type. To me it makes more sense to have a soil map, combined with a weather map (you are presenting different precipitations) and with a nitrate concentration in the irrigation water map, and all them combined with the cop map, resulting in multiple combinations. Perhaps some of the variation that you can not explain is due to your simplification. L128: Have you try to make first a comparison of the observed concentration at each well with the percentage

of each crop in the well proximity? Because if it is not related, the rest of the assumptions could be not true. L129-138: Please define better the process. If I understood well you obtained for each crop three cores per depth; but, how do you divide them in order to get samples dried at 105°C and at 40°C at the same time. Moreover, do you think that if you dry the sample during 3 days at 40°C the soil nitrate and ammonium is going to be the same than analysed in fresh samples conserved in the refrigerator few hours/days? And mostly in deeper layers, because as you say mineralization, nitrification, denitrification and all the N processes could be enhanced by this temperature increase, doesn't they? Please discuss or define better. L184: I understand modelling simplification, but if there are some farms close to the region (as you propose as cause of the well differences) I have some doubts about the application of only this kind of compost. Could you discuss a little bit. L189: I understand that you try to fix your simulated data after 50 years to the values observed in the 12 cores; however, what are your initial data? Moreover, you said that the same crops have been cultivated during 15 years but you simulate 50. Is the same water table now than 50 years ago? (Probably with smaller irrigated area). Could you discuss that? L193: Can you define better what slightly means? L200-202: And what do you expect to happen with the N movement? Because in the no crop plots there also mineralization and nitrate leaching. L208: calibration is a main part in a modelling process, but independent validation also is. Because you calibration can sometimes be tricky, because you have many ways to get to a good result if you are combining many different parameters, but not only one of this ways is the more accurate. Because of that I suggest you to divide some observed results (in time, space or whatever) and use them for a new calibration and confirm that (validate) simulating for the other points and getting also an accurate adjust to the observed results. L234: Again, why are you using now 20 years instead of the 15 that are sure with the same management? L234-235: Consider including a reference for this statement. L237: the figure labels for each zone (particularly Bnei-Zion) are oversized and do not allow to see at least one sampling point and the scale. L238-239: the figure caption for b) and c) are changed. L242: please, define the period

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observed for wells. L250-252: How do you expect that this change affect the crops? Do you have a crop module? And some of these data fit better in the results than here. L256: are they similar or are you using the same data? Define. L274: Why do you think that nitrate flux is 540 kg ha in the persimmon A if you only apply 200 kg? L315: consider including units. L330-332: how do you define which region should be multiplied by which factor? I do not understand this arbitrary correction. Table 5: define which coefficient for each one, please. L343-345: this has been already defined in the material and methods L369-370: It could be many other things, the simplification level of the system, the soil variability (you only sampled 12 cores for a 13.3 km2 surface), different soil/rainfall/management/nitrate in the well irrigation water/... for the same crop. L370-373: if you do not completely trust your data; how do you expect that we could do? L379: I could agree with you, but you should validate these coefficient in order to see that they are not just a mathematical trick. Figure 10: check the image quality. L417: I do not think that this is a "significant success" without some kind of validation

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