



EGUsphere, referee comment RC3
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Review of egusphere-2022-104

Stan Schymanski (Referee)

Referee comment on "Dynamic root growth in response to depth-varying soil moisture availability: a rhizobox study" by Cynthia Maan et al., EGU sphere,
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Dear editor,

The manuscript by Maan et al. describes an experiment where a maize plant was grown in a transparent rhizobox and root growth was monitored along with soil moisture in the vertical soil profile. The authors compare different model simulations with the observations, one with a prescribed exponential root distribution, and several simulations based on dynamic root distributions with different levels of observation data assimilated into the simulations. The authors find that root growth rates follow the soil moisture distribution, and that this could be simulated by assuming that root growth rate is a function of soil moisture and only happens at a normalized water content greater than 0.075.

The results presented are interesting and potentially insightful, but unfortunately, the paper is not well organized and lacks details and clarity. Therefore I found the results difficult to interpret and the conclusions difficult to verify. The paper consists of essentially three separate methods and results sections, one for each model version. It is not clear which parameters were calibrated in each model run and how, e.g. whether in 2.4 only u_3 was calibrated, or also u_2 , and on what data precisely. It is also not clear in which soil depth how much irrigation was applied when, and whether the vertical soil moisture differences were induced by differential irrigation or root water uptake. The main conclusion is that root growth is strongly determined by soil moisture, with high soil moisture promoting root growth. However, since irrigation was "adjusted in steps to follow the plants growth and demand for water" (L68), and the soil moisture increases over time in the deeper soil (Fig. 2C), I am a bit confused in how far the vertical soil moisture distribution was controlled and if it really triggered differential root growth. More information about the experimental strategy would be helpful.

I would propose to consolidate the methods and results in two separate sections as per standard convention, and include sufficient details about the experimental and modelling methods to enable reproduction of the experiment and analysis. The authors promise to

publish the data for producing the plots and results in the future, and provided links for the referees, but unfortunately, the links did not work for me, so I was not able to assess if the promised material will be indeed adequate to enable reproducibility of results.

I added detailed comments in an annotated pdf-file, as they are too many to list here. Some of the equations provided are incorrect, but I cannot tell if they were correct in the analysis. For linguistic glitches, I just highlighted bits of text in yellow. I hope that my review will help to revise the manuscript and add more clarity about the methods and results.

Please also note the supplement to this comment:

<https://egusphere.copernicus.org/preprints/2022/egusphere-2022-104/egusphere-2022-104-RC3-supplement.pdf>