

The manuscript “Plant hydraulic traits regulating productivity and drought resistance in boreal crops” written by Tang et al., explored the responses gross primary products and evapotranspiration for some crops and grasses via perturbing some aboveground plant hydraulic traits. Those traits are defined and linked to the specific modeling parameters and recently development soil-plant model. The shown data was complex with mix of measured (EC and Sentinel2 which have been published elsewhere) and simulated data for two sites with contrast soil and evaporative demand and different modeling configuration (some selected hydraulic traits).

The MS could be considered further for the publication however some critical points need to be considered: (i) clear objectives and hypothesis are required and followed by the structured results and discussion. (ii) it is important to explain how to simulate different crop/grass traits where the sites contain many species. The name of two sites with two dominant species: GRASS and OAT are confusing and misleading since there are more species there (iii) The limitation of model and work have been discussed with regards of lack measurement in plant hydraulic conductance. The MS only focused on the aboveground traits and root roles did not consider or mention which are even more important in responses and adaptation. (iv) may terms and variables are mentioned. Overall, they are quite well explained however, some are not, in terms of unit and name (see below).

Many detailed comments are listed below.

Abstract

Line 2 Crop and grass definition

Line 6: what is hydraulic conductance, plant or root or stem?

Introduction

Determination and definition of hydraulic traits are still vague. What are exact hydraulic traits are you looking at?

See also the apparent hydraulic traits which also mentioned somewhere? What they are? i.e. in line 68-69 and line 71. Which exact scale of hydraulic traits considered in your modeling approach?

Line 23-24: this is not clear sentence, what is inherent structural constraints. How stomatal regulation could be a trade-off?

Line 25: I still do not see the diverse hydraulic strategies, especially how it is relevant for grass and oat in boreal regions. Why did you choose these two types of plants? These two plants are “grass” with stem-hollow plants, how the xylem metabolism is important in this case? How important of the root in the hydraulic regulation and overcome the drought?

Line 64: the reference was a bit too less, there are more work ongoing (to include plant hydraulic into crop models) in this topic.

Line 75: you said “our hypotheses” what are they? Or do you mean the summarize of three hypotheses that you draw out from the existing literatures i.e. safety, efficiency, and plasticity? One needs a better and clear hypothesis, objectives and how they are related to the clearly defined hydraulic traits.

Look at to the results section, the results are not so well structured and clearly link to the hypotheses and objectives.

Materials and methods

Line 86: how about the other component of plant conductance? Root, stem?

Line 88: how estimate the g_s and which one is leaf and/or plant water potential? It is not clear to me the gradient of water potential in the plant or canopy.

Line 100: V_{cmax} , how do you estimate the carboxylation capacity of leaves? Is not from Rubisco?

Line 105: how the soil water status is updated (after one day, one hour, one week) and how did it link to photosynthesis? This is more important.

Line 125: How do you measure the alpha and gamma parameters and at which scales?

We need of table with variable name of parameters with unit and used values for the calibration and validation work for different plant types.

Line 35: It seems that the model treats LAI as single canopy that do not separate the photosynthesis, transpiration over different leaf types and depths?

Line 149, soil to root water potential was estimated? And how root play a role here? What is belowground boundary of model and simulation?

Line 158: how ET is calculated? How to link the evaporative demand with soil and plant root water uptake. What is the aboveground boundary?

Line 160: how the phenology was simulated as the authors mentioned here

Line 165: how root growth and root distribution are simulated and used in the other modeling routine and how it relates to the hydraulic traits

Line 192: there are different modeling routines in the whole model which are different from temporal resolution (hourly, daily) how do the sub-model link at that point and how the soil-plant-atmospheric are coupled. I did not see the role of root and set-up of below and above boundary of the model. How dynamics of root growth, leaf area growth contribute to the simulation of water and carbon fluxes.

Line 196: What are the mineral soil crop fields? It is not clear writing.

Line 197 and 202: there are mix crops and do not know how big shares of crop are? The name of sites in 205 did not sound reasonable, see 225.

Line 224: is it similar for both sites? The data showed differently for two sites

Line 225: The names are confusing and not correct because the footprints contain mix of species. It is not sure how the model treated this difference in terms of species within footprint.

Line 225: this did not make sense. There were the measurements of climate data at the EC but why the authors use the ERA5 data which could result many uncertainties for modeling results. Any check or compared for the location data?

Line 226: Since the footprint has mix of crop and species, how the authors differentiate the LAI based on the Sentinel-2. This is very critical. How the crop map was used in the footprint? Did the authors have the detailed crop map?

Figure 2b, it is not clear the range of SWC for two locations, look like Qnidja with purple color has very high SWC, around $0.5 \text{ cm}^3 \text{ cm}^{-3}$, or the legend did not show clearly.

For the LAI in 2c, it should be clear how to create the interpolated LAI, especially the off-seasons

Line 263, the Ψ_{50} is the leaf water potential or stem water potential? For the herbaceous crops or grass, -3 MPa is already too low that plant might be almost wilt thus the loss of hydraulic conductance at this threshold might be too low for 50% reduction.

Table 1 and Table 2 are confusing, while the author emphasized two locations with GRASS and OAT, the table mentioned again different crops and grass which is very inconsistent to the text. It is really not clear whether the study simulate single plant or mix of plant per site or all sites.

Line 199, did the authors simulate different grass, legume, oat, clover, rye grass? It is not clear, for which analysis and objectives?

Line 294 and 295, units?

Section 2.2.3, it is not clear the table 2 should belong to the results. Also, it is not clear how the modeling sensitivity analysis and perturbation contribute to the objective and hypothesis (see repetition in section 3.2)

It would be better to provide a diagram to show the work flow. It is really confusing there with two sites with different soils and SWCT, different growing seasons, initialization, different PPE with soil moisture and VPD then different bet-fist of parameters. It is complex to follow up the information.

Results and discussion

Line 305: The figure must be right away after the first mentioned text.

Line 312: now the crop mixture comes, how the simulation was done with crop mixture and how hydraulic traits were considered?

Line 320: "diurnal"

Figure 3: what does it mean "grass (all)", "Oat (all)". Why there is no red and blue crosses in c) and d)

Figure 4: from which best fit parameters? There are different ones? Or mean of different best fit parameter sets.

Figure 5. The author mentioned the measured soil moisture content at 5-10 cm soil depth, I did not see the measured soil water content here. And which simulated SWC are shown here in 5i and 5j. See also the figure 6., which soil depth or over soil profile? How is to determine the wilting point?

It is confusing to use the inconsistent term: best fit parameter and five best fit parameters for the results.

Figure 8: check the units of variables, micromole C?

Figure 9: Figure 9a needs unit of plant water conductance to avoid the ratio unit

Figure 9c uses the same term ET or transpirations like in other graphs

Why the change of GPP is much less compare to change of ET when increase in plant water conductance. The GPP in 9b even still maintains or increase around 2 %? There will be no reduction of GPP due to the soil water reduction as sequence of high plant hydraulic conductance

Figure 10 now shows for different crops and grass which should be somewhere in very beginning. Why now measured data for oat in 10e. Why plant conductance has unit in m (see also somewhere in the materials and methods).