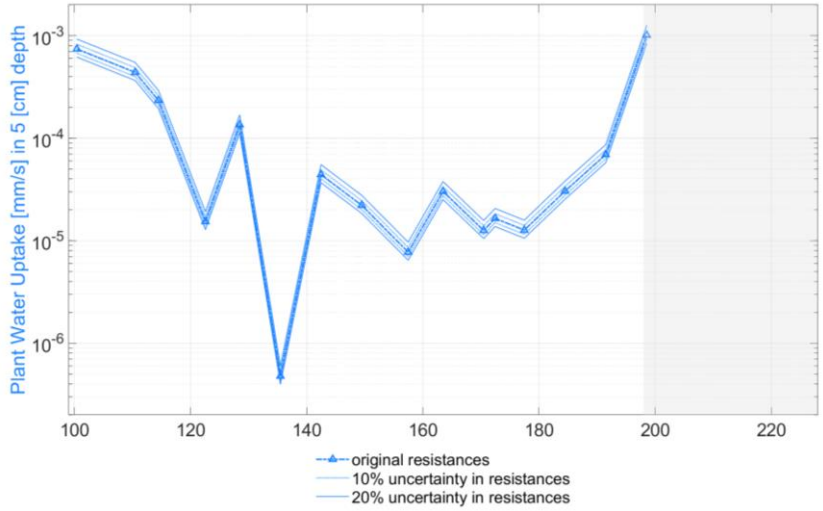
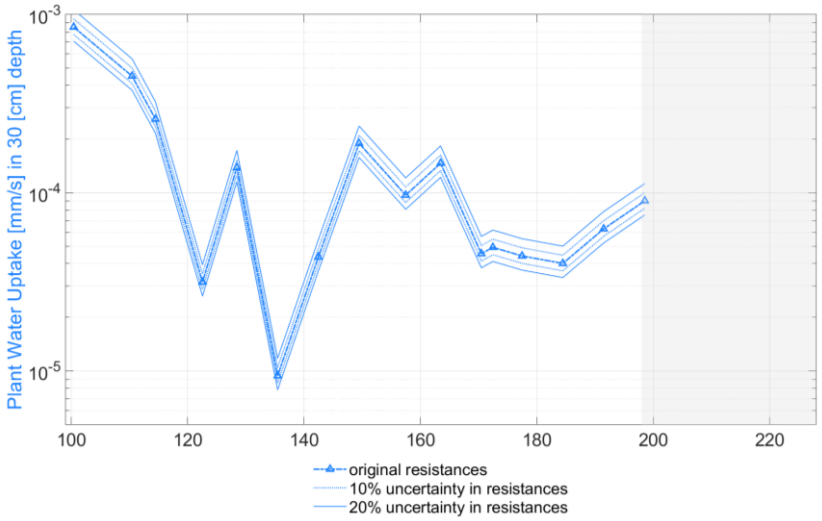
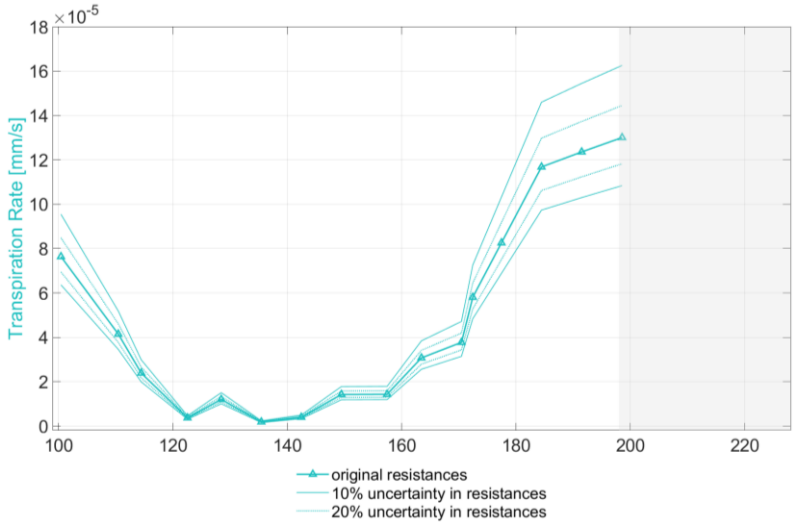
Response to Reviewer 3

Towards Estimation of Seasonal Water Dynamics of Winter Wheat from Ground-Based L-Band Radiometry: A Concept Study (Manuscript # BG-2021-71)

Comments	Responses/Actions
The topic is really interesting and fits the purpose of the journal. The objectives to derive the water uptake and TR are challenging. The manuscript is well structure, the method and the data are well described. There are some points that need to be addressed before considering this work for publication.	Many thanks for the reviewer's encouraging evaluation. We addressed all points, raised by the reviewer, in the following responses and changed the manuscript accordingly.
Generally, the discussion contains many sentences that can be part of the conclusion, which conclusion then seems like an abstract. The discussion needs to be re-worked.	We worked through the discussion and the conclusion sections and re-named, re-organized, re-wrote and specified the individual text paragraphs. Redundant text paragraphs were removed. Moreover, we specified a paragraph in the discussion section about uncertainty of key variables (flow resistances) in the retrieval algorithm to inform about their influence on PWU- & TR-estimation.
Plus, there are a lot of repetitive ideas (a few examples : lines 667 page 31 and 683 page 32 ; line 598 page 28 and lines 634 page 30) which make the discussion incomplete with vague comments. Another example is section lines 681-685 : « Our results show the potential of combining » These sentences sound general without precisions (to do what ? Our results ..where ; to existing results but which results ? Which parameters ?	We removed the repetitions in the discussion sections and re-formulated vague statements wherever found. As mentioned directly by the reviewer: ▪ We adapted and coordinated the paragraphs in lines 667 and 683 to keep their common idea, but removed the repetitive text parts. ▪ We cancelled the paragraph in line 634 on page 30 in the discussion section, as it is equivalent to the statement in lines 598 on page 28 of the results section. ▪ We removed the vague statement in lines 681-685. We also cancelled or moved the following statements: ▪ We cancelled the repetitive statement in lines 626-628. ▪ We cancelled a repetitive ECOSTRESS statement in lines 643-645. ▪ We also cancelled the repeated statement on limitations in line 657. ▪ We deleted the repetitive comment on the transpiration from top and bottom of leaves in lines 662-664. ▪ We cut out the repeated statement on wide-area retrieval in lines 672—673. ▪ We cancelled the re-occurring statement on the challenge to estimate resistances at remote sensing scales in lines 704-705.

	▪ We moved the statements lines 710-718 (end of discussion section) to the conclusion section.
But most importantly, it lacks an analysis on the influence of each variables (uncertainties). The methods use many parameters and equations to compute the TR and PWU. Some of the parameters are difficult to obtain as mentioned in the manuscript , but one can not evaluate their importance on the final results. Is it worth having a precise value for these or not ? For instance paragraph lines 657-664, the discussion points out issues but there is no link with existing studies on the topic nor the influence of these parameters on the results.	We re-wrote and specified the paragraph in the discussion section (lines 657-664) to quantify the uncertainty of the PWU- & TR-estimation regarding the flow resistances. For this, we first conducted an uncertainty analysis on the influence of the major input variables following table 2. We found that especially the flow resistances, necessary to calculate the water fluxes (PWU & TR), are critical and not directly measurable or assessible at field-scale, neither by remote sensing nor by in situ measurements. Hence, we focused on the uncertainty of the resistances on flux estimation. We changed the resistance values by $\pm$1%, $\pm$5%, $\pm$10%, $\pm$15% and $\pm$20% of value in order to understand these uncertainty effects on the flux estimates. In Figs. R1 to R3 below, the uncertainty-induced change ($\pm$10% & $\pm$20%) is shown exemplary for plant water uptake in 5 [cm] and 30 [cm] depth as well as for the transpiration rate.  Fig. R1: Change in plant water uptake in 5 [cm] depth due to uncertainty ($\pm$10% & $\pm$20%) in resistance values compared to original values.  Fig. R2. Change in plant water uptake in 30 [cm] depth due to uncertainty ($\pm$10% & $\pm$20%) in resistance values compared to original values.

	 Fig. R3. Change in transpiration rate due to uncertainty (±10% & ±20%) in resistance values compared to original values. Figs. R1 to R3 reveal that the seasonal trend for PWU and TR is not changed when the knowledge about the resistance values is more and more uncertain. Moreover, the larger the PWU- and TR-values, the stronger the uncertainty affects the estimates. This led to uncertainty-induced maximum changes of PWUs and TR of $3.5 \cdot 10^{-4}$ $[mm/s]$ (30 $[cm]$ depth), $4.2 \cdot 10^{-4}$ $[mm/s]$ (5 $[cm]$ depth) and $5.4 \cdot 10^{-5}$ $[mm/s]$, respectively, when including 20% uncertainty.
Validation of PWU is difficult but there is nothing in the manuscript to evaluate the significance of the derived results.	We added a statement concerning the difficulty to evaluate the significance of the achieved results in the end of the conclusion section: "A first comparison of TR estimates from the presented field-based approach and from the space-borne ECOSTRESS mission indicates similar value ranges (same order of magnitude, mainly between zero and $1.0 \cdot 10^{-4}$ $[mm/s]$). However, the validation of absolute accuracies needs to be tackled in future studies with dedicated in situ measurements of water dynamics (potentials & flux rates). This is especially true for the PWU estimates where no comparison or validation dataset was available in contrast to the TR case."
Minor Corrections	
Page 673/674, page 31, « Algorithms …. » what is the point of this sentence ?	Many thanks. This sentence was misleading. We cancelled it.
Figure 11 : the 2 derived RWC are delayed by 15 days. What can explain the differences ? Which one is used in equation (3) (line 480)	1. The two derived RWC curves are temporally delayed, where RWC_{Season} from m_g leads by 2-3 weeks compared to RWC_{Season} from VOD. One explanation could be that VOD also follows the biomass dynamics and not only the water dynamics, whereas m_g is only sensitive to the water dynamics. The water content in the plants peak around DOY 140 (see Figure 10), whereas the biomass peaks around DOY 155. This may explain the temporal delay. 2. We added a sentence to the paragraph to clarify that RWC_{Season} from m_g is used in the analyses:

	"From RWC_{Season}, the VWP of the winter wheat can be retrieved using (3) and assuming different change rates of VWP according to RWC_{Season}-dynamics (cf. Fig. 3). In the following the RWC_{Season} from m_g is used in the analyses. Figure 12 shows in green color the VWP using intermediate change rate and in a gray area between dashed curves the behavior of the VWP according to the different assumed change rates (blue color: slow change rate & red color: rapid change rate)."
figure 14 top : There is no x-axis ; what is the difference with figure 4 top. Generally the paper contains a lot of figures, it is recommanded	The x-axis is the same for both plots in figure 14, but only plotted once for the bottom plot. We added a sentence to the caption of figure 14 for clarification: "The x-axis labels are the same as for the bottom plot."
Figure 2 : all acronyms are defined but RWC	Thank you very much. We added the definition of RWC to Figure 2 which is the relative water content of vegetation.