Response to Dr. L. Brocca (SC1)

Thank you very much for your nice comments, and sharing your related researches with us, which is found to be enlightening in revising our paper. Please find our point by point responses as below.

Short comments

1) While I mostly agree that in situ soil moisture data can be used for obtaining water fluxes, i.e., the soil water budget components, I also believe that uncertainties in the inversion approach are present.

Response: We totally agree that substantial uncertainties could be involved in the inverse approach, and this kind of uncertainties is even unavoidable in such calculation, irrespective of the used data model. For instance, uncertainties could occur due to errors in measurements of both the soil hydraulic parameters and soil moisture, or it may be due to the incomplete knowledge of boundary conditions and the limited volume that each set of soil moisture probes can monitor. To solve the concern, we will add a new section (**4.5 Uncertainty analysis**) to discuss all the possible uncertainties that could affect our results, and we argue that although such uncertainties inherently existed, the results are acceptable given the uncertainties are carefully considered and addressed.

2) The main issue I found is exactly related to the uncertainties in the inversion procedure. For instance, the six soil moisture probes show significant differences in the amount of irrigation for different probes; irrigation at NT1 is nearly double (1.8 times) of NT3. I do not understand how it might be possible as I believe that the amount of irrigation applied in the field is the same for all probes. Am I wrong? Indeed, the irrigation estimates strongly depend on the assumption behind equation (2) and, specifically, in the estimation of $S_{max.}$

Response: As also mentioned in our response to the last question proposed by Dr. Brocca, that kind of uncertainties have been thoroughly discussed and evaluated in the light of the effects on accuracy of our calculation (please see the newly added section of **4.5 Uncertainty analysis** in the coming revision). Upon the significant differences in the amount of irrigation for different plots noticed by Dr. Brocca, I would say you are right, but this was a misunderstanding probably due to our unclear wording in abstract. Indeed, the reason for NT1 got much higher irrigation than the other plots is that there was no plastic film mulching at this plot, while other plots (NT2-NT6) have (the cover percentage is about 40% of the total area). To solve the concern, we reworded and clarified this point in the revision. We agree that the irrigation estimates strongly depend on the assumption behind equation (2) and, specifically, in the estimation of S_{max}, and potential uncertainties caused by it and the reasonability behind it will be analyzed in the **4.5 Uncertainty analysis** in the revision.

3) Why is the comparison with in situ observations of irrigation not done? I believe it is needed definitely.

Response: We do have the in-situ observations of irrigation at field scale, but unfortunately not at plot scales, and the available in-situ observations of irrigation were also not directly measured through water meters, but instead through an indirect method. We used the power consumption of the pumping irrigation well (P) to obtain the actual irrigation amount of the plots (Q) through a well-built relationship, $Q = P \times \eta$, where η is the ratio of the power consumption per unit water pumped

specifically determined at the field station. While we can calculate the more detailed irrigation data at plot scale with the recorded the irrigating time span for each plot, we believe the getting result is not accurate enough due to the potential inconsistence of water flow rate per unit time at this scale. That is why a compromising way was adopted in this paper, in which the estimated irrigation volumes of the six plots (through soil moisture data-based method) were averaged and tested against the observations (actual irrigation calculated from the power consumption) at field scale. Although the estimated average irrigation volume within the plots (831.6 mm) compares well with the actual irrigation volume (868.8 mm) determined through power consumption, we are aware that this is a drawback of our work, so that related discussions upon the possible uncertainties caused by it have been included in the earlier version of the manuscript and further evolved in this revision.