Dear Editor and Reviewer # 1:

Thanks for your careful reviewing and all constructive comments on our manuscript. We have taken all your comments into account and responded positively to qualify our manuscript for a potential publication in the journal. Our responses are written in blue below.

Comment 1:

I was very impressed by such valuable daily SM for more than 20 years over the whole mainland of China. Comparing with quantities of public products retrieved from remote sensing or downscaling into fine resolution, Chinacropland really open a new window for us to provide key parameters on earth observations. Irrigation practices do play more significances on crop production in China, especially for dryland crop. Therefore, no any doubt will be shown on the values of irrigation sub-model. Such novelty imply a potential way for applying irrigation sub-model into other areas and crops in the world. The study is fallen closely within the scope of ESSD. However, the authors should consider my several concerns below before their submission being accepted.

Thank for your positive comments, which really encourage us to improve our study.

(1) I am wondering how they obtain the crop dryland maps. For wheat or maize, it seem to me the location is constant. I need more detailed information to better understand their study.

Response:

Yes, we did remain the ChinaCropland location constant as several publications did similarly (Gervois et al., 2008; Ke et al., 2018). We proposed a new crop phenology-based crop mapping approach to generate a 1 km harvesting area dataset for three staple crops (i.e. rice, wheat, and maize) in China from 2000 to 2015 based on GLASS leaf area index (LAI) products (Luo et al., 2020a, b). Actually, we used the union of the annual harvested area dataset for maize and wheat as the China crop drylands maps.

Reference:

Gervois, S., Ciais, P., de Noblet-Ducoudré, N., Brisson, N., Vuichard, N., and Viovy, N.: Carbon and water balance of European croplands throughout the 20th century: CARBON BALANCE OF EUROPEAN CROPLANDS, Global Biogeochem. Cycles, 22, n/a-n/a,

https://doi.org/10.1029/2007GB003018, 2008.

Ke, X., van Vliet, J., Zhou, T., Verburg, P. H., Zheng, W., and Liu, X.: Direct and indirect loss of natural habitat due to built-up area expansion: A model-based analysis for the city of Wuhan, China, Land Use Policy, 74, 231–239, https://doi.org/10.1016/j.landusepol.2017.12.048, 2018.

Luo, Y., Zhang, Z., Chen, Y., Li, Z., and Tao, F.: ChinaCropPhen1km: a high-resolution crop phenological dataset for three staple crops in China during 2000–2015 based on leaf area index (LAI) products, Earth Syst. Sci. Data, 12, 197–214, https://doi.org/10.5194/essd-12-197-2020, 2020a.

Luo, Y., Zhang, Z., Li, Z., Chen, Y., Zhang, L., Cao, J., and Tao, F.: Identifying the spatiotemporal changes of annual harvesting areas for three staple crops in China by integrating multi-data sources, Environ. Res. Lett., 15, 074003, https://doi.org/10.1088/1748-9326/ab80f0, 2020b.

(2) I do not think RF is a new method to retrieve SM. That is to say, more interesting findings have ascribed from combining irrigation module into SM estimation model. However, the authors have not specified the point. I am looking forward to more information on it, e.g. the accuracy comparison between with irrigation module and without it.

Response: Many thanks for your valuable suggestion. We have compared their accuracy results between with-irrigation module and without-irrigation module as supplemental materials. Please see it in **Table S5**. The improved accuracy results were consistently indicated by all comparisons, e.g. decreases in RMSE, and ubRMSE and increase in R^2.

Table S5 The accuracy comparison between with irrigation module (in bold) and without it.

ChinaCropSM1km	BIAS		R^2		RMSE		ubRMSE	
wheat$_{0-10}$	**−0.0011**	−0.0019	**0.860**	0.801	**0.037**	0.044	**0.037**	0.044
wheat$_{10-20}$	**−0.0002**	−0.0006	**0.895**	0.838	**0.031**	0.039	**0.031**	0.039
maize$_{0-10}$	**0.0009**	0.0007	**0.861**	0.798	**0.036**	0.043	**0.036**	0.043
maize$_{10-20}$	**0.0003**	−0.0001	**0.894**	0.812	**0.029**	0.038	**0.029**	0.038

(3) Deeper and more extent discussions will further expand the reputation and influence of their

study.

Response: Thanks very much for your constructive comment. We have followed you to insert deeper and more extent discussions into our manuscript (Line 307~320 in the revised manuscript).

"The ChinaCropSM dataset are credible and accurate according to the results comparing with the public datasets, however, some limitations are still existed in our study. First, the limited AMS irrigation records may lead to the uncertainty in the irrigation factor predictions. More detailed irrigation information will help to improve irrigation module performances. Second, our method for generating cropland SM is applicable to other regions and crops, but more environmental variables will be increasingly required considering the SM variabilities are complex processes controlled by many factors (Famiglietti et al., 2008; Qin et al., 2013; Guevara and Vargas, 2019), especially for irrigation activities. For example, to characterize more accurately the irrigation activities, many field samples are highly required in both spatial and temporal resolutions. Other auxiliary data on information of crop growth, classification, and managements (e.g. irrigation frequency, amount and method) will benefit to develop our irrigation module and derive SM datasets more accurately. Moreover, advanced algorithms will be potential alternatives for random forest due to its strong dependence on inputs (Breiman, 2001; Rasmussen, 2004). Improving irrigation module should be focused on details such as irrigation amount and frequency, which will significantly help to verify and improve the accuracy of both irrigation and SM predictions.".

(4) Generally, the English writing is Ok. But typo can be observed sometimes, a careful check should be conducted throughout their manuscript.

Response: Thank you for your careful comments. We have modified carefully throughout the revised paper (Line 58, 100, 143, 524).

Line 58: r^2 -> R^2

Line 100: "accumulated precipitation for 10 days" -> "ante-accumulated precipitation over ten days"

Line 143: ~~in China~~

Line 524: "mode" -> "factor"