Hydrological forecasts provide valuable information for agricultural planning and management. This paper has developed a physical, statistical and machine learning model, which is called FarmCan, to forecast crop water deficit at farm scales. One feature of FarmCan is the integration of remote sensing datasets, including soil moisture, root zone soil moisture, precipitation, evapotranspiration and potential evapotranspiration. Through the case study of four farms in Canada. The usefulness of FarmCan is demonstrated.

There are three comments for further improvements of the paper.

Firstly, there is a gap between rainfed farms and needed irrigation. Specifically, four rainfed farms are investigated in this paper (Lines 85 to 86) and the attention is paid to the needed irrigation (Lines 107 to 112). It is noted that rainfed and irrigated systems are two distinct approaches to agricultural production and that irrigation is generally not involved in rainfed systems. Please clarify the issue of needed irrigation in rainfed farms.

Thank you for the thorough review. The study aims to understand whether rainfed farms' natural water supply is generally enough to meet a balanced crop water demand. NI is another name for Irrigation Consumptive Water Use (ICU) for optimized Water Use Efficiency (WUE). With climate change affecting the water supply of rainfed farms, the number of stakeholders now looking into adopting irrigation is rising. Therefore NI information is critical for both irrigated and rainfed farms. I added the explanation in the introduction:

“In irrigated farms, information on NI can help regulate water deficit, achieve higher levels of crop produced per unit of water consumed, and optimize profit while minimizing potential negative environmental effects {Han-M.-2018-01, Chalmers_D.J.-1981-01, Taghavaeian_S.-2020-01}. However, information on the proper quantity of water to feed crops is also essential in rainfed areas with insufficient rainfall to maintain crop yields and soil conditions {Virnodkar_S.S.-2020-01}. As climate change and drought continue to impact crop water stress and food insecurity, rainfed farms in the U.S. and Canada are increasingly adopting irrigation technologies {USDA_2021-01}. For example, the Canadian Ministry of Agriculture is encouraging farmers in Saskatchewan to evaluate their potential NI and apply for irrigation development {Saskatchewan_2022-01}. Knowing the quantity and timings of the water supply gives farmers incentives for more efficient practices, allows them to identify the timing and amount of nutrients, and facilitates more extensive management planning and adaptation strategy goals {White_J.-2020-01, Levidowa_L.-2014-01, IPCC_2013-01, Geerts_S.-2009-01, Taghavaeian_S.-2020-01}.”

This study is the first step toward planning farm management, such as scheduling fertilizer, crop yield assessment, and uncertainty analysis. Even in rainfed farms, we cannot achieve those goals without first knowing how much water is available in real-time and how it circulates about timing and crop schedule. Indeed, one can not manage what one cannot measure. I also mentioned that despite the findings of this study, decisions about how much water should be supplied would need to be made in a more extensive community dialogue within management goals.

Secondly, the irrigation if applied would augment soil moisture and then affect evaporation. In Eq. (1) on Page 7, the needed irrigation is calculated by using evaporation and soil moisture. The calculation seems to mix independent and dependent variables. Specifically, from the perspective of statistical modelling, if x depends on y then it may be improper to regress y against x.

This is a good point. However, it would be difficult to separate how long it takes for the soil to absorb a rain episode or when and at what rate the evaporation begins affecting that particular portion of the soil moisture. Therefore, to address the interaction delay among hydroclimatic factors, we are doing this analysis in 8-day composite periods to take care of those unseen delays among system components and to reduce errors.

Thirdly, the algorithm of FarmCan accounts for 4 phenological stages of crop growth (Lines 179 to 180). It is known that crop water requirements vary by the different stages even under the same background climate (https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/crop-water-requirement). In addition, the analysis involves multiple crops, including soybeans, oats, spring wheat, etc. Please illustrate how the different crops and crop growth stages are considered under the same framework of FarmCan. Given that there are numerous combinations of crops/stages, can the data presented in this paper provide enough samples to train the FarmCan? How are the sampling variability and parametric uncertainty for the FarmCan?

That is a correct statement. However, the scope of the paper is not to count for crop water requirements at each stage. Instead, we use different stages as a benchmark for switching from surface soil to root zone soil moisture to calculate available water for a given crop on the farm on a given day. We assume that the near-real-time PET is the atmospheric demand and indirect indicator of crop water requirement at any stage. Therefore the NI should provide a realistic estimate of the water missing relevant to the stage. Future analysis can also work on various tests to tweak, and bias corrects the NI based on any crop water demand stage.

Below are a few minor comments:

1. Please add a flowchart of the steps of data processing and the dataset involved.

Figure 2 shows a simplified version of the flowchart to summarize the steps taken in each stage to clarify the process.

2. In Fig. 9, it seems the uncertainty ranges are determined by linear regression models. Can the FarmCan quantify the uncertainty by itself?

The FarmCan algorithm uses the observed data as they come in to calculate past weeks' uncertainty to update the training of the RF algorithm for more realistic next week's predictions. Figure 9 presents an overall evaluation of uncertainty for the algorithm. There are many ways to branch out this research. Focusing on uncertainty analyses and more detailed ongoing uncertainty reporting by FarmCan is undoubtedly one of those avenues we will explore in the future.