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Discussions

Interactive comment on "Agro-hydrology and multi temporal high resolution remote sensing: toward an explicit spatial processes calibration" *by* S. Ferrant et al.

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Dear Editor and first Referee,

We would like to thank the first referee for his contribution to improve the quality of this manuscript. The main concern emerging from this review is a need of methodological clarification concerning the initialization of seeding date. Our intention was to set up an accurate methodology to adjust the temporal crop growth dynamic simulated using the agro-hydrological model TNT2 on multi-temporal satellite observations at a catchment scale. The main objective of the manuscript is to evaluate the improvement of such

new calibration step for simulating LAI dynamics and crop yields at the crop field scale and nitrogen fluxes at the watershed scale.

To reach this objective, two situations are compared: a so called "a-priori" situation, i.e. a classic calibration made without remote sensing data; a new calibration method that integrate satellite images series which enable us to fit the simulated LAI profile on observations by resetting seeding dates.

Whereas the crop succession is known for the whole catchment and study period (2006-2010) by crossing the RPG spatial data base (French crop field GIS data base for crop cover identification) and remote sensing images (SPOT, Formosat-2) classification, other agricultural data are only parsimoniously available. It is the case for crop cultivar, seeding dates, fertilization dates and amounts and harvesting dates which have been collected from the farmers within the framework of the Auradé municipality farmer's association enquiry program.

This version of the manuscript describes the resetting methodology of seeding date, but we agree that the "a priori" selection of seeding date is not clearly explained. "A priori" seeding dates were selected on the basis of farmer's annual enquiries. Only crop field owning to a member of this association and located within the municipality area are concerned. Yields are also collected but often correspond to an average yield of several and unidentified crop fields. This data base is not exhaustive: for example, in 2006, only a third of the seeding dates are recorded for the whole municipality area, none of the corresponding crop fields are included in the experimental catchment. In 2007, seeding dates of 18 crop fields among the hundred composing the catchment area are recorded.

Before the availability of satellite images, expert opinion rules were used to fill the gaps of this data base. For one year, each missing seeding date is estimated by using the average seeding date recorded for the crop fields owned by a farmer. If no seeding date is recorded for a crop field belonging to the farmer, the average of recorded seeding dates, computed for the crop type (Wheat or Sunflower) and the year, is used. In this area, recorded winter wheat seeding dates could vary from the beginning of September to the end of November and sometimes even December. Sunflower seeding dates vary from the middle of March to the end of April. This data reconstruction on expert opinion rules aimed at finding appropriate seeding dates in relation to farmer behavior and climatic variables.

The reviewer suggests that we compare optimized seeding dates and actual (recorded in the data base) seeding dates. In 2007 for instance, 8 and 10 seeding dates for respectively winter wheat and sunflower crop field were recorded within the experimental catchment. Four cultivars of wheat (Biensur, Ayave, Quality, Apache) and four cultivars of sunflower (Camarsol, Electra, Countri, Atomic) are mentioned. Only one wheat cultivar (Biensur) is pre-calibrated for STICS crop model whereas three general sunflower cultivars are pre-calibrated: an early, semi early and late varieties. Cultivar parameters could have been optimized based on LAI profile on crop fields where seeding dates and cultivar information exist. Nevertheless, cultivar is missing for a majority of the crop fields. To simplify, we have used one crop cultivar (biensur) for the wheat and one (early cultivar) for the sunflower, and have re-set the seeding date for each crop field to simulate an accurate LAI profile in time. For this example, the average difference between estimated and actual seeding date in 2007 is 20 and 8 days for respectively wheat and sunflower crop. It goes from 1 day to 1 month and 1 to 17 days for respectively wheat and sunflower. Three factors are behind these heterogeneous differences: inappropriate cultivar growth parameters; non accurate detection of emergency period by biased LAI interpolation from remote sensing; uncertainties behind farmer statements which are completed at the end of each year.

We agree with the reviewer that crop growth parameter have a big impact on the estimated seeding dates, but as cultivar information is not available and even often not being subject to calibration in crop models, we have only considered seeding dates as an input parameter to fit LAI profile. Our main intention is to better simulate the

crop growth dynamic in an agro-hydrological model in the focus of simulating water and nitrogen cycles at the catchment scale.

Finally, we agree with the reviewer that the improvement made from the “a priori” situation constructed from this local data base may be more evident by constructing a seeding date scenario based on regional recommendations. It could be done in further applications at larger scale, e.g. by considering the whole Formosat-2 scenes ground coverage.

All these elements will be added in a revised version of the manuscript and integrated in a detailed answer to all referees.

Sylvain Ferrant on behalf of all Co-Authors

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 7689, 2014.