We would like to thank this reviewer for his/her comments and suggestions. We are convinced that incorporating the proposed revisions will significantly improve the quality of the paper. Specific replies to the reviewers questions and comments can be found below (in italic).

Anonymous Referee #2
Received and published: 24 September 2015

Dear Editor and Authors,
I have read the draft article by Biemans et al. closely. My comments are summarized below. Hope some of them are useful for making decision and further revisions.

General comments

The authors applied the LPJmL global hydrological model to four nations in South Asia. They added some new numerical schemes and data to express multiple cropping in LPJmL and quantified irrigation water consumption and withdrawal by season (the wet season called Kharif and the dry season called Rabi), type of crops, and source of water (surface or groundwater). They found the seasonality in irrigation water demand and abstraction is remarkable in the region.
In the Asian Monsoon region, farmers drastically change the type of crops and application of irrigation for periodical wet and dry seasons. Although the practice is common for millennia in Asia, neither systematic datasets nor comprehensive macro-scale hydrological models are yet available, particularly on water use. The work presented here would potentially contribute to this field.
I found the draft is well prepared, but for further clarity, additional information is required at some points. The details are commented below.

Specific comments

Page 7850 Line 28 “Normal onset dates of the monsoon over South Asia are determined by the India Meteorological Department (IMD). . .”: What is the primary factor to determine the onset? Is the factor (e.g. rainfall) consistent between WFDEI and IMD? In other words, is the discrepancy of data between WFDEI and IMD negligible? Another point is that the onset varies year by year. Did the authors use the year-specific onset date in the simulation period or fix throughout the period? If latter is the case, what would be the potential impacts to the results?

The sowing dates were kept constant during the whole simulation period and based on average monsoon onset dates. The IMD bases their determination of onset on a combination of certain rainfall, windspeed and outgoing long wave radiation characteristics. Potentially there is an mismatch between the WFDEI and the IMD year specific monsoon onset dates, but because of the combination of factors it is not straightforward to determine whether there is a mismatch between the WFDEI and the IMD reported onset.
This IMD map was used to determine grid specific input data for the sowing date of kharif crops, and this sowing date is –despite of an eventual mismatch of few days- a major improvement compared to the previous version of the model, with only one cropping period which was not related to timing of monsoon.
We will mention this issue as an uncertainty in the discussion of the revised version of the paper. We will also briefly discuss potential impacts on the results.

Page 7851 Line 21 “represented by three parameters: maximum leaf-area index, maximum harvest index and a parameter that scales leaf-level biomass production to plot level”: What is “plot level”? What does “scale” mean? What kind of “management” is represented by this

parameter? Similarly, perhaps it might be informative for readers to note that the maximum LAI and harvest index represent cropping density and adoption of high-yield crop species respectively.

The calibration procedure of LPJmL was developed by Fader et al. (2010) and applied here. Plot level in this context means the total area of the crop within the gridcell, a plot shares the same climate, soil and landuse. "Scale" means that a yield reduction has been applied to translate from biomass production of individual plants to plot level. Fader (2010) explain this as follows: "The assumption is that intensively managed crop stands (LAImax = 7) have little or no areas with reduced productivity (α–a = 1.0) due e.g. to poor soil conditions or pests and diseases, while such areas are more common in extensively managed crop stands (LAImax = 1; a–a = 0.4)."
We will add a note that the three parameters are related to crop density, crop varieties and the occurrence of poor soils, pest and diseases respectively.

Page 7852 Line 5 "We used 5 year average yield statistics, for 2003-2004 till 2007- 2008": First, the calibration period seems overlapping with the simulation period (page 7848 line 24). If this is the case, note clearly that calibration and validation periods are same in this study, particularly where the performance of simulated crop yield is discussed. Second, "5 year average yield" indicates that the model performance on inter-annual variation of crop yield (i.e. the crop yield response to change in meteo- rological condition) was not validated. Without this, it should be difficult to justify the reliability of comparison of crop yield between with and without irrigation (e.g. Page 7855 Line 17).

We will add a note to clarify that figure 4 reflects the result of a calibration and that there was no separate validation (we do not refer to validation in the text). In this study we compared the multi-year average. We did indeed not validate the crop yields from individual years, which would be a good addition to the study. This is actually done in a second, connected paper (Siderius et al, in review), which specifically focusses on the impact of inter-annual variability. We will added a reference to this paper in the discussion and will shortly highlight what are the consequences. Despite the lack of an inter-annual comparison we do think the current approach justifies the here presented comparison.

Page 7856 Line 26 "Use of residual soil moisture from one season to the other was not incorporated in this way": Another possible factor is abstraction of river water in upstream: simulations separating Kharif/Rabi exclude this factor, hence the estimated surface water availability could be overestimated.

The reviewer is right here, although within the two simulations the effect of upstream abstractions is reflected in downstream availability. Simulating double cropping of a range of crops with different planting dates in a single integrated model run not a feature of the LPJml model, or most global hydrology-vegetation models. We are further developing the model and in a next version we plan to fully integrate a double cropping module, which allows us to relate all withdrawal to source of supply in a totally consistent way.

Figure 5: Would it be possible to add a same graph for water source? It would be helpful (and hopefully interesting) to visualize the seasonal march of dominant water source from surface water to groundwater and vice versa.

An estimate of the seasonality of surface water and groundwater supply per basin is given in figure 7. Unfortunately, model architecture does not yet allow for fully integrated model runs with double cropping and therefore a detailed figure as figure 5 can not yet be provided yet

We are working towards a version that will make this analysis possible. (see also previous comment).