Response to Report #1 by Reviewer #1

The Authors wish to thank the Reviewer for the positive comments acknowledging the revision efforts and for the minor revision proposed. We responded to those as text amendments and references additions and we detail the answer in the following:

1. Line 413-416, Line 547 and Line 556-558,you are indicating the improvement of ERA-Interim/land over ERA-Interim is the combined effect of the GPCP precipitation correction and the land surface model improvements. On the other hand, there is no experimentation results to support.

The improvements are indeed a combined effect of land surface updates and bias correction of precipitation and here the isolated improvements are not analyzed in detail. The GPCP correction is largest in the Tropics as shown by Agustì-Panareda et al. (2010) for Western Africa and Betts et al. (2009) in the Amazon region and much smaller error are for instance over US (Balsamo et al., 2010a), therefore the statement about GPCP is supported. Future research will analyze in more detail the merits of the forcing and land surface model improvements. The references Agustì-Panareda et al. (2010) and Betts et al. (2009) are added to the text.

For example, for latent heat flux, you performed two intermediate versions towards ERA-Interim/Land (i) offline with the TESSEL model; (ii) offline with the HTESSEL model without GPCP corrections. Through the comparison of these results, you can identify the improvement is due to either the model change or the GPCP correction. For the section 3.1.2. river discharge, it is suggested to show the similar results to support your statements in those lines indicated at the beginning of this point.

River discharges are indeed an important verification dataset for assessing model performance of different water cycle components. Performing intermediate re-analysis would permit to attribute some of the improvements but yet the reader may wonder if the improvements are due to a particular set of parameterizations. This is mentioned in the conclusions for future work but the experimental work necessary to answer those questions is not affordable for this paper. A sentence is added in the conclusion to refer to this work that can be addressed in an ongoing EU-funded project.
"The improvement compared to ERA-Interim is the combined effect of the GPCP precipitation correction and the land surface model improvements, and future work will extend the use of river discharge for supporting model development and disentangle the impact of different components (e.g. meteorological forcing and parameterization changes) in the framework of the EU-funded EartH2Observe project."

2. For Figure 14, the description between line 505 and 507

is a bit confusing. It is said that in ERA-Interim most of forests remained too dark.

I assumed that the "darkness" (in Figure 14) refers to the difference between ERA-Interim Albedo and MODIS Albedo (Albedo_Diff= ERAInterim - MODIS). In this case, then the darkness means the lower albedo values in ERA-Interim, when compared to MODIS product. In this case, it seems conflicting with the statement that the forest tend to keep a low albedo while ERA-Interim tends to have a higher albedo not accounting for the openness of many forests. Then, for such statement, you shall mention lightness instead of darkness?

Please clarify this point.

This is reformulated as: “Particularly forests tend to keep a low albedo with snow accumulating under the canopy rather than on it, but in ERA-Interim, forests with snow were specified to be too dark, not accounting for the openness of many forests and ERA-Interim/Land has lighter snow-forest albedos. As albedo is an important component of the surface energy balance, it significantly affects the atmospheric heating and the timing of snowmelt in spring”.

Minor comment:
In Figure 13, in the caption, only the "RMS error" appears in the text, while in the figure, both "RMSE" and "Bias" are there.

Changed accordingly the legend now reads as: “ERA-Interim snow depth RMSE/BIAS (solid/dashed red line) and ERA-Interim/Land snow depth RMSE/BIAS (solid/dashed blue line) with respect to the daily European SYNOP observations at 6UTC. The number of stations with snow is indicated by squares (right y-axis). Model snow depth combines the snow mass and density variables”.

Responses to Report #2 by Reviewer #4

The authors wish to thank the reviewer for the positive comments and for acknowledging the revision efforts. Our response to the specific comments is in red below.

I read the latest revision of the manuscript as well as the response by the authors to the previous round of revisions and was very pleasantly surprised. The manuscript has been substantially improved and is now (almost) ready for publication. The paper is an important contribution to the literature and is now of excellent quality. I appreciate the authors' effort to make such substantial improvements. I only have a few minor comments/suggestions, see below. I do not need to see the manuscript again.

Minor comments:

1) Line 27: Add the term "monthly" after "based on" and break apart the sentence as suggested below. (Otherwise, the "resolution of about 80 km and 3-hourly frequency" could be mis-read as applying to the GPCP data.)

"ERA-Interim/Land is the result of a single 32-year simulation with the latest ECMWF land surface model driven by meteorological forcing from the ERA-Interim atmospheric reanalysis and precipitation adjustments based on monthly GPCP v2.1 (Global Precipitation Climatology Project) observations.

ERA-Interim/Land retains the horizontal resolution of about 80km and 3-hourly frequency of ERA-Interim."

(This is not the most elegant edit, it only serves to illustrate the concern. Feel free to improve the edit.)

Changes as suggested, the new sentence reads as: "ERA-Interim/Land is the result of a single 32-year simulation with the latest ECMWF land surface model driven by meteorological forcing from the ERA-Interim atmospheric reanalysis and precipitation adjustments based on monthly GPCP v2.1 (Global Precipitation Climatology Project). The horizontal resolution is about 80km and the time frequency is 3-hourly.

2) Line 329: Replace "Particularly the use of climatology ...with the Cressman scheme, make ERA-Interim/Land ..." with "Particularly the use in ERA-Interim of climatology...with the Cressman scheme make ERA-Interim/Land ..."

(Add "ERA-Interim" to clarify that the climatology and

Cressman scheme are for ERA-Interim. Omit the comma, which does not seem quite right?)

Changed as suggested.

3) Line 387: Replace "of data assimilation" with "of land surface data assimilation"

Changed as suggested.

4) Line 465: Replace "GPCP bias correction" with "monthly GPCP bias correction"

Changed as suggested.

5) Fig 2: It seems odd that the ice sheets of Greenland and Antarctica are colored in for soil moisture, which should be irrelevant and difficult to estimate under the ice. If those areas are not included the darkest color could be used more efficiently. Similarly, I am wondering whether the snow over the ice sheets simply reflects year-after-year accumulation. If so, the estimates plotted over the ice sheets would not be very useful and should probably be masked, which would also free up a color that could be put to better use.

Soil moisture is defined on all land points. We agree with the remark that soil moisture is difficult to measure below permanent snow but this is not a sufficient reason to mask the values. Usefulness is a difficult criterion to apply if areas shall be masked (high mountains would then probably be in the same category). Similarly for snow.

6) Fig 8: Please give lat/lon coordinates and/or station IDs for the two stations plotted here (in the main text and/or the caption). There are lots of stations in Utah and Washington.

Latitude and longitude have been added. The legend now reads as: “Evolution of volumetric soil moisture for the year 2009 at a site in Utah (latitude 47.000, longitude -118.567, top panel) and Washington (latitude 39.017, longitude -110.167, bottom panel). In-situ observations are in black, ERA-Interim is in red, and ERA-Interim/Land estimates in blue.”

7) Fig 14: Please define "spring". Do you mean "MAM"?

The sentence has been reformulated adding (MAM) after spring for clarification.