

Interactive comment on “Sensitivity of water balance components to environmental changes in a mountainous watershed: uncertainty assessment based on models comparison” by E. Morán-Tejeda et al.

Anonymous Referee #1

Received and published: 9 December 2013

The manuscript presents a modelling study about possible hydrological changes in the future brought about by climate change and land-use changes in northeast Spain. The authors use three climate models (global-regional) that drive two hydrological models under several climate and land-use changes scenarios.

I found the manuscript in general terms clearly written and interesting. I particularly liked the use of several models to highlight the risks of relying in just one simulation with a particular model. In my view the authors focus most strongly on the hydrological,

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somewhat glossing over some of the uncertainties inherent to the climate simulations they have used.

My main concern is related to the regional climate simulations. The most important hydrological variables, such as evaporation, depend non-linearly on the absolute temperature, and not just on the simulated temperature changes. In this study the authors assume that the regional climate models are able to simulate the present climate without biases, and thus the simulated climate changes can be used to drive the hydrological models directly. However, this is not always true, and unfortunately regional and global climate models may display large biases with respect to the observed climate that may attain values of 2–3 K. For precipitation the biases may be even more severe from the physical point of view. The manuscript does not indicate whether or not climate simulations by the regional models are close to the observations. Their validation of the regional simulations is limited to Table 3, showing some correlations between simulations and observations, but it is not clear what Figure 3 is actually displaying.

Figure 3 contains a Taylor diagram, showing the correlation and ratio of variances between observation and simulations. It is not clear to me what this correlations mean. Are they the correlations between the observed and simulated annual cycles of the area-average temperature (and precipitation)? are these the spatial correlations between the mean annual mean temperature fields from observations and simulations?

In any case, this figure does not include the possible bias, i.e. the difference between the mean simulated and mean observed temperature in the present climate. Figure 3 also includes the centred RMS errors- I interpret that for the calculation of the RMS the bias has been eliminated, and I suspect that the authors did so because the bias is large. The manuscript does not include references to a description and analysis of this simulations either, so that the reader cannot assess by themselves whether there biases are large or small. A glimpse into similar simulations (e.g. the project Prudence; Jacob et al. *Climate Change* 81, 31 (2007) strongly suggests that the biases can

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easily be as large as the simulated climate change signal. I would strongly suggest to include a figure showing the model bias for winter and summer, for temperature and for precipitation, for all three models. If the authors deem that this figure may get too loaded with information, an alternative would be to include this information in a table for the climate variables averaged over the spatial domain, although the complex topography may render the spatial averages more difficult to interpret.

The manuscript should also include a discussion about the possible influence of the systematic errors of the regional models on the results achieved here. For instance, if a regional model displays a systematic error of 2 K in the present climate in this region, how robust are the simulated changes in evapo-transpiration? How robust is the simulated changes in the annual cycle of snow-pack, etc.?

The contents of Figure 3 should be much more clearly explained.

Table 1 is also poorly described. Are the numbers in Table 1 the area-average changes between the present climate (which period) and the future period (2021-2050)? Please consider that many readers will later want to have a quick look at the tables and figures and they would like to find this information in the figure/table caption.

Some minor points:

'is related to the increase of wildfires in the Mediterranean region. Specifically in Spain wildfires have experienced a significant increase since the 70s due to climate and land-use changes as demonstrated by Pausas (2004)'

This conclusion cannot be derived from the work of Pausas. Pausas shows that the number of fires is negatively correlated with summer precipitation, but that paper also shows that summer precipitation shows no statistically significant trend in the last decades. Pausas argues that it is reasonable to think that higher temperatures may have contributed to soil dryness and thus to the increase of fires in the last decades. However, in that study no correlation between temperature and number of fires is in-

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dicated, and therefore this conclusion, though plausible, has not been 'demonstrated'. Pausas demonstrates a link between the interannual variations of precipitation and fires, but not a link between climate change and fires.

'Zaragoza and Lleida'. These are the names of these cities in Spanish and Catalan, respectively. It seems to me more logical that, being this a text written in English, the English names should be used (Saragossa and Lerida).

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 11983, 2013.

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