

## ***Interactive comment on “Quantification of hydrologic impacts of climate change in a Mediterranean basin in Sardinia, Italy, through high-resolution simulations” by M. Piras et al.***

**Anonymous Referee #2**

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General comments: The manuscript presents an investigation of climate change impacts for a Mediterranean basin, Rio Mannu, located in Sardinia. The study is based upon a set (four) of GCM-RCM combinations that in turn are used to drive a physically-based hydrological model, tRIBS, for past and future conditions under the A1B emissions scenario. Climate data are spatially and temporally downscaled and bias-corrected using statistical techniques whose skills have been exhaustively demonstrated in previous literature studies.

Overall, the study is well designed and the methodology is scientifically sound. The illustrations are all very high quality, and well organized. The issues discussed in this

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paper should be of interest to the scientific community, and is suitable for HESS. I recommend this manuscript being accepted with some minor/moderate revisions. Most of the issues that I have just need a bit clarification, with the first point listed below requiring the presentation of few additional simulation results.

Specific comments: 1. I agree with authors that a reliable assessment of climate change impacts, especially in the Mediterranean area, depends on the use of high-resolution information. In this sense, the novelty of the paper stems from the implementation of a downscaling procedure that generates an atmospheric forcing term on an hourly time step and over different points of the catchment. The improvement achieved with this setup, however, is not completely disclosed throughout the manuscript. Authors should therefore define a sort of base line simulation driving the hydrological model with spatially coarser (e.g., one point of the original RCM grid or a weighted average of the contributing points) and temporally (daily) constant climate information. To this aim, authors could arbitrary select one member of the ensemble and make a one-to-one (coarse vs high-resolution setup) comparison. This extra analysis will better highlight the value of the adopted methodology in reproducing changes in the different aspects of the hydrological response of the basin. This additional effort will eventually convey a stronger message to the scientific community.

2. I found the analysis over the different sub-basins quite interesting. Some additional information, however, could improve the discussion. It is important to define the points of the atmospheric grid contributing to the response of each sub-basin. Indeed, considering their small size some of them are probably driven by the same atmospheric forcing term. In so doing, authors will be able to better distinguish their response in terms of soil properties and atmospheric variations. Moreover, to acknowledge the lack of the buffer effect due to a deeper groundwater table, it is necessary to inform the reader about the range of water table depth within the catchment and between the different sub-basins.

3. How do authors explain the consistent decrease in Q over winter months shown

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in Fig.6a without a significant decrease (increase) in P (ETr) illustrated in Fig. 4a (Fig.12a)?

4. The discussion around the groundwater dynamics seems a bit too short. Additional plots, showing for instance variations in the seasonal groundwater head values, could be useful and shed more lights on the involved processes.

5. In a similar vein to the previous comment, vegetation effect seems completely disregarded by authors. Some comments on this point will be useful as well.

Technical corrections:

- Please replace throughout the text “real evapotranspiration” with “actual evapotranspiration”
- Groundwater exfiltration and perched return flow seem more related to the conceptualization used in the model. Please try to define them (at least the first time in the text) in a more understandable way for the reader.
- Please check the y-label in Fig. 12a
- Please check “Delrieu” citation.

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