

Interactive comment on “Distributed hydrologic modeling of a sparsely-monitored basin in Sardinia, Italy, through hydrometeorological downscaling” by G. Mascaro et al.

Anonymous Referee #1

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GENERAL COMMENTS The authors present a novel methodology for calibration of a complex distributed rainfall runoff model with sparse data. The methodology involves spatio-temporal downscaling of rainfall and potential evapotranspiration fields. Their emphasis is on hydrological modelling in regions where historical records of rainfall and discharge are scarce and need an extension through rainfall-runoff modelling, with the ultimate goal of climate change analyses in mind. The authors discuss methodological issues related to the downscaling procedures and to the calibration of the rainfall-runoff model and present an application to the Rio Mannu basin in Sardinia.

The topic is relevant for the audience of Hydrology and Earth System Science, the

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objectives are clearly identified, the methodology for the analysis is adequate and the conclusions are relevant and correctly supported by the results and discussion. The rainfall and evapotranspiration downscaling models show excellent behaviour in reproducing observed statistics and there is a reasonably good agreement between the ensemble simulations and the observed discharge in the case study. Therefore, I believe the paper deserves publication in Hydrology and Earth System Science.

SPECIFIC COMMENTS I also think that there are several aspects of the paper that deserve a deeper discussion, such as the following:

a) On page 8, line 17 the authors quote a mean annual potential evapotranspiration (ET₀) of 750 mm for the basin, located in Sardinia. This figure is very low for Mediterranean climate, as is shown by the daily values of ET₀ shown in Fig 7b. These values range from 2 to 6 mm/day while the average daily value that corresponds to the figure of 750 mm/yr is only 2 mm/day.

b) On page 9, lines 12 to 14, the authors discuss the small differences in vegetation cover in the basin from 1954 to 2006. With 48% of agricultural land, I would expect that irrigation development had somehow transformed the vegetation cover (and the hydrologic behaviour) in the region during that period. Irrigation is later invoked to explain the discrepancy between model results and observations during low flows (page 22, line 17). If irrigation is present in the basin, a brief discussion of this issue is advisable.

c) On page 12, lines 18-19: results obtained from the downscaling procedure at 45 min resolution are resampled at 1 hour resolution. This is strange. If rainfall runoff simulation was going to be performed at 1 hr resolution, why not select this resolution in the downscaling, dividing the 6 hr period in 6 steps instead of 8? On the other hand, if the downscaling procedure could not be adapted to 1 hr resolution, why not use the 45 min time step in hydrological modelling?

d) Page 19, lines 15-19. Values of RMSE and bias for the difference between MAPO and MAPD are very large compared to the mean value. Mean Annual Precipitation is

680 mm/yr, which corresponds to around 2 mm/day. The values of RMSE are around twice the average value of the signal, while the bias is around 50% of the signal. This is hardly a "slight" underestimation.

e) Page 21, lines 16-18. I agree with the positive evaluation of the fact that the model captured individual peaks measured by the Italian Hydrographic Service. However, the utility of the model to analyze flood frequency under climate change is conditioned to the hypothesis of stationarity of the rainfall process, because the downscaling procedure derived from data at the end of the 20th century was applied to the period 1930-32.

TECHNICAL CORRECTION From the formal standpoint, the paper is very well written, correctly organized and adequately illustrated with tables and figures. Figures 9 and 10 could benefit from the use of colours, if possible. Although I am not a native English speaker, I believe the following expression should be corrected:

On page 23, line 10, This holds promising for a subsequent..... (holds promise?).

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