Hydrol. Earth Syst. Sci. Discuss., 11, C2715–C2718, 2014
www.hydrol-earth-syst-sci-discuss.net/11/C2715/2014/

Hydrology and Earth System Sciences
Discussions
Open Access

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 #1

Received and published: 25 July 2014

The paper is well written, evaluating the climate change impacts on water resources in the Mediterranean basin is a challenging tasks as noted by several authors before. The introduction is giving a clear overview of the proposed approach; however recent work in the same area with very similar methods should be acknowledged and discussed: Such as Camici et al., 2013, who considered stochastic rainfall generators for catchments located in central Italy or Tramblay et al. 2013 who evaluated high-resolution climate model outputs for hydrological impacts studies in semi-arid conditions. My main problem with the manuscript of Piras et al. is that it lacks validation of the different steps of the modelling chain. These days, a wealth of papers are published about

the hydrological impacts of climate change, however prior to make projections there is a need to ensure that the methods are robust and able to provide projections with some skills and the associated uncertainty. The only uncertainty that is taken into account in the present work is the climate change signal, by using different climate models and different scenarios. What about the uncertainties at the different steps of their quite complex downscaling approach? And the hydrological model ?

I have several major concerns about the manuscript, which preclude to my opinion its publication without a major revision:

1- The observed data is not presented in the paper. The reader can find page 8502 line 5 that "The procedure was calibrated in the RMB using meteorological data observed in one station over 1995–2010". Which station? What parameters are recorded? Are there rain gauges in the catchment with available data? Or the authors rely solely on E-OBS ? Is there discharge data recorded and for what time period? In addition, what is the relevance of the E-OBS dataset in south Sardinia? Are there enough stations in E-OBS covering Sardinia, or E-OBS data in that area is pure interpolation, as in several parts of southern Europe with low density monitoring networks?

2- In Mascaro et al. (2013a), one could read that the discharge data is available only for the years 1925–1935: the year 1930 was selected for calibration, the years 1931 and 1932 for validation. This is not sufficient to validate the hydrological model in a robust way to conduct a study of the projected climate change impacts: The hydrological model is not evaluated during the reference period 1971-2000. The authors are using a "physically" based model, however there is no guarantee that a validation on two years (1931 and 1932) will ensure the stability of the results over long time period (30years). In addition, all "physically-based" models behave conceptually at the grid scale, therefore it is still required to validate such models. In Refsgaard et al., 2014 are presented several guidelines to evaluate the hydrological impacts of climate change, in particular the need of long data series to validate the models on contrasted climate periods.

3- The authors preformed a large scale bias correction (section 3.1.2) and then a local bias correction with a stochastic generator of multiplicative multifractal cascades (section 3.1.3). The latter downscaling approach was calibrated in the previous study of Mascaro et al. 2013a over the period 1986-1996 in a coarse (104x104km) spatial domain. Is this calibration valid for the catchment of interest? What about the validation of such an approach, and the stationarity assumption of bias correction over different time periods? The strong assumption behind bias correction is that model bias is stationary in time. Maraun 2012 showed with ENSEMBLES RCM runs that the precipitation bias is stationary for most parts of Europe, but strongly affected by variability in arid and semi-arid regions. Tramblay et al., 2013 also failed to validate a daily quantile-mapping approach of bias correction under semi-arid conditions.

References:

Camici, S., Brocca, L., Melone, F., Moramarco, T.,2013: Impact of climate change on flood frequency using different climate models and downscaling approaches. Journal of Hydrologic Engineering, in press, doi:10.1061/(ASCE)HE.1943-5584.0000959. http://dx.doi.org/10.1061/(ASCE)HE.1943-5584.0000959.

Maraun, D., 2012: Non stationarities of regional climate model biases in European seasonal mean temperature and precipitation sums, Geophys. Res. Lett., 39, L06706, doi:10.1029/2012GL051210.

Refsgaard J.C., H. Madsen, V. Andréassian, K. Arnbjerg-Nielsen, T.A. Davidson, M. Drews, D. Hamilton, E. Jeppesen, E. Kjellström, J.E. Olesen, T.O. Sonnenborg, D. Trolle, P. Willems, J.H. Christensen, 2014 : A framework for testing the ability of models to project climate change and its impacts. Climatic Change, 122, 271–282.

Tramblay Y., Ruelland D., Somot S., Bouaicha R., Servat E., 2013: High-resolution Med-CORDEX regional climate model simulations for hydrological impact studies: a first evaluation of the ALADIN-Climate model in Morocco. Hydrology and Earth System Sciences 17, 3721-3739 http://dx.doi.org/10.5194/hess-17-3721-2013

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 8493, 2014.