

Interactive comment on “Comparing dynamical, stochastic and combined downscaling approaches – lessons from a case study in the Mediterranean region” by N. Guyennon et al.

Anonymous Referee #2

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This paper compare three different methods to downscale GCM data over the southern part of Italia. The first method is a dynamical downscaling method based on a regional model. The second method is based on statistical downscaling method and the last one is a combination of the dynamical and the statistical methods. This study sheds light on the comparison between different downscaling techniques but I am not convince by the interest since there is no comparison with other new methods that can be better than the methods used here. Also, I do not understand how the authors compare the dynamical method, which is independent to the observations, to the statistical method that is corrected by the observations. I consider that the following comments addressed

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need to be clarify before publishing this paper.

Major comments : 1- I am not convinced whether it is valuable to compare these three methods. In fact, there are so many different methods to downscale that one can be easily overwhelmed by the sheer range of possibilities. It would be nice to provide some contextual information indicating where do your methods fit within this large number of existing methods. Related with the point raised above, the authors must shown objectively without ambiguities the interest of this study. There is no information in the current version of the manuscript that allows a fair and objective comparison of this approach with other techniques. A comparison with other downscaling approaches, such as stochastic weather generation or the CDF-transform method, that are freely available in the net, should be done.

2- The authors apply the quantile matching method directly. It should be done in two steps : a learning period to calibrate then a projection or validation period. Moreover, the quantile matching method used here is not really a downscaling method but more a correction method. So the values from DD are corrected by the observations for the same period, whereas the DD method is independent from the observations. So this seems difficult to compare these two products.

Minor comments: Abstract p9848, l27, these sentences should be in the introduction section

P9850, l7: “In this context...”. The originality of this study is not clear in relation to previous studies. Is it only the study area ?

p9852, l10. You mean 6h accumulated precipitation and temperature every 6h ?

p9852, l24. Following the constraints associated with the method, a discussion on the ability to study extreme events using the Quantile matching method is necessary here.

P9854, l12 “The GCM ...”. Please clarify, do you mean that it is reanalysis ?

P9858, l3: The temperature evolution of the DD (2) seems to be strongly correlated

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to the temperature evolution provided by the GCM (1). The effect of the downscaling seems to be only in term of bias. Can you comment this result. Do you consider the regional domain large enough to evolve independently of the large scale forcing ?

P9858, l12: For the section 3.1. Do you apply the quantile matching method for the entire period, before performing these scores ? In that case, it is not correct to compare a method corrected from the observation to the DD without correction. To make this kind of comparison, the authors should distinguish two periods for the SD method. The first period is the learning period and the second one, the validation period (without information about the observations). In this section, I consider feasible only the comparison between (1) and (2) or between (3) and (4).

P9860, The results for the 4 methods are strongly correlated. I understand for the SD but I am surprised for the DD. Moreover, from these results, it seems that the tendency over this area is only explained by the large scale forcing and is not offset by the regional modelling. Can you comment these two points ?

P9863: l 3 How to interpret the tendency observed in Fig. 6 for precipitation in the GCM and the Sen's slope closed to 0 in Fig. 8 second line ?

P9863: l17 How do you explain the impact of the DD in precipitation without significant modulation regarding temperature ?

P9864: The third paragraph at the beginning of the discussion section should be moved to the introduction section. This discussion section is too long given its interest. The authors should be more concise.

Figures: Fig 1: The indications on the spatial scale are oversimplified. The SD is based on local observations, how do you estimate the associated spatial scale ?

Fig 6 and Fig 7: It is difficult to distinguish the lines, please use different colours.

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