REPLY TO REFEREE 3

This paper describes the structure and performance of an open tool developed by the authors to complement and extend climatological time series based on statistical downscaling of reanalysis/GCM data. It could contribute substantially to climatological studies especially on statistical properties of climatic variables at stations subject to localized effects. My comments are as follows.

1. Since selection of appropriate predictors is crucial to acquire the best estimation, it is desirable to state more specific and systematic methodology to select predictors from numerous meteorological variables in the reanalysis/GCM dataset at lines 186-188 and lines 341-343.

The number and variety of scientific questions that can be addressed through downscaling is considerable. This work aims to facilitate the utilization of analogue downscaling by potential users, although the systematic selection of predictors may prove challenging. As a general principle, the predictor should be one of the main forcing fields of the local variable; however, we refrain from providing guidance to avoid influencing the research process.

Anyway, following your suggestion we have modified the sentence: "After selecting a predictor variable that is expected to have a strong relationship to the predictand variable, it is necessary to choose a predictor field domain that can identify relevant synoptic patterns for the study area."

To:

"After selecting a predictor variable that is expected to have a strong relationship to the predictand variable, **for instance its main large-scale forcing field, and that is relevant to the proposed scientific question,** it is necessary to choose a predictor field domain that can identify relevant synoptic patterns for the study area."

2. Since RASCAL is a downscaling tool of reanalysis/GCM data, I think its strength comparing to existing downscaling methods should be clarified rather than describing improvement from the reanalysis data in detail (in conclusions for example).

We think the main advantage of using RASCAL is that it is fully documented, tested and publicly available It is therefore possible that this will facilitate the learning curve of future users or encourage the utilization of this technique among those with less developed programming abilities. The following paragraph sustents this idea

"This work introduces and explains RASCAL v1.0 (Reconstruction by AnalogS of ClimatologicAL time series), an open-source tool for climatological time series reconstruction and extension using ESD. The primary goal of RASCAL is to promote and accelerate rigorous climate research in regions where surface meteorological observations are insufficient for climate analysis and where relevant regional and local meteorological processes can only be captured through in-situ observations. RASCAL could prove highly

3. To evaluate the real performance of the estimation model, observed data used for model validation should be excluded from model calibration. (For example, by splitting the observed period into calibration and validation periods)

4. There are many options (closest, average, quantile) to adjust estimation to observation data. In such case, I think robustness of the selected option should be tested to make sure if it is valid only for the calibration data. (For example, again, by splitting the observed period into two or several periods and comparing the selected option)

5. For temperature reanalysis data for the four stations in chapter 5, are they corrected according to difference of elevation? It seems simple elevation correction using typical adiabatic lapse rate gives quite good estimation. The reconstructed data should be compared to the corrected reanalysis data.

representation of the observation distributions, and the seasonal cycle (Figures 8-10) is also closer to the observations.

We specified this correction to the reanalysis data in lines 306-307:

"To compare its performance against the reanalysis, the temperature data of the reanalysis was corrected with the elevation using the environmental lapse rate (−6.5 $^\circ$C/Km)"

The followings are minor corrections for specific words or phrases.

6. L16-17: "thus…biases" is repeated.

The sentence was corrected. This sentence was erased.

7. L56-57: "From a few hundreds of…to several thousand" According to Fig.1a, several thousand (around 7,000) at the end of the nineteenth century and several tens of thousand (around 30,000) at the end of the twentieth century.

The sentence was corrected.

8. L129: Title of Section 3.1 appears here, but Section 3.2 doesn't exist.

Solved. All content has been consolidated into a single section, designated as section 2, as previous section 2 has been incorporated into section 1.

9. L218: "In this method is possible" > "In this method it is possible"?

The sentence was corrected.

10. L219: "The the number of" > "The number of"?

The sentence was corrected.

11. L321: "sumarized" > "summarized"

The sentence was corrected.

12. L322-323 and L333: "observations of precipitation and temperature since 1893" and "Observations…available since 1948" are confusing as explanations of the data period of Retino station.

You are right, we changed the sentence from:

"Observations have been available at Navacerrada station since 1946. This station is located at 1888 m.a.s.l. and has one of the longest meteorological records for studying mountain meteorology in the world. The whole region has remained practically unchanged since then, making it a valuable resource. In contrast, the Retiro station is located in the heart of the city of Madrid. Observations of this station have been available since 1948. The city has undergone significant growth, particularly since the 1960s."

To:

"Observations have been available at Navacerrada station since 1946. The whole region has remained practically unchanged since then, making it a valuable resource. In contrast, the Retiro station is located in the heart of the city of Madrid, which has undergone significant growth, particularly since the 1960s."

13. L389: "ahow" > "show"

The sentence was corrected.

14. Table 1: It is better to change the order to S, N, C, R according to the order in Figs. 4-10.

The sentence was corrected.

15. Fig.4, Fig.5, Fig.6 captions: "a, d, g, j, m" > "a, d, g, j", "b, e, h, k, n" > "b, e, h, k", "c, f, i, l, o" > "c, f, i, l"

The sentence was corrected.

16. Fig.7, Fig.8, Fig.9, Fig.10 captions: "a, b, c, d, e" > "a, b, c, d", "f, g, h, I, j" > "e, f, g, h", "k, l, m, n, o" > "I, j, k, l"

The sentence was corrected.