Dear Reviewer,

We wish to thank you for the very constructive comments and for the positive opinion on our manuscript. The points which have been raised gave us the opportunity to discuss in deeper detail some features of the downscaling method, which we didn't examine in depth in the previous version.

The detailed answers to your comments are reported below in bold italic.

Best regards,
Silvia Terzago and co-authors

Reviewer #1

"The paper presents the application of a precipitation downscaling technique for climatological purposes. It is based on the Rainfall Filtered AutoRegressive Model (RainFARM). The rainfall downscaling algorithm (RaiFARM) is modified in order to account for realistic precipitation patterns generated by complex topography. The conclusions of the work are interesting, and the topic is suitable for publication in Natural Hazard and Hearth System Science. The paper is well written and clear. The improvement of the methodology proposed here allows for applying the RainFARM approach also to climatological predictions. It would be interesting to see how the modified RainFARM behaves in space-time."

We thank the reviewer for his very positive comments. His request to further investigate the behavior of the method in space and time has led us to introduce a small improvement in the downscaling procedure, using Gaussian (instead of constant) weights for the smoothing step discussed in section 3.1. In fact, this modification provides a better agreement in terms of spatial power spectra between the downscaled fields and the original reference fields.
In order to highlight the performance of the method in space we enclose in fig. R01 a comparison of the spatial power spectra for the perfect model experiment discussed in section 4.1. As shown in the figure, the spatial power spectra reconstructed at small scales with the RainFARM method agree well with those of the reference fine-scale data, particularly when the modified method discussed in this manuscript is used. The modified method appears to be able to capture an additional orographic signature in the spatial spectrum which the original method, by definition, could not represent.
For illustration we also enclose, in fig. R02, a comparison of spatial snapshots of the downscaled fields with the original data for a specific time frame (05 Jan 1980, as an example). This comparison shows qualitatively how the modification suggested in this paper, which is able (see figs. 2f-g in the manuscript) to reduce remarkably the biases in the climatology of precipitation, does not visibly affect the individual downscaled fields at a given instant in time. The figure also illustrates the advantage of using a smoothing kernel as discussed in section 3.1, compared to precipitation conservation based on box-averages which shows box-like artefacts (Fig. R02b).

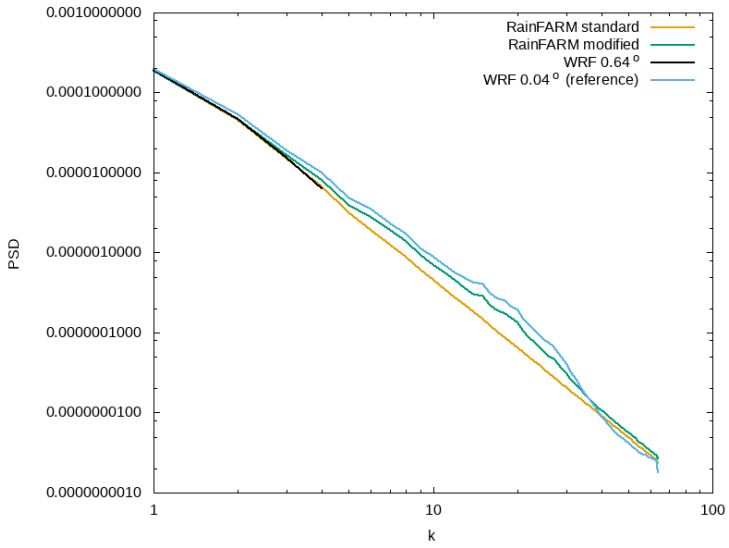

Figure R01. Spatial power spectra of the WRF precipitation fields. Precipitation downscaled with the standard RainFARM (orange), with the modified RainFARM (green), the reference (cyan), and the large-scale aggregated WRF field (black).

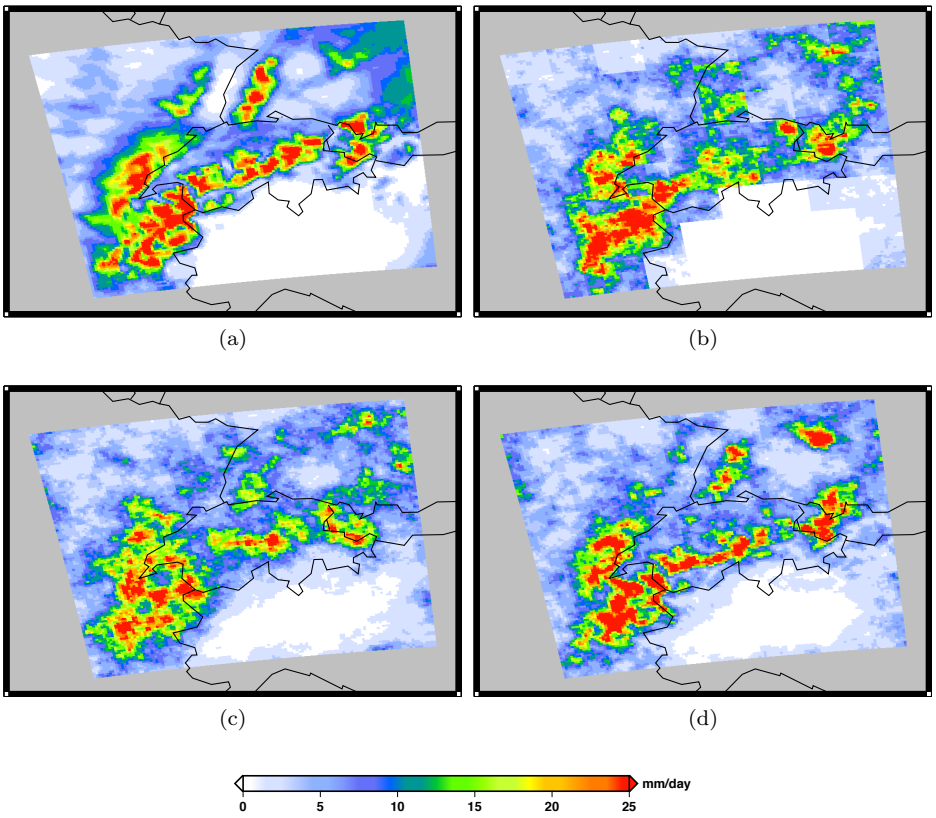

Figure R02. Snapshots of precipitation fields at a specific date (5 Jan 1980) for a) WRF reference at 0.04° spatial resolution; downscaled fields with b) the standard RainFARM method with box-averaging; c) the standard RainFARM method with gaussian smoothing; d) the modified RainFARM method with improved climatology discussed in the manuscript.