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One Dimensional Satellite-based Precipitation Products Downscaling

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The objective of this study is to develop a framework for statistical downscaling for satellite-based precipitation estimate (SPE) products using the Vienna Enhanced Resolution Analysis (VERA) method. Precipitation measurements are traditionally performed using rain-gauges. Not only these gauges need effort for data collection, but also they may only tell us precipitation information within a certain radius around the measurement location and moreover are irregular in space. With a network of rain-gauges, the precipitation of a total area of interest can be calculated using different geospatial interpolation techniques. Often interpolated maps are not correct and do not provide the actual spatial variation of precipitation. SPEs are not as accurate as gauges or radar rainfall but have the advantage of a regular spatio-temporal resolution over land and ocean, which is particularly important over complex terrain and sparsely populated areas.
The idea of including additional information to measurement values goes together with the interpolation of irregularly distributed and sparse data to a dense regular grid. The method used is a constrained least squares fitting method, a spline method. Then the cost functions with first and second order derivatives are used as a constraint for the smoothness of the interpolated field. The observed values are interpolated to grid points together with the incorporation of the satellite measurements over the field.
The method we used, related to the fingerprint technique, developed by Steinacker et al. (2006), is a numerical model-independent way of downscaling irregularly distributed observational data. The constraint is that first, the values of downscaled analysis must exactly fit the satellite data and second the spatial distribution is as smooth as possible.

References

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