High-resolution Spatial Estimates of Precipitation in Equatorial Americas by Blending Station and Satellite Data

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Abstract. Droughts and flood management require accurate estimates of precipitation in space and time. However, in regions with complicated terrain, such as the equatorial Americas, this data is sparse, often in valleys, and of poor quality - consequently, extreme events are poorly represented. Satellite derived rainfall data is an attractive alternative in such regions and are being widely used. But they too suffer from problems such as underestimation of extreme events, as they are dependent on retrieval algorithms used in the process. Thus, it seems appropriate to blend satellite-derived rainfall data with this extensive spatial coverage with station observed precipitation with better representation of extremes, in order to provide a robust estimate of precipitation – motivating this research. We propose two methods for blending – (i) a traditional parameter approached using Kriging and (ii) a nonparametric method based on local polynomial functional estimation. First, each station observation is assigned to the nearest grid of the satellite estimates and the difference between them is considered the 'observed error' field. The two methods mentioned above are fitted to this observed error field. Thus, at any grid point (whether an observation location or not) the models are used to estimate the 'error' which is then added to the satellite estimate to obtain a 'blended' estimate. Covariates such as latitude, longitude, and elevation are used in the spatial estimation models. We demonstrate these methods by applying them to monthly average precipitation fields from satellite and station observations during 2009. The models are validated in a cross validated mode and subsequently applied to obtain blended precipitation estimates. Their ability to capture extremes is also probed. These blended methods may be used in providing a more accurate climatology. They also have the potential for use in providing daily blended precipitation estimates.

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