

**AN ABSTRACT OF A DISSERTATION**  
**TRANSFER OF UNCERTAINTY OF SPACE-BORNE HIGH**  
**RESOLUTION RAINFALL PRODUCTS**  
**AT UNGAUGED REGIONS**

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Hydrologically relevant characteristics of high resolution (~ 0.25 degree, 3 hourly) satellite rainfall uncertainty were derived as a function of season and location using a six year (2002-2007) archive of National Aeronautics and Space Administration (NASA)'s Tropical Rainfall Measuring Mission (TRMM) Multi-satellite Precipitation Analysis (TMPA) precipitation data. The Next Generation Radar (NEXRAD) Stage IV rainfall data over the continental United States was used as ground validation (GV) data.

A geostatistical mapping scheme was developed and tested for transfer (i.e., spatial interpolation) of uncertainty information from GV regions to the vast non-GV regions by leveraging the error characterization work carried out in the earlier step. The open question explored here was, "If 'error' is defined on the basis of independent ground validation (GV) data, how are error metrics estimated for a satellite rainfall data product without the need for much extensive GV data?" After a quantitative analysis of the spatial and temporal structure of the satellite rainfall uncertainty, a proof-of-concept geostatistical mapping scheme (based on the kriging method) was evaluated. The idea was to understand how realistic the idea of 'transfer' is for the GPM era. It was found that it was indeed technically possible to transfer error metrics from a gauged to an ungauged location for certain error metrics and that a regionalized error metric scheme for GPM may be possible. The uncertainty transfer scheme based on a commonly used kriging method (ordinary kriging) was then assessed further at various timescales (climatologic, seasonal, monthly and weekly), and as a function of the density of GV coverage.

The results indicated that if a transfer scheme for estimating uncertainty metrics was finer than seasonal scale (ranging from 3-6 hourly to weekly-monthly), the effectiveness for uncertainty transfer worsened significantly. Next, a comprehensive assessment of different kriging methods for spatial transfer (interpolation) of error metrics was performed. Three kriging methods for spatial interpolation are compared, which are: ordinary kriging (OK), indicator kriging (IK) and disjunctive kriging (DK). Additional comparison with the simple inverse distance weighting (IDW) method was also performed to quantify the added benefit (if any) of using geostatistical methods. The overall performance ranking of the kriging methods was found to be as follows: OK=DK > IDW > IK. Lastly, various metrics of satellite rainfall uncertainty were identified for two large continental landmasses that share many similar Köppen climate zones, United States and Australia. The dependence of uncertainty as a function of gauge density was then investigated. The investigation revealed that only the first and second ordered moments of error are most amenable to a Köppen-type climate type classification in different continental landmasses.