**UNIVERSITY OF THE PHILIPPINES**

**Master of Science in Meteorology**

**Archie I. Veloria**

***Inter-relationship between ground and satellite precipitation measurements in the Philippines***

Thesis Adviser:

**Gay Jane P. Perez, Ph.D.**

Thesis Co-adviser:

**Giovanni A. Tapang, Ph.D.**

**Institute of Environmental Science and Meteorology**

**University of the Philippines Diliman**

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## ABSTRACT

### INTER-RELATIONSHIP BETWEEN GROUND AND SATELLITE PRECIPITATION MEASUREMENTS IN THE PHILIPPINES

**Archie Ilarina Veloria**

Situated in the tropics, the Philippines is an archipelago that receives huge amount of precipitation that varies significantly with the season and location. However, due to sparsely distributed synoptic stations in the country, representation of precipitation is inadequate. Thus, this study analyzed the inter-relationship between available ground and satellite-based measurements in order to better represent occurrences of precipitation in the country.

The study utilized ground measurements from synoptic stations managed by PAGASA and rain gauges installed by DOST-ASTI and satellite-derived precipitation products from TRMM and GPM. Comparison between station and satellite precipitation measurements show that these data agree well at the monthly timescale. Daily satellite products are prone to ground measurement mismatch even at different precipitation intervals. Furthermore, GPM improves on the bias and mean absolute error of its predecessor TRMM.

Interpolation and iterative method was done on station measurements to demonstrate if interpolated precipitation from station data alone can represent precipitation in the country. Results show that the interpolated precipitation from synoptic stations agrees well with TRMM measurements over Luzon and Visayas. However, significant differences between the interpolated precipitation and TRMM were found in Mindanao during the months of November to March. This difference may be caused by the sparse synoptic stations in Mindanao having an average minimum distance of 1.093° (approx. 110 kilometers) between stations.

Precipitation data from a dense network of rain gauges were then used

to complement synoptic measurements. Comparing the two, results showed that as the rain gauge is situated farther from the synoptic station, the agreement between their measurements decreases. The opposite is true for rain gauges located near the synoptic station. Because of this relationship, inverse distance weighting (IDW) was done to combine rain gauge measurements to represent precipitation in a 0.1° cell. IDW values were found to correlate well (r = 0.58 to 0.97) with the overlapping synoptic station measurements inside the cell.

The IDW values of precipitation were blended with GPM data through regression kriging. The blended product showed least difference when compared to GPM during the months of February to May. Moreover, higher precipitation values (with respect to GPM) were observed from the blended product on places where dense rain gauges are situated. In contrast, lower precipitation values (with respect to GPM) were observed from the blended product on places of higher altitude.

Understanding the relationship of ground and satellite-derived measurements is the key to the ability to combine these measurements and formulate a technique for generating a time series of comprehensive and consistent precipitation data for the entire country. Such data are needed for many applications including drought, flooding and water availability studies. Various interpolation, regression and data fusion techniques were used to create maps of candidate data sets that were evaluated through comparative analysis. This study shows some promising results but the relatively poor correlations suggests a lot of noise in the data that may be attributed to errors in the retrieval of precipitation from satellite data or improper maintenance of station instruments or rain gauges.