ABSTRACT
RAINFALL ESTIMATES FROM MODERATE RESOLUTION IMAGING SPECTRORADIOMETER (MODIS) CLOUD PRODUCTS

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This study investigates the viability of Moderate Resolution Imaging Spectroradiometer (MODIS) Cloud Products (MOD06) to estimate rainfall in the Philippines. Satellite rainfall retrievals, like the Tropical Rainfall Measuring Mission (TRMM) estimates, are conventionally obtained using microwave and infrared bands. This study utilizes visible and infrared bands-derived cloud properties in retrieving rainfall estimates such as [1] rain or no rain, [2] rainfall amount and [3] rainfall intensity. Clouds are classified according to height (low, middle or high) and depth using cloud top pressure (CTP) and cloud optical thickness (COT), respectively. The classified clouds are categorized as raining or non-raining. TRMM 3B42 precipitation estimates are used to identify raining and non-raining pixels. With respect to automatic weather station (AWS) rainfall dataset, skills are assessed using standard dichotomous evaluation parameters with the following results: Probability of detection - *POD*MODIS = 0.30 & *POD*TRMM = 0.28; Probability of false detection - *POFD*MODIS = 0.11 & *POFD*TRMM = 0.05; False alarm ratio - *FAR*MODIS = 0.56 & *FAR*TRMM = 0.44; Bias index - *BI*MODIS = 0.67 & *BI*TRMM = 0.51; Critical success index - *CSI*MODIS = 0.22 & *CSI*TRMM = 0.23; Percentage corrects - *PC*MODIS = 0.76 & *PC*TRMM = 0.83. MODIS cloud effective radius, cloud water path, cloud top temperature and COT are utilized to create a linear regression model that would approximate rainfall amount with respect to AWS rainfall data as ground-truth. Rainfall estimates from the TRMM 3B42 product are also evaluated using the same data set from AWS. The R2, correlation (*Cor*) and RMSE scores are: *R2*MODIS = 0.11 & *R2*TRMM = 0.09; *Cor*MODIS = 0.33 & *Cor*TRMM = 0.30; *RMSE*MODIS = 4.30 mm & *RMSE*TRMM = 3.90 mm. Using the MODIS rain model, rainfall maps are made and evaluated with respect to AWS based on the rainfall intensity classification (heavy, moderate, light) of the Philippine Atmospheric, Geophysical and Space Administration (PAGASA). The same evaluation is done to the Multifunctional Transport Satellite infrared channel 1 (MTSAT IR1) rainfall intensity classification which is based on brightness temperature thresholds. The overall accuracy (*OA*) and kappa (*k*) are: *OA*MODIS = 60 & *OA*TRMM = 56; *k*MODIS = 0.14 & *k*TRMM = 0.11. TRMM performs better than MODIS in most of the dichotomous evaluation parameters and has lower RMSE. However, MODIS has superior R-square and correlation. The rainfall intensity classification of MODIS has better overall accuracy and kappa compared to MTSAT IR1. The study successfully demonstrates that MOD06 is a viable source of rainfall estimates in the Philippines. The potential of optical and infrared channels to estimate rainfall should be extended to other and future satellite instruments.