A TIME LAG MODEL TO ESTIMATE RAINFALL RATE BASED ON GOES DATA

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A time lag model is proposed to estimate rainfall rates based on multichannel observations obtained from GOES-12. Weather radar data over Puerto Rico were used to calibrate the model. The radar is a WSR-88D unit and is located in Cayey, PR (18.12°N, 66.08°W, and 886.63 m elevation). The frequency is 2.7 GHz, and operates in S-band with 10 cm wavelength. The maximum radial distance is 462 km, and the radar scans the entire island every 6 minutes. We show that there is an inverse piecewise linear relationship between radar reflectivity and brightness temperature from thermal channel (10.7 μm). We also shown that brightness temperature from water vapor channel (6.7 μm), and brightness temperature from differences between these two channels exhibited also an inverse piecewise linear relationships with radar reflectivity. Thus, reflectivity increases as the brightness temperature decreases. On the other hand, radar reflectivity and visible reflectance (0.65 μm) exhibit a piecewise linear relationship and radar reflectivity increases as the visible reflectance increases. The Lindsey-Grasso algorithm was implemented to compute the albedo for the near infrared channel (3.9 μm). We implemented this algorithm and found that small albedo values correspond to large effective radius and consequently high rainfall rate. We found empirical relationships that are in agreement with the lookup tables generated by Lindsey and Grasso (2008). Thus for small albedo the rain rate is larger, and also small albedo is associated with large particle size and consequently higher rain rate. These observations imply that linear models can be developed to derive the empirical relationships between radar reflectivity and cloud brightness temperature, visible reflectance, and albedo.