ABSTRACT

RAINFALL MEASUREMENT UNCERTAINTY AND ITS IMPACT ON STREAMFLOW PREDICTION

Jason Dwaine Tambie

Rainfall measurement uncertainties present in different types of rainfall data (rain gauge, satellite and RADAR) impact on streamflow predictions in various ways. Satellite-based rainfall data (TRMM 3B42 algorithm) from the Tropical Rainfall Measuring Mission (TRMM) were compared to rain gauge data in the Caroni basin, Trinidad over an eleven year period (1998-2008). Weak positive correlations existed between TRMM and average rain gauge measurements (a range of *r* values: 0.14-0.54) on a daily scale. TRMM 3B42 represented monthly rainfall totals better and gave a clearer representation of differences between dry and wet seasons in Trinidad.

A distributed hydrological model, GSSHA (Gridded Surface Sub-surface Hydrologic Analysis) was set up for the Maracas/St. Joseph (MSJ) catchment and calibrated against measured streamflow by using point based rain gauge data. The model's performance was generally poor during validation periods (Nash Sutcliffe Coefficient (NSE) range: -0.13- -58.5; Coefficient of Determination (COD) range: 0.01- 0.12 and Index of Agreement (IA) range: 0.16- 0.19). Simulations run using different representations of the TRMM data showed that TRMM generally did not predict streamflow well (Root Mean Square Error

(RMSE): 0.65-0.87 (for raw (3-hourly) and downscaled (hourly) TRMM 3B42) and 0.87-5.38 (for adjusted (3-hourly) TRMM 3B42). Adjusted 3-hourly TRMM 3B42 data produced peak discharges which generally overestimated the observed peaks while the raw and downscaled TRMM 3B42 data did not generate any large peak discharges.

In order to quantify the uncertainty present in measured rainfall and its impact on streamflow, RADAR images of a rain event were used in a "virtual" rain gauge analysis of the impact of spatial and temporal sampling on streamflow prediction. Rain gauge and TRMM 3B42 data were sub-sampled from the RADAR and used to run simulations. Only the fine resolution (point-based) data (15-minute) produced peak discharges. The outcomes of this study may help hydrologists to make better decisions when choosing rainfall data for hydrological modelling studies.

Keywords: Rainfall Measurement; TRMM; Rain Gauge; GSSHA; Weather RADAR; Uncertainty; Streamflow Predictions; Hydrological Modelling; Trinidad