



اَبُو بَكْرِ سَيِّدِي تَكْنُوْلُوْجِي مَارَا  
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1

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Title :  
**The Use of Radar-Rainfall Inputs for Quantitative  
Precipitation Estimation (QPE) in Klang River Basin**

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Flooding is a natural disaster that often occurs in Malaysia due to its heavy rainfall distribution. Lately, the exceptional amount of rainfall worsens the flood situation. Many incidents of floods attributed to the extreme downpour caused massive problems. The capability of gauge to receive data of the torrential precipitation is affected and need to be addressed. Thus, the deployment of radar helps to retrieve better rainfall data due to spatial and temporal factors. Radar has the advantages of detecting rainfall amount with higher resolution and covers larger areas. In addition, radar can also access hilly and ungauged areas with the ability to detect cloud movement and lead to estimation of precipitation. However, radar faces several glitches that hinder its accuracy. Among the problem reported on radar application in quantitative precipitation estimation (QPE) is the inappropriate reflectivity-radar (Z-R) equation used to convert reflectivity to rainfall rate. This research focuses on Z-R relationships in radar conversion to obtain rain data especially for Klang River Basin. In order to integrate radar data into any quantitative precipitation estimation, the

suitable Z-R equations must be used to produce acceptable results. Z-R relationship is dependent on rain types and spatial location. For Malaysia that experiences rain from monsoon seasons, the Z-R relationship is then needed to be categorized under several types including general and monsoon rain. Seven rain classes are recommended as low, moderate, heavy, South West, North East and also two inter monsoon rains. By using Simplex Algorithm, the optimum Z-R relationship is derived to suit the Malaysian rain types. The newly derived Z-R equations were found to provide better estimations compared to the current Z-R used by Malaysian Meteorological Department (MMD) for Klang River Basin area. It reduces the radar-rainfall overestimation by 50% and depicts better performance in the statistical measurement analysis. With the new Z-R equations, the average mean error for all seven rain categories is reduced from -68.17 to -6.59, for average mean absolute error, the value decreases from 71.50 to 16.32. The average value for root mean square error (RMSE) also reduced from 89.90 to 20.30 while the bias denotes average error reduction from 3.20 to 1.22. The improved radar rainfall as quantitative precipitation estimation (QPE) has also been applied in the rainfall-runoff modeling with grid-based Soil Conservation Service Curve Number (SCS-CN) method and GIS utilization. The outcomes demonstrate good agreement between simulated data and observed data for selected events especially with the new Z-R equations. The results performance suggests that the new Z-R equations deliver better estimation in the modeling operation. In short, radar and rain gauge data are good complementary that undisputedly enhances the quantitative precipitation estimation (QPE) for improving flood analysis in the future.