

Comparison of Spatial-Based Rainfall Estimation Methods for Matara District, Sri Lanka

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Abstract

Weather significantly influences agronomic production in Sri Lanka. This study develops a spatially based rainfall model for Matara District, analyzing average annual and seasonal rainfall (Southwest monsoon (SWM), First-inter monsoon (FIM), Northeast monsoon (NEM), and Second-inter monsoon (SIM)) using data from 2011 to 2020 (09 rainfall stations). Objectives included creating rainfall maps via interpolation models in GIS, generating Isohyetal maps, and identifying the best interpolation model for rainfall distribution using zonal statistics and spatial analysis. Methods involved raster interpolation techniques Inverse Distance Weighting (IDW), Kriging, and Spline to map average annual and seasonal rainfall. Isohyetal maps portrayed rainfall boundaries, while zonal statistical analysis determined minimum, maximum, and mean rainfall by Divisional Secretariat Division (DSDs) in Matara. Statistical tests (sample test, paired t-test, and One-way ANOVA) assessed the significance of differences between interpolation models within DSDs and seasons at 1% and 5% significance levels. Findings showed significant annual average rainfall variation between southern and northern DSDs. Kotapola DSD recorded the highest mean annual and seasonal rainfall across all interpolation methods: IDW (294.99 mm), Kriging (294.18 mm), and Spline (382.45 mm). In contrast, Dewinuwara DSD had the lowest mean rainfall using the IDW method (153.47 mm), while Thihagoda DSD recorded the lowest values using the Spline (154.69 mm) and Kriging (154.42 mm) methods. One-way ANOVA indicated no significant difference at the 5% level between interpolation types for each rainfall pattern. Mean comparisons revealed the Spline method had the lowest Standard Mean Error (± 6.67) for annual average rainfall, while IDW had the lowest errors for seasonal rainfall during monsoon and inter-monsoon periods. The study concludes that Spline is suitable for mapping average annual rainfall, whereas IDW is best for seasonal rainfall patterns in the district, supported by Isohyetal lines.

Keywords: *Inverse Distance Weighting, Kriging, Spline, Divisional Secretariat Division, Isohyet lines*