

TABLE OF CONTENTS

ABSTRACT	i
ACKNOWLEDGMENTS	ii
TABLE OF CONTENTS	iv
1. INTRODUCTION	01
1.1 Geographic Information Systems and development planning	03
1.2 Advancement of technologies and Sri Lankan approach	04
1.3 Importance of spatial statistics	05
1.4 Problem identification	06
1.5 General objective of the development of practical spatial data applications for water management	08
1.6 Constrains and risk factors	10
2. NATURAL VARIABILITY AND SPATIAL STATISTICS	11
2.1 Geographic mapping and measurements	12
2.2 Map projections	17
2.3 Control network of Sri Lanka	19
2.4 Cartography	22
References	24
3. SPATIAL DATA AND METHODS ANALYSIS	26
3.1 Spatial data	26
3.2 Types of spatial data	26
3.3 Spatial data analysis	27
3.4 Measurements	31
3.4.1 Measurements – A definition	31
3.4.2 Levels of measurement	31
3.4.3 Dimensionality	34
3.4.4 Level of measurements in four scales	37
3.5 Accuracy of measurements	42
References	48
4. MEASUREMENT OF CENTRAL TENDENCY IN SPATIAL DATA	49
4.1 Mean center	52
4.2 Weighted mean center	53
4.3 Manhattan median	55

4.4	Euclidean median	59
4.5.	Point data analysis	65
	4.5.1 Standard distance	66
	4.5.2 Nearest neighbor statistic	67
	4.5.3 Quadrat analysis	74
References		77
5. SPATIAL DISTRIBUTION OF AREAL DATA		78
5.1	Conversion of point data in to areal data	78
	5.1.1 Interpolation of rainfall data using Thiessen polygon method	79
	5.1.2 Interpolation of rainfall data using isolines	80
	5.1.3 Variogram analysis	80
	5.1.4 Kriging	101
5.2	Location quotient method	106
5.3	Coefficient of localization	109
5.4	Lorenz curve	111
5.5	Gini coefficient, or index of dissimilarity	114
	5.5.1 Calculation of Gini coefficient using coefficient of localization values:	118
References		119
6. SPATIAL SAMPLING		120
6.1	Types of samples	121
	6.1.1 Non probability sampling	122
	6.1.2 Probability sampling	128
6.3	Geographic populations and sampling	135
6.4	Spatial sampling techniques	135
6.5	Spatial point sampling	142
References		151
7. BIVARIATE OBSERVATIONS		152
7.1	Representation of bivariate data distributions	152
7.2	Correlation	159
7.3	Pearson's product-moment correlation coefficient for interval/ ratio scale data	160
7.4	Nonparametric correlation coefficients	167
	7.4.1 Rank correlation coefficients for ordinal scale data	167
	7.4.2 Spearman's rank correlation coefficient	167
	7.4.3 Kendall's rank correlation coefficient (τ)	172

7.5	Measures of association using chi-square statistics (χ^2)	176
7.6	Correlation coefficients and areal association	182
7.7	k - Color maps	186
	References	193
8.	SPATIAL AUTOCORRELATION AND SPATIAL AUTOCORRELATION COEFFICIENTS	194
8.1	General statistical interpretation of spatial autocorrelation	194
8.2	Binary Connectivity matrix or table C	194
8.3	Global measures of spatial autocorrelation	200
	8.3.1 Join Count Statistic	200
	8.3.2 Calculation of joint count statistics using sampling with replacement	202
	8.3.3 Calculation of joint count statistics using sampling without replacement	208
8.4	Practical applications of Moran and Geary Indices	210
	8.4.1 Moran's I index	210
	8.4.2 Geary's Ratio	216
	8.4.3 General G statistic	218
	References	226
9.	ANALYSIS OF HYDROLOGICAL TIME SERIES	227
9.1	Moving totals and averages	228
9.2	Calculation of trend values	231
	9.2.1 Seasonal fluctuations	232
	9.2.2 Seasonal variation	234
	9.2.3 Forecasting	238
	References	240
10.	SPATIAL STATISTICAL PROBLEMS	241
10.1	Boundary problem	241
10.2	Scale problem	243
10.3	Problem of modifiable units	245
10.4	Problem of pattern	247
	References	249