

TABLE OF CONTENTS

CONTENTS	PAGE No.
Abstract	i-vi
Declaration	vii
Certificate of the Supervisor	viii
Acknowledgments	ix-x
Table of Contents	xi-xiii
List of Tables	xiv
List of Figures	xv--xviii
List of Acronyms	xix-xxi
CHAPTER 1: Introduction	1-12
1.1 Introduction	1-3
1.2 Objectives	3-4
1.3 Description of the study area	4-6
1.4 Thesis organization	6-7
1.5 Reference	8-12
CHAPTER 2: Variation and relationship of PM2.5, AOD 550 nm and meteorological parameters over Brahmaputra valley at the valley-site scale	13-42
2.1 Introduction	13-17
2.2 Data, sources and pre-processing	18-23
2.2.1 MODIS AOD 550 nm	19-20
2.2.2 Reanalysis data	20-21
ERA5 ECMWF meteorological data	
MERRA-2 aerosol components	
2.2.3 Ground-based data	21
Meteorological data	
PM2.5 surface concentration	
AERONET AOD 550 nm	
2.2.4 Data pre-processing	21-23
Collocation of data	
Data integration	
2.3 Methodology	24-25
2.3.1 Calculation of total PM2.5 surface concentration	24
2.3.2 Validation of data	24
2.3.3 Correlation analysis and significance test	25
2.4 Results and discussion	25-35
2.4.1 Performance assessment of MERRA-2 PM2.5 with reference to ground-based data	25-26
2.4.2 Performance assessment of ERA5 ECMWF reanalysis meteorological data with reference to ground-based data	26-27

2.4.3	Performance assessment of MODIS AOD 550 nm with reference to ground-based data	27
2.4.4	Spatial and seasonal variation of PM2.5, AOD 550 nm and the meteorological parameters	28-31
2.4.5	Inter-annual variation of PM2.5, AOD 550 nm and meteorological parameters	32-33
2.4.6	PM2.5-AOD-Meteorology relationship analysis	33-35
2.5	Conclusion	36-37
2.6	Reference	38-42
CHAPTER 3: Boundary layer dynamism and PBLH-PM2.5 interaction over Brahmaputra valley at the valley-site scale		43-66
3.1	Introduction	43-45
3.2	Data, sources and pre-processing	45-48
3.2.1	ERA5 ECMWF BLH	45-46
3.2.2	MERRA-2 PBLH	46
3.2.3	Radiosonde	47
3.2.4	MODIS AOD 550 nm	47
3.2.5	PM2.5 surface concentration	47
3.2.6	Data pre-processing Collocation of data Data integration	47
3.3	Methodology	49-51
3.3.1	Determination of PBLH	49-50
3.3.2	Validation of PBLH data	50-51
3.3.3	Calculation of day-time and night-time PM2.5 surface concentration	51
3.4	Results and discussion	51-60
3.4.1	Performance of ERA5 and MERRA-2 PBLH with reference to radiosonde derived PBLH	51-52
3.4.2	Spatial variation of day-time and night-time PBLH and PM2.5 over BV	52-54
3.4.3	Synergism in PM2.5 and PBLH diurnal variability	54-56
3.4.4	Seasonal changes of PM2.5, AOD 550 nm and PBLH over BV	56-57
3.4.5	PBLH-PM2.5 relationship	58-60
3.5	Conclusion	61-62
3.6	Reference	63-66
CHAPTER 4: Estimation of PM10 over Brahmaputra valley using Geographic Weighted Regression model		67-85
4.1	Introduction	67-68
4.2	Data, sources and pre-processing	68-71

4.2.1	PM10 ground-based data	69
4.2.2	ERA-interim meteorological data	70
4.2.3	MODIS AOD 550 nm	70
4.2.4	Data pre-processing	71
	Collocation of PM10 and MODIS AOD 550 nm	
4.3	Methodology	71-74
4.3.1	GWR Model	72-73
4.3.2	VIF multicollinearity test and local R ²	73
4.3.3	Moran I spatial autocorrelation test	73
4.3.4	10- fold cross-validation	74
4.4	Results and discussion	74-81
4.4.1	GWR model performance in estimating PM10 surface concentration	74-78
	Spatial autocorrelation	
	Multicollinearity	
4.4.2	PM10-AT, PM10-PBLH and PM10-AOD 550 nm relationship	78-80
4.4.3	Spatial distribution of PM10 surface concentration	80-81
4.5	Conclusion	82
4.6	Reference	83-85
Chapter 5: CONCLUSION		86-88
5.1	Summary and conclusion	86-88
5.2	Future scope	88

List of Publication