Emission Sources Mapping and Preparation of Local Action Plan around Air Pollution Hotspot

Sirifort Area, Delhi

Introduction

Rising air pollution in Indian cities is a grave concern from last few years and seeking efficient and effective air quality management planning to obtain acceptable air quality. However, the success of any Air Quality Management Planning (AQMP) depends upon the integration and linkage between its key components that are policy objectives, monitoring network, emission inventory, source apportionment, air quality modelling, health exposure assessment, control strategies, and public participation. The selection of control is the key for success of management plan; however, it is very challenging to select the effective control options in Indian cities considering the high spatio-temporal variations in pollution level. This high variation leads to formation of air pollution hotspot in certain areas in the city, which needs specially efforts to bring down the pollution level first on city average then to bring it below specified standards. This complexity needs a thorough understanding the air pollution level around the air pollution hotspot and mapping of sources properly which leads to selection of appropriate control option.

Graphs and Tables:

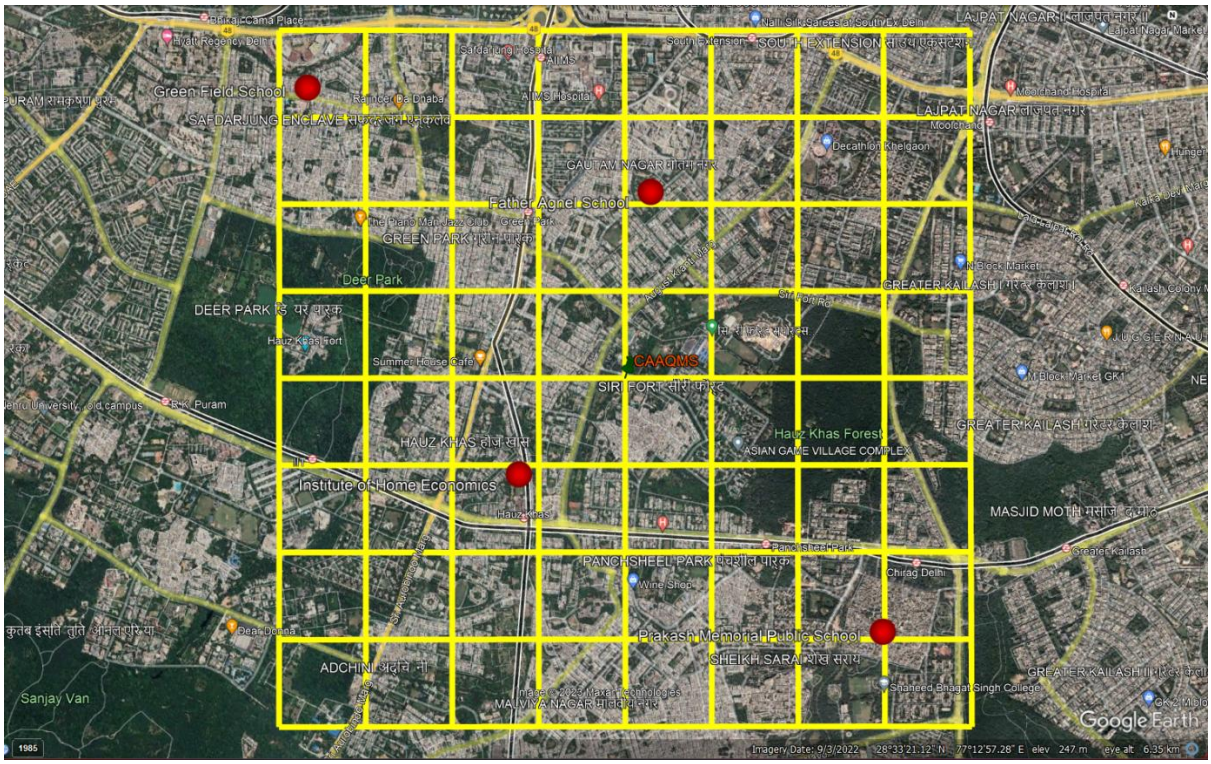
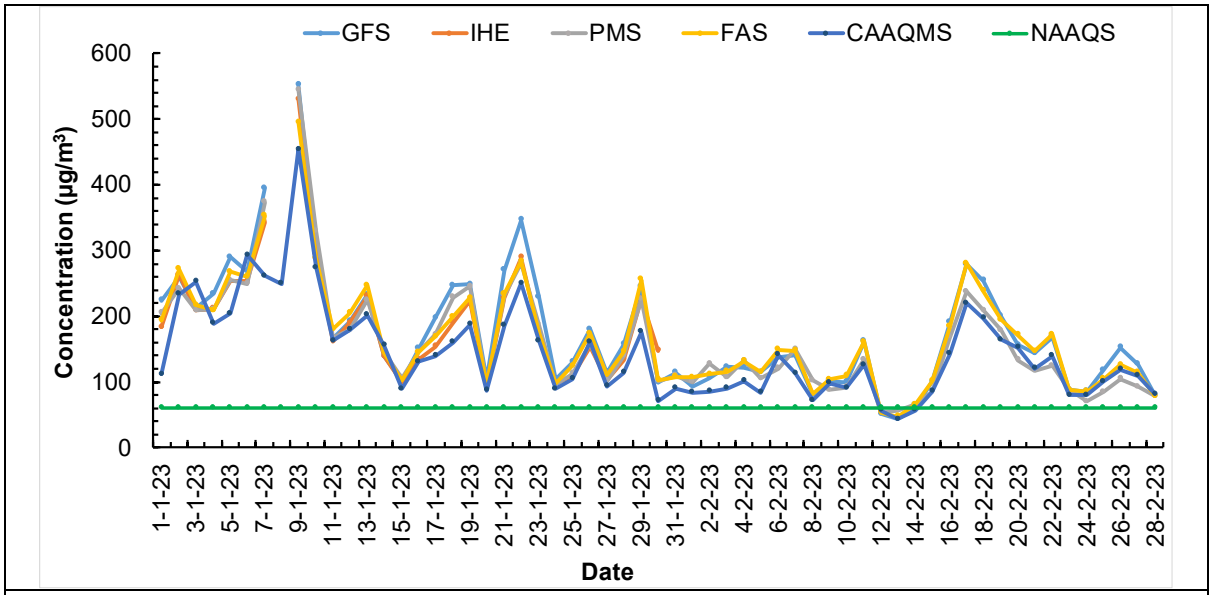
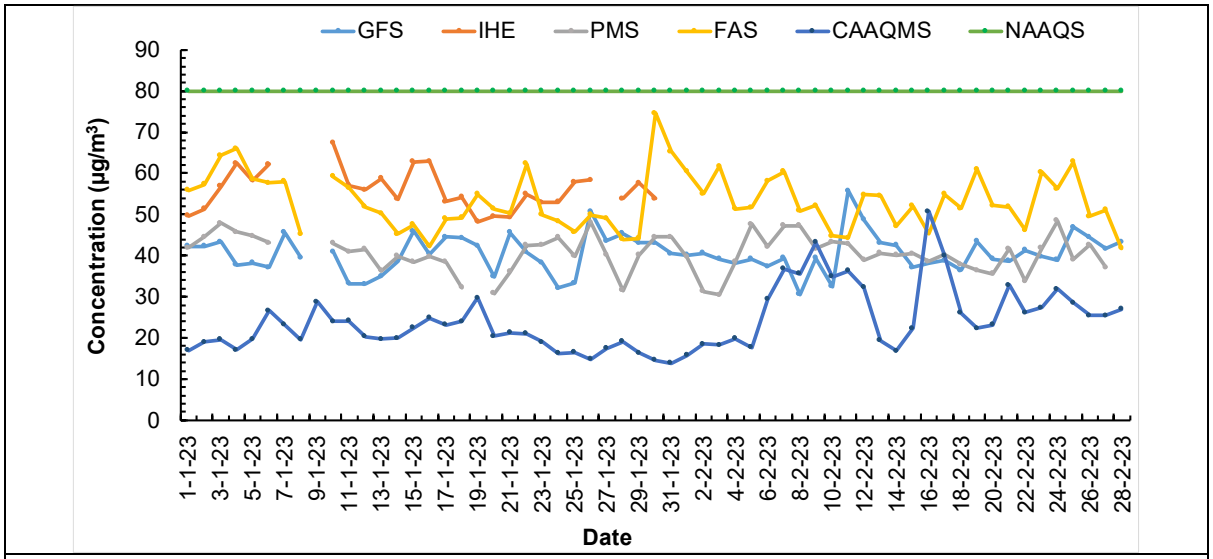


Fig. 3.1: Study Map showing locations of Fixed EPS Air Quality Monitors

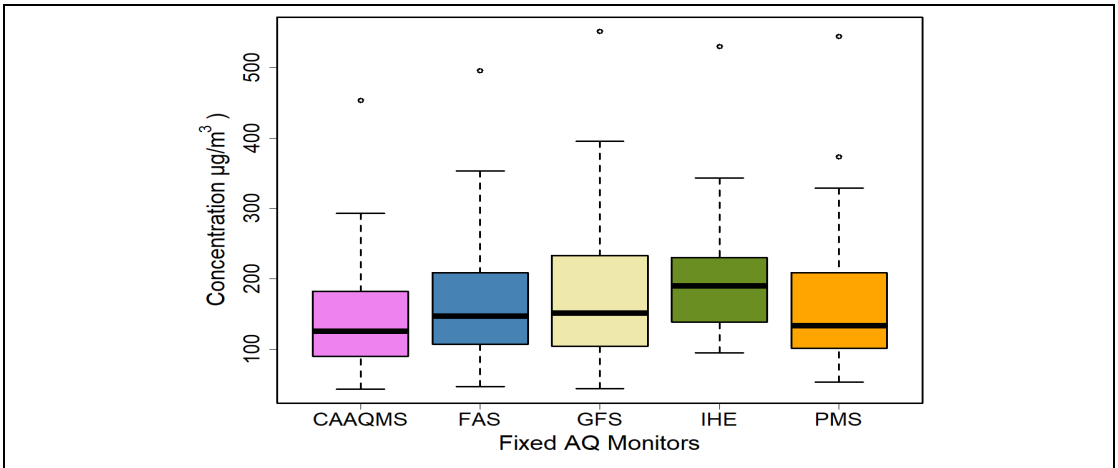


a) Daily Average $PM_{2.5}$

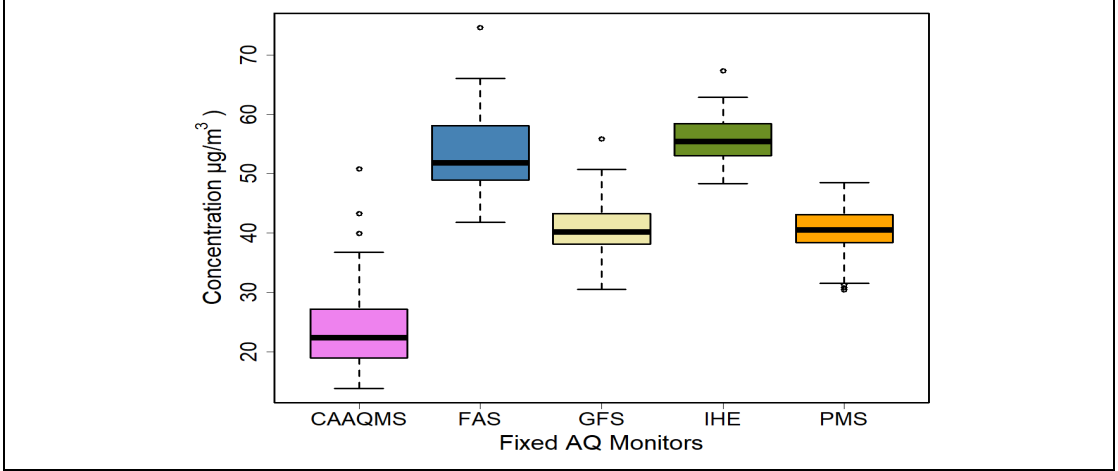


b) Daily Average NO_2

Fig.3.6: Time series plot of daily average pollutant concentration



$PM_{2.5}$



NO_2

Fig.3.7: Boxplot and whiskers for the different Parameters and Pollutants

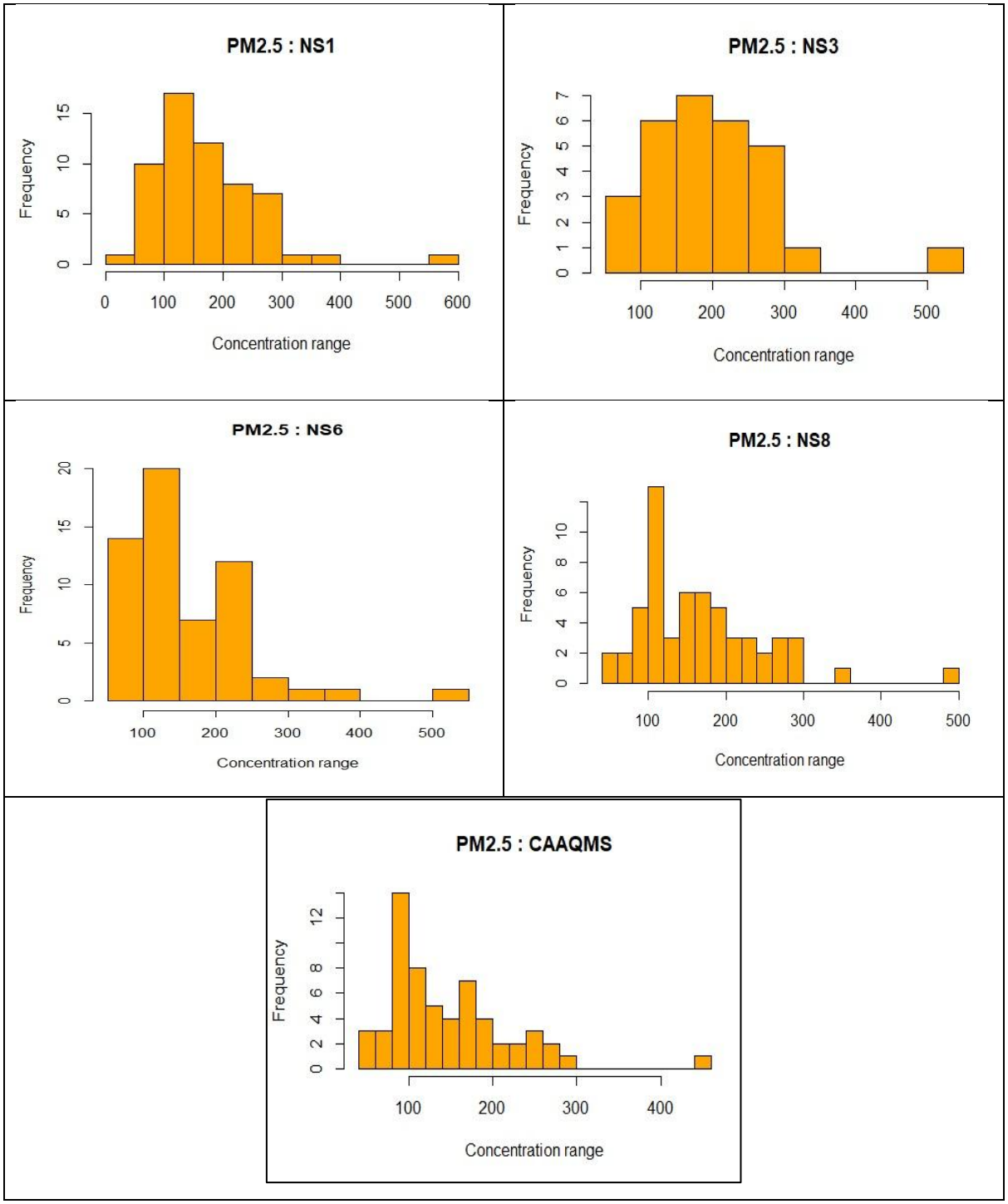


Fig.3.8: Histogram of various Fixed monitors showing frequency of $PM_{2.5}$ concentration.

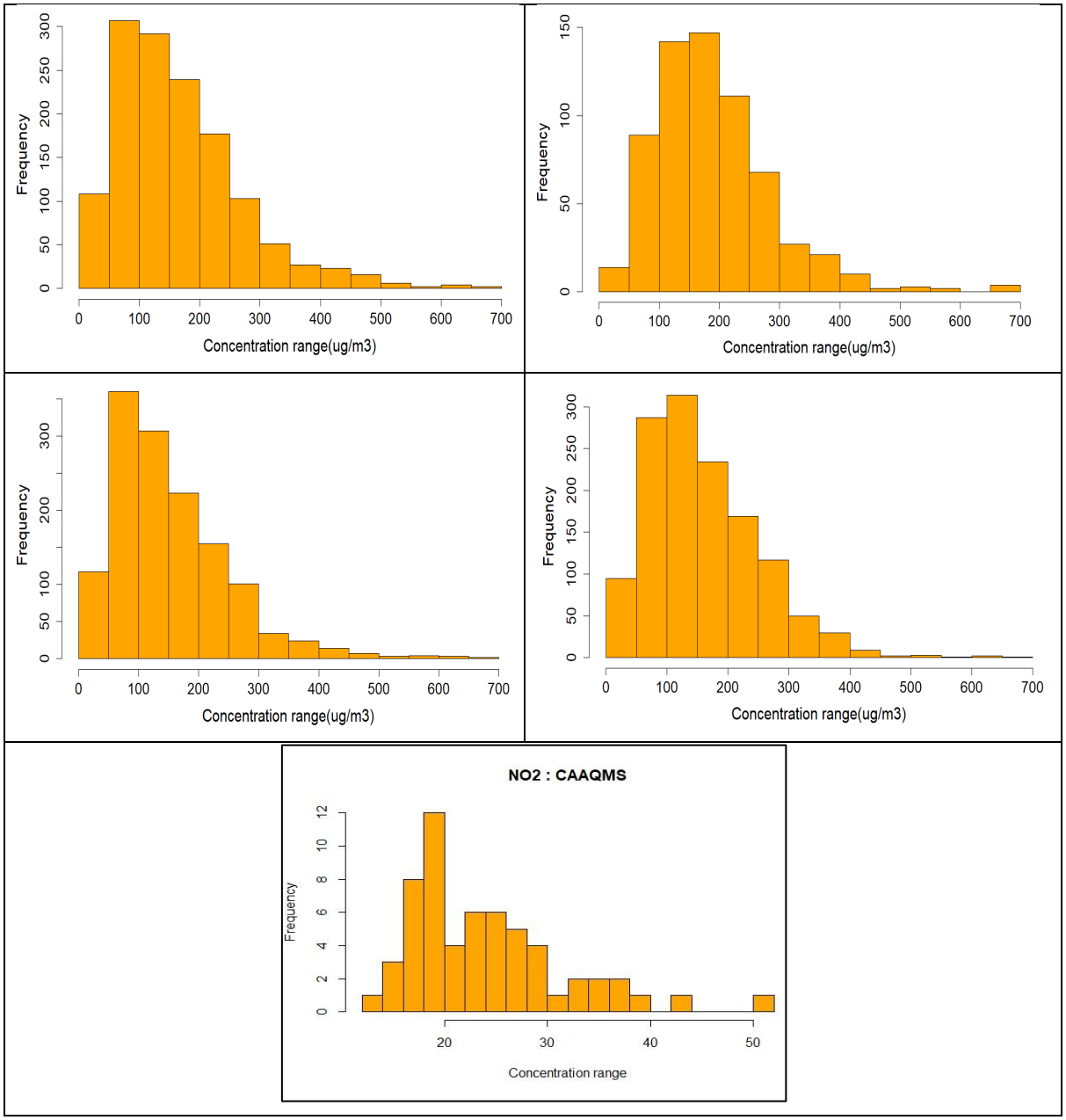


Fig.3.9: Histogram of various Fixed monitors showing frequency of NO_2 concentration.

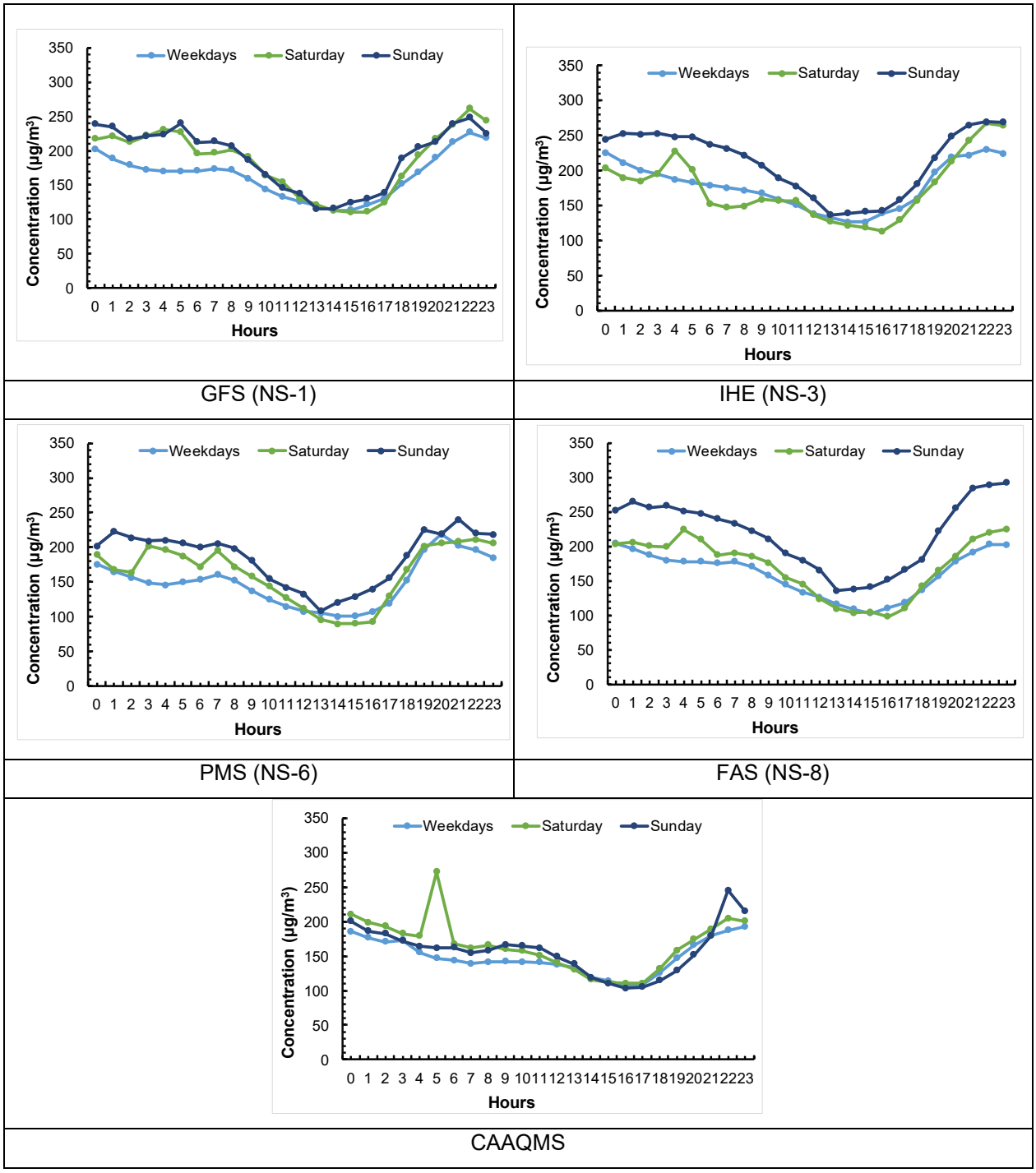


Fig. 3.10: Diurnal plot of $PM_{2.5}$ concentrations for Weekdays and Weekends during January-February 2023

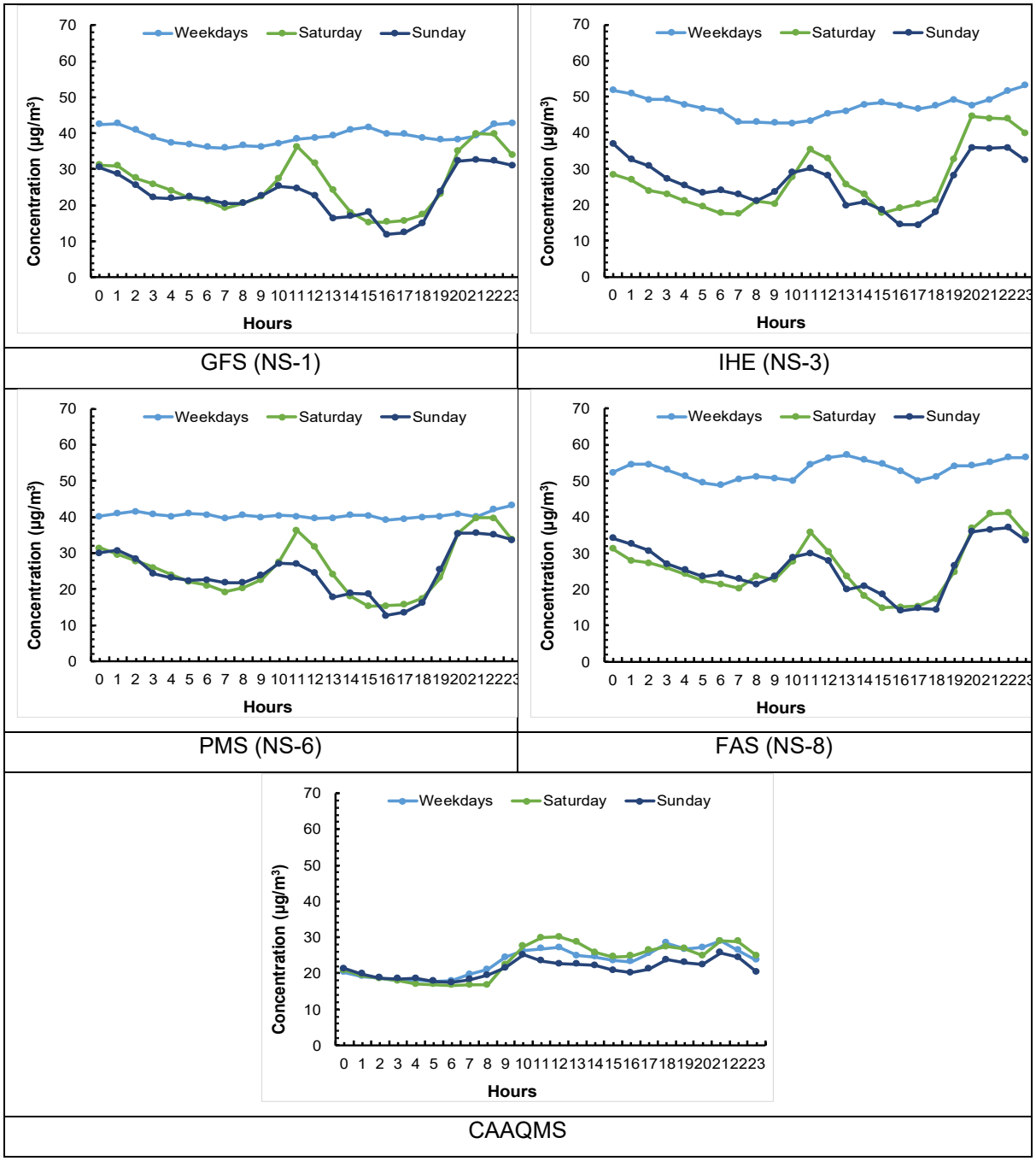
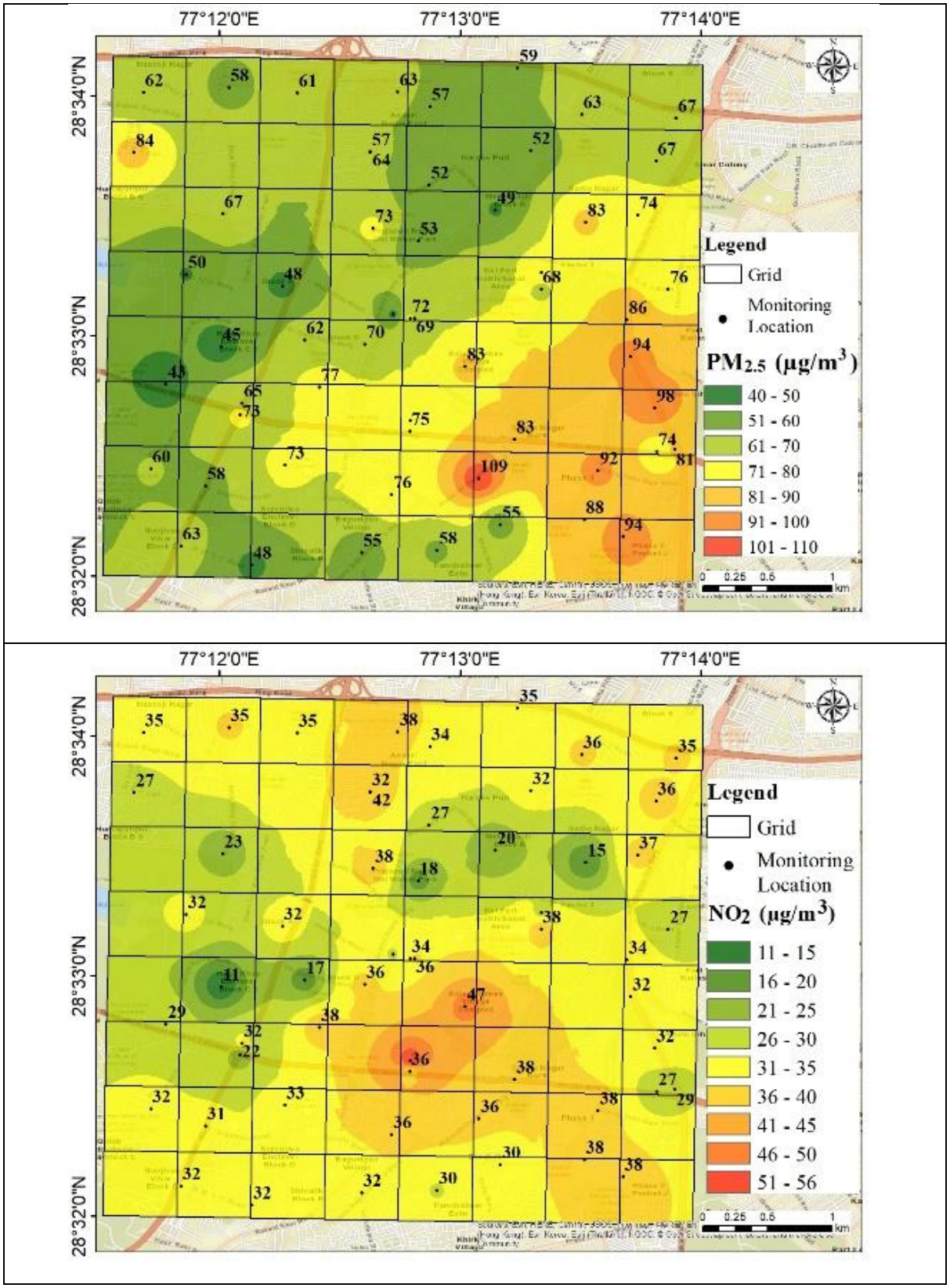


Fig. 3.11: Diurnal plot of NO_2 concentrations for Weekdays and Weekends during January-February 2023


77°12'0"E
77°13'0"E
77°14'0"E
28°34'0"N
28°33'0"N
28°32'0"N
Legend
Grid
Monitoring Location
PM2.5 (µg/m3)
40 - 50
51 - 60
61 - 70
71 - 80
81 - 90
91 - 100
101 - 110
0 0.25 0.5 1 km
NO2 (µg/m3)
11 - 15
16 - 20
21 - 25
26 - 30
31 - 35
36 - 40
41 - 45
46 - 50
51 - 56

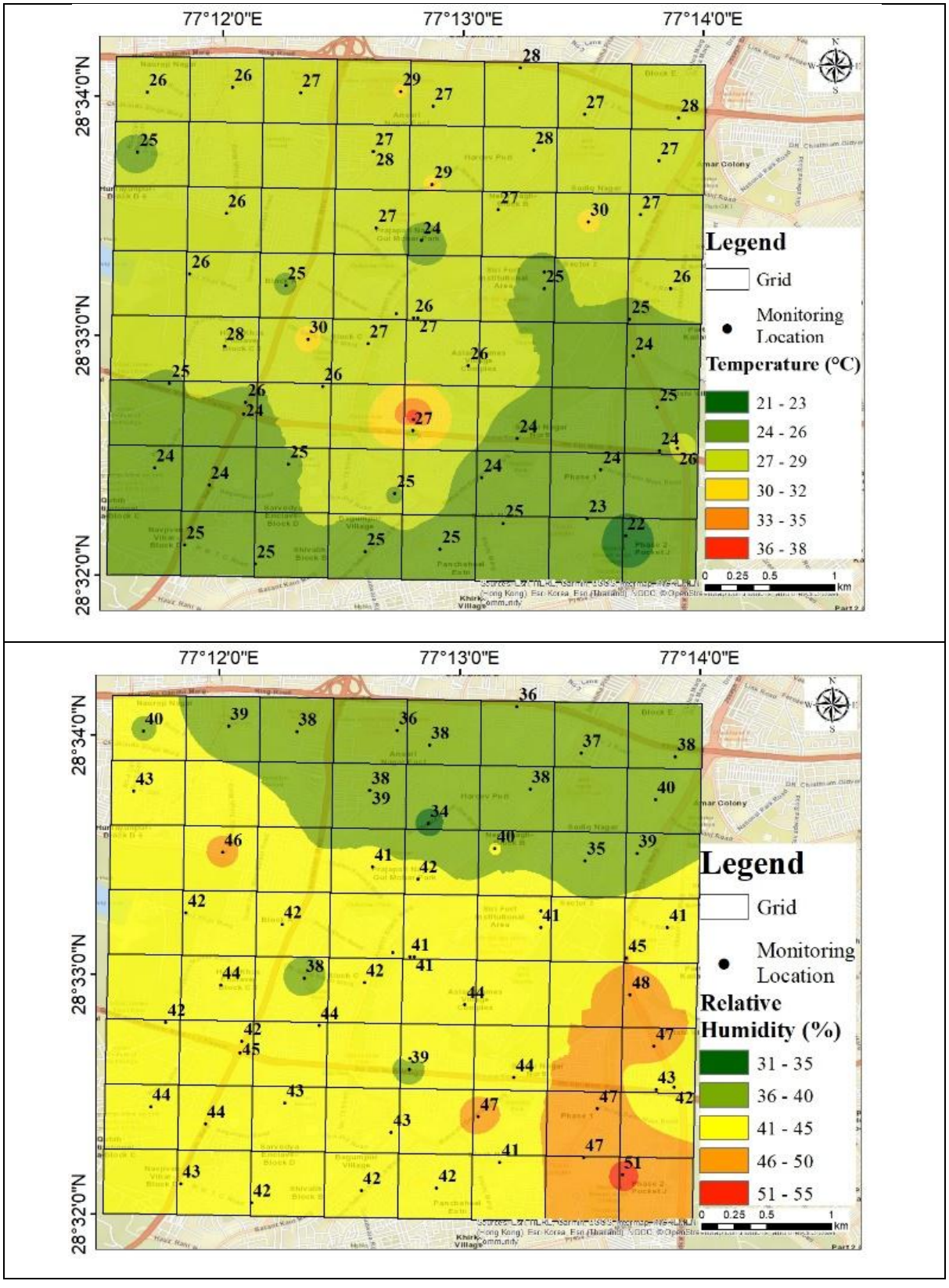


Fig.3.12: Spatial distribution of $PM_{2.5}$, NO_2, Temperature, and Humidity during monitoring.

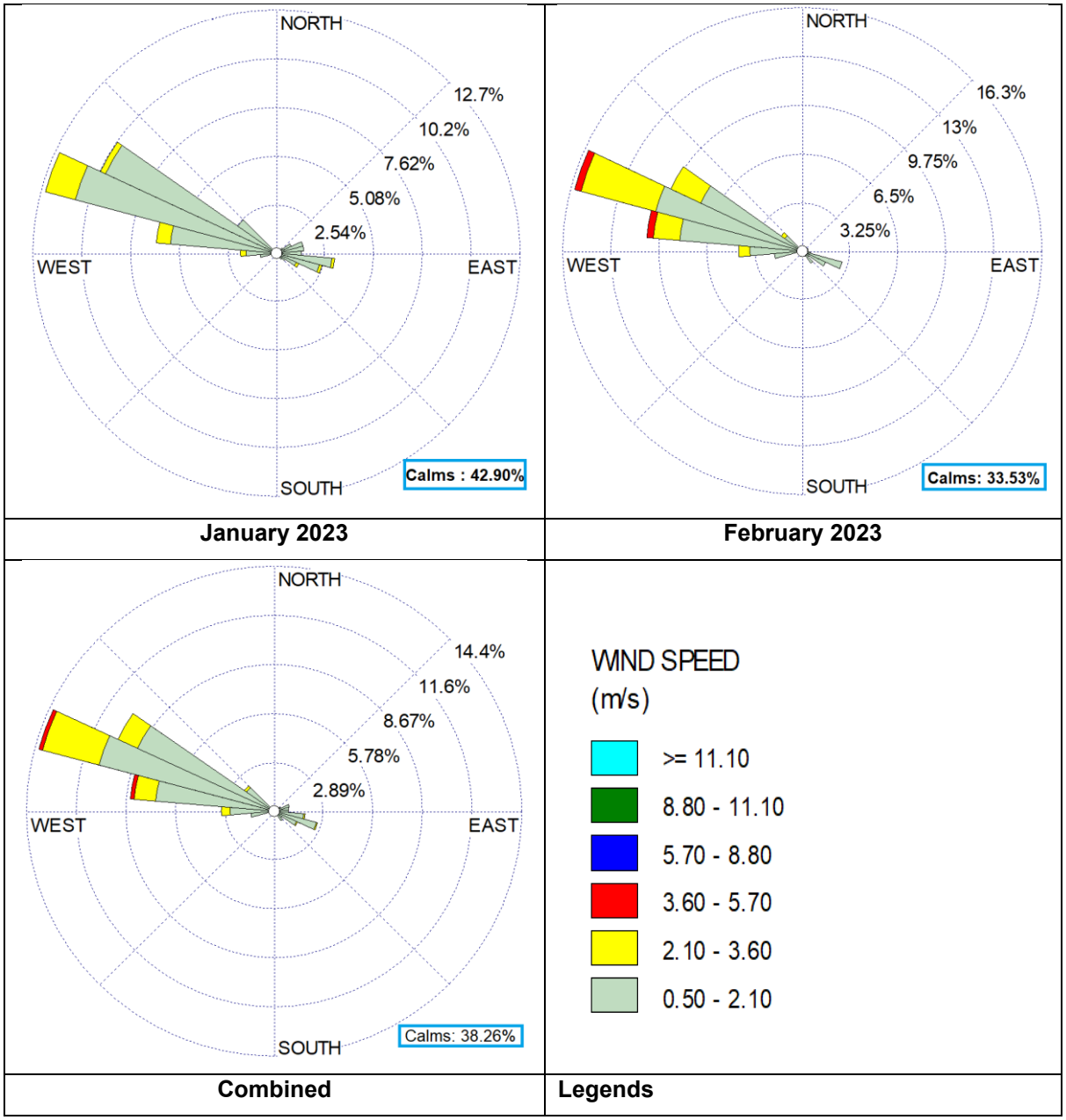
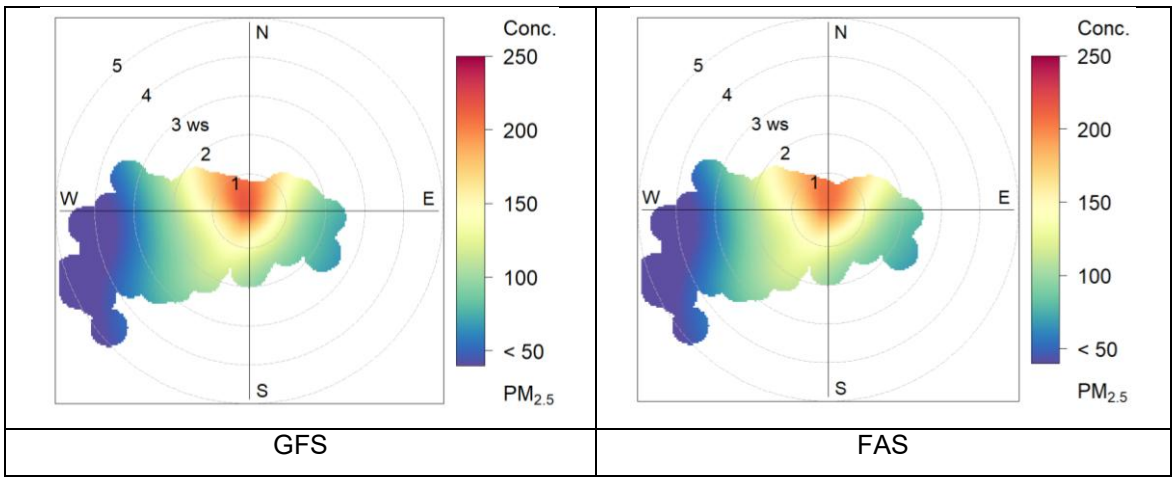
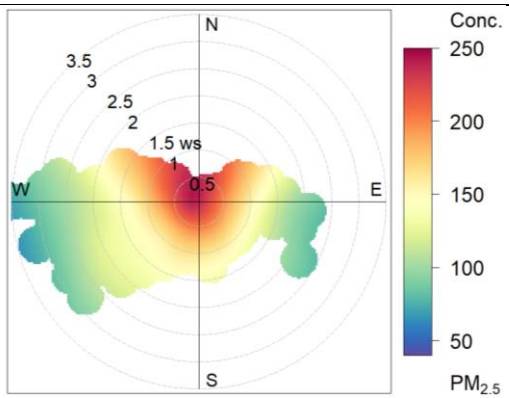
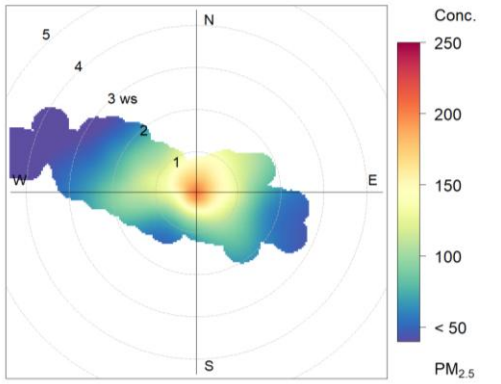


Fig.3.15: Windrose diagram for the study period

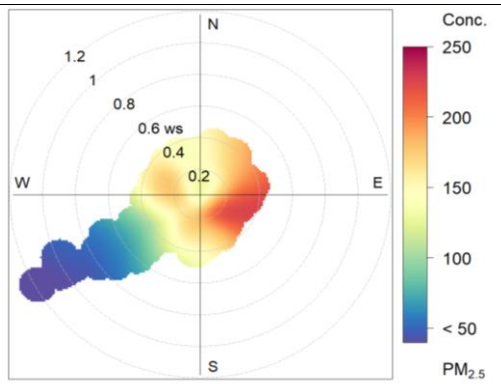




IHE



PMS

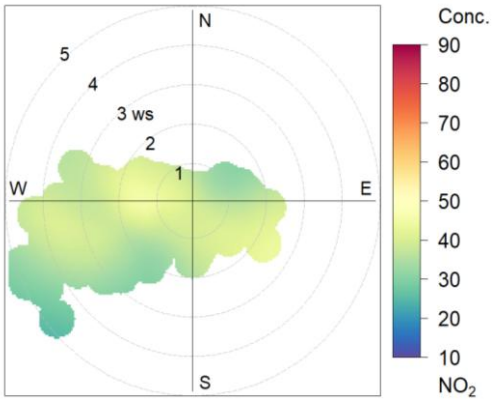


CAAQMS

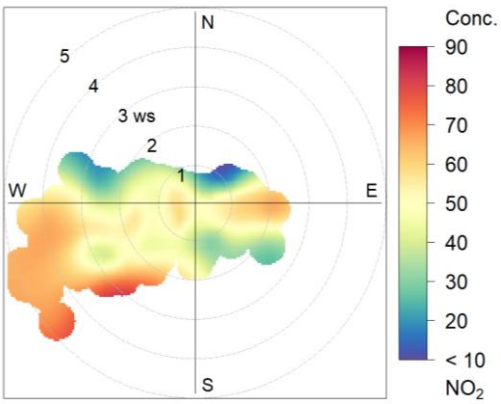
Monitor	Dominant Source Area	
	Wind Speed	Wind direction
GFS	<2 m/s	NW, NE
FAS	<2 m/s	NW, NE
IHE	<1.5m/s	W, N
PMS	<1 m/s	E, SE
CAAQMS	Calm	-

Dominant direction reflecting Source location

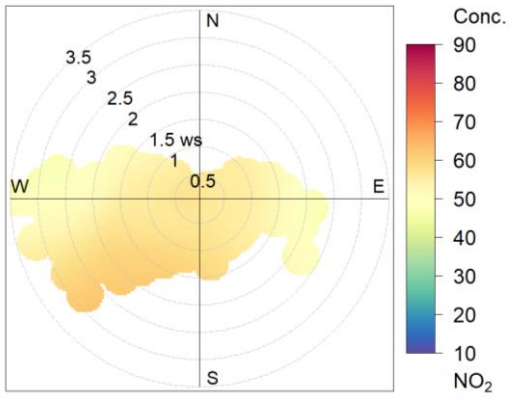
Fig 3.16: Polar plot of $PM_{2.5}$ concentrations showing dominant wind sector (Speed & direction) responsible for air pollution level, prepared using OpenAir tool



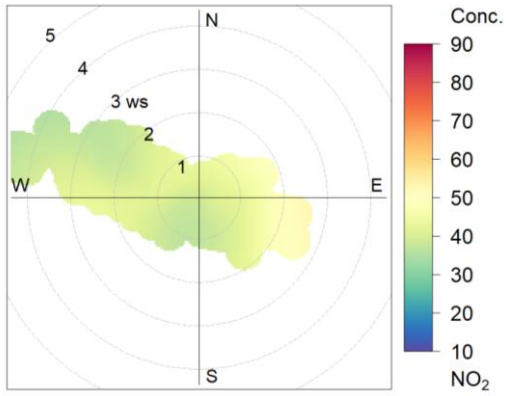
GFS



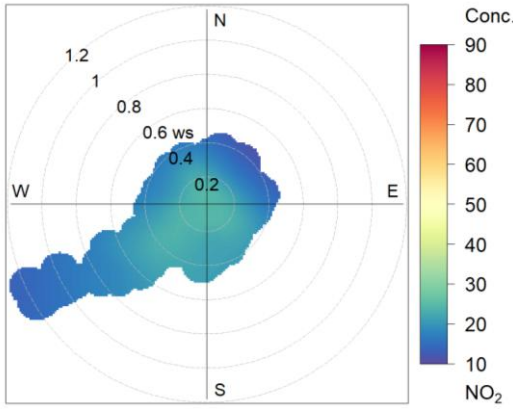
FAS



IHC



PMS



CAAQMS

Monitor	Dominant Direction reflecting Source location	
	Wind Speed	Wind direction
GFS	<2 m/s	W, SE
FAS	2-4 m/s	SW, E
IHE	0.5-3.5 m/s	SW
PMS	<2 m/s	SE
CAAQMS	<0.5 m/s	-

Dominant direction reflecting Source location

Fig 3.17: Polar plot of NO_2 concentrations showing dominant wind sector (Speed & direction) responsible for air pollution level, prepared using OpenAir tool

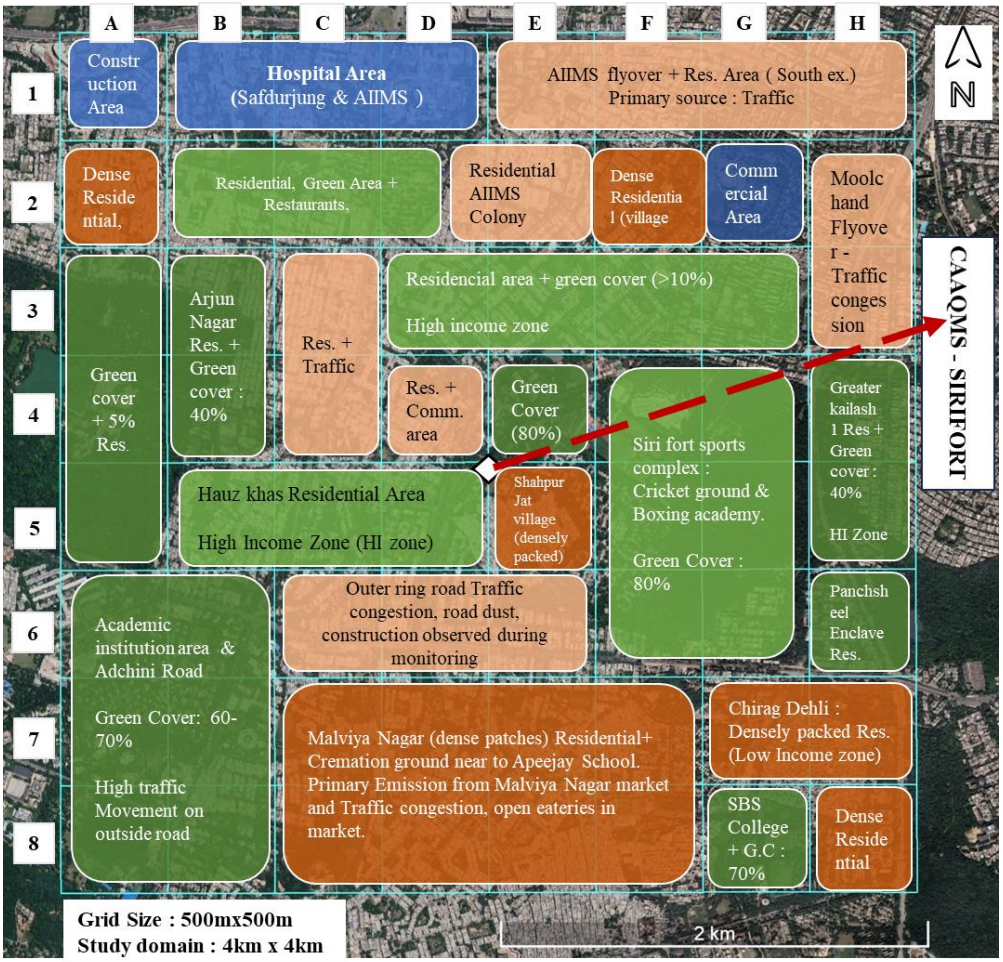
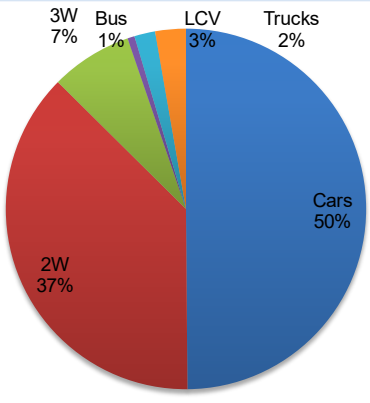
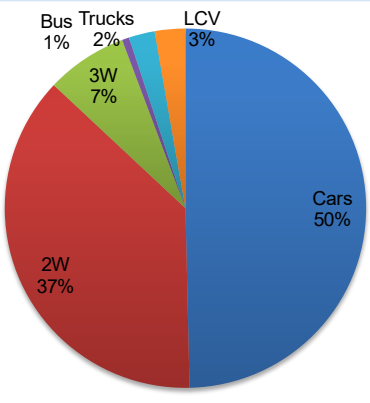
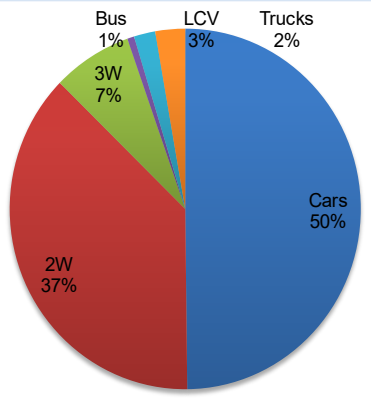
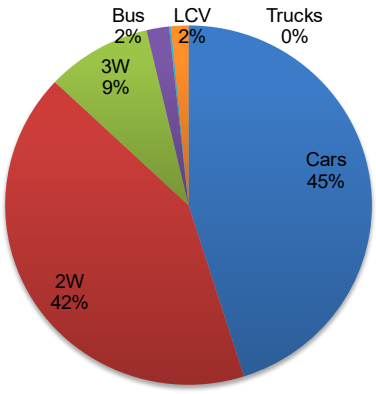
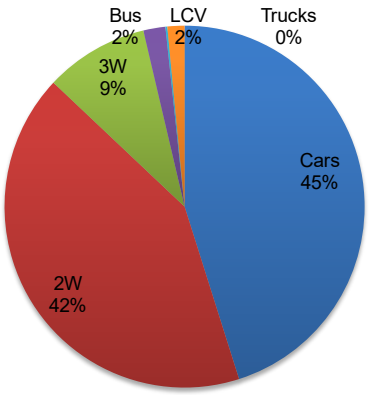


Fig. 4.3: Grid-wise Land-Utilization map depicting different major activity levels in the study area

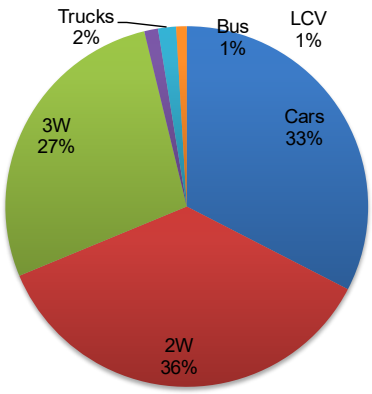
		
R1 - IIT Metro to IIT Flyover	**R2 IIT Flyover to Hauz Khaz metro**	**R3 Hauz Khaz metro To Chirag Delhi Crossing**



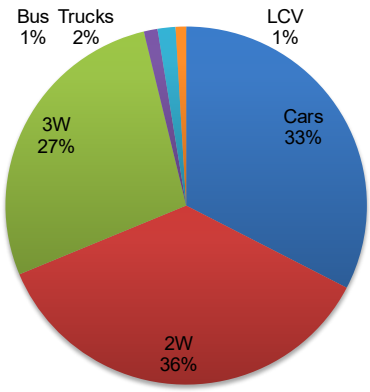
R4 - AIIMS to IIT Flyover



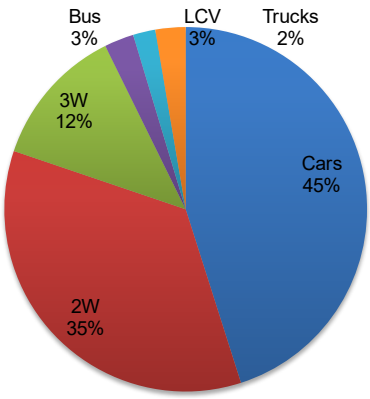
R5 IIT Flyover To Adchini



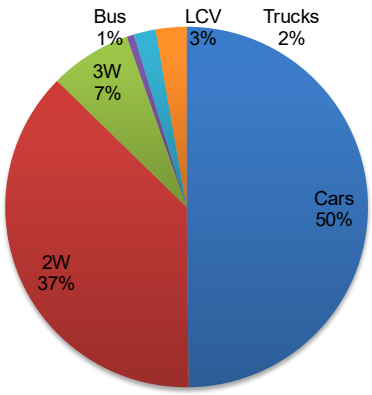
R6 – August Kranti Marg



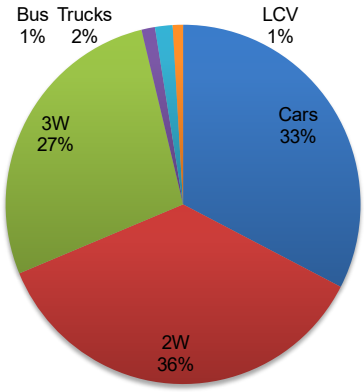
R7 Hauz Khaz metro To Malviya Nagar



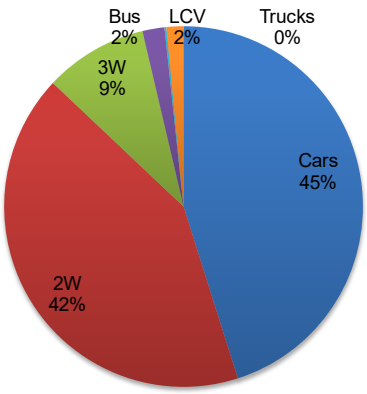
R8 - Bikaji Kama Place



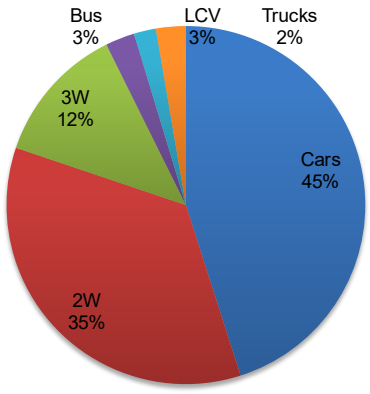
R9 - Moolchand to Chirag Delhi



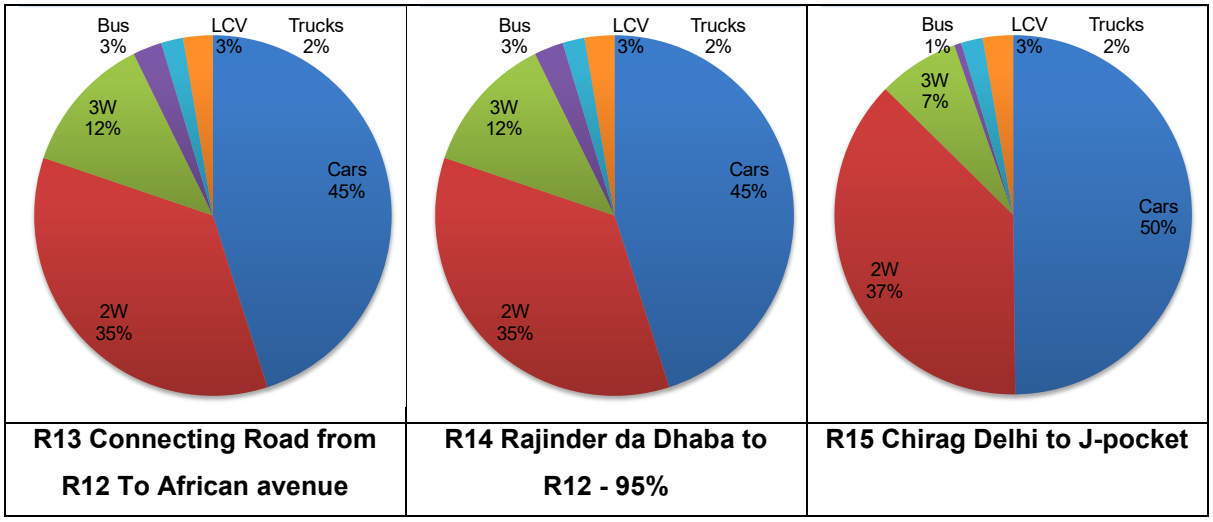
R10 Connecting Road from R6 To R9



R11 Connecting Road from R4 To R6

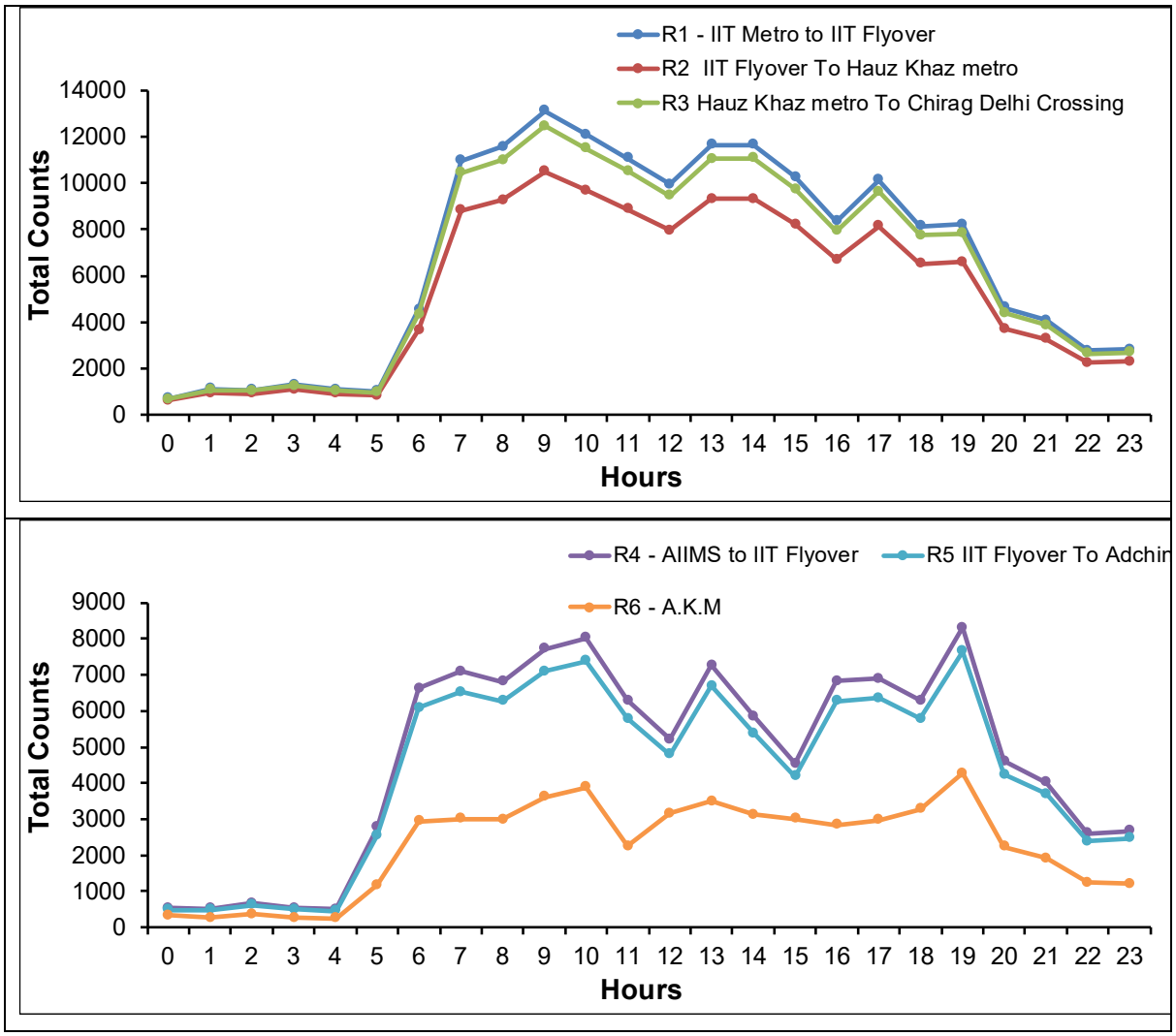


R12 Connecting Road from R8 To R4



R13 Connecting Road from R12 To African avenue	R14 Rajinder da Dhaba to R12 - 95%	R15 Chirag Delhi to J-pocket

Fig. 4.4: Vehicles fleet composition at 15 road locations in Siri-fort Study area



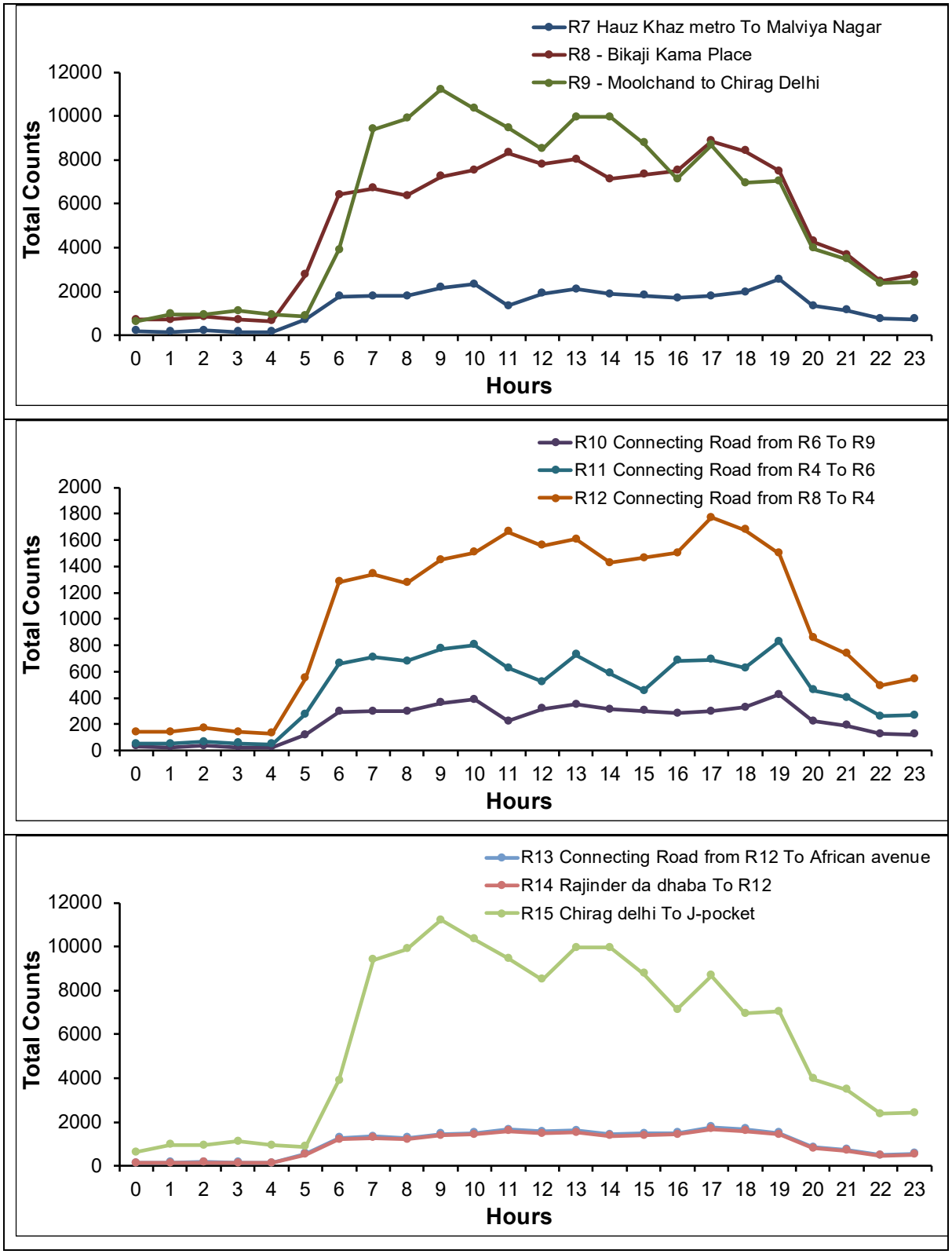
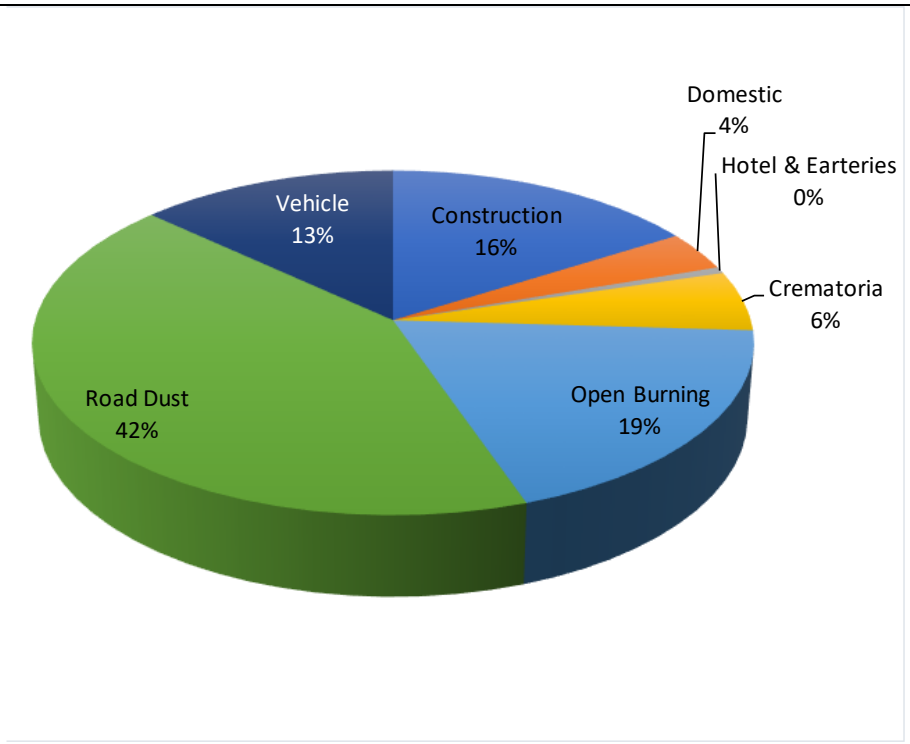
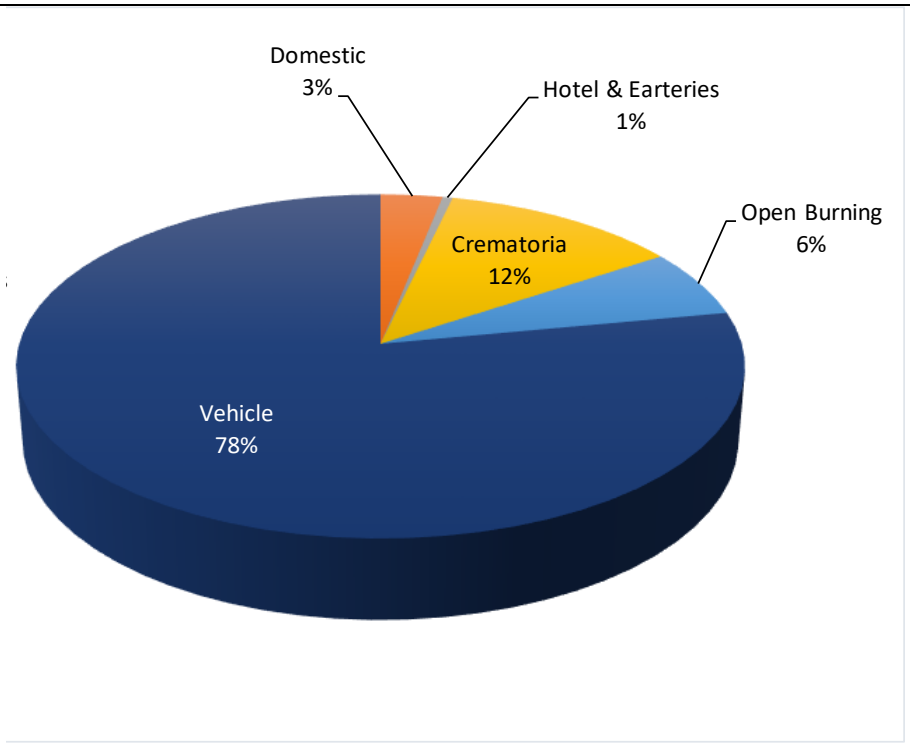


Fig. 4.5: Diurnal profile of vehicles at 15 monitored locations in Siri-fort Study area



$PM_{2.5}$



NO_2

Fig 4.13: Source's contribution in overall all emission load of $PM_{2.5}$ and NO_2

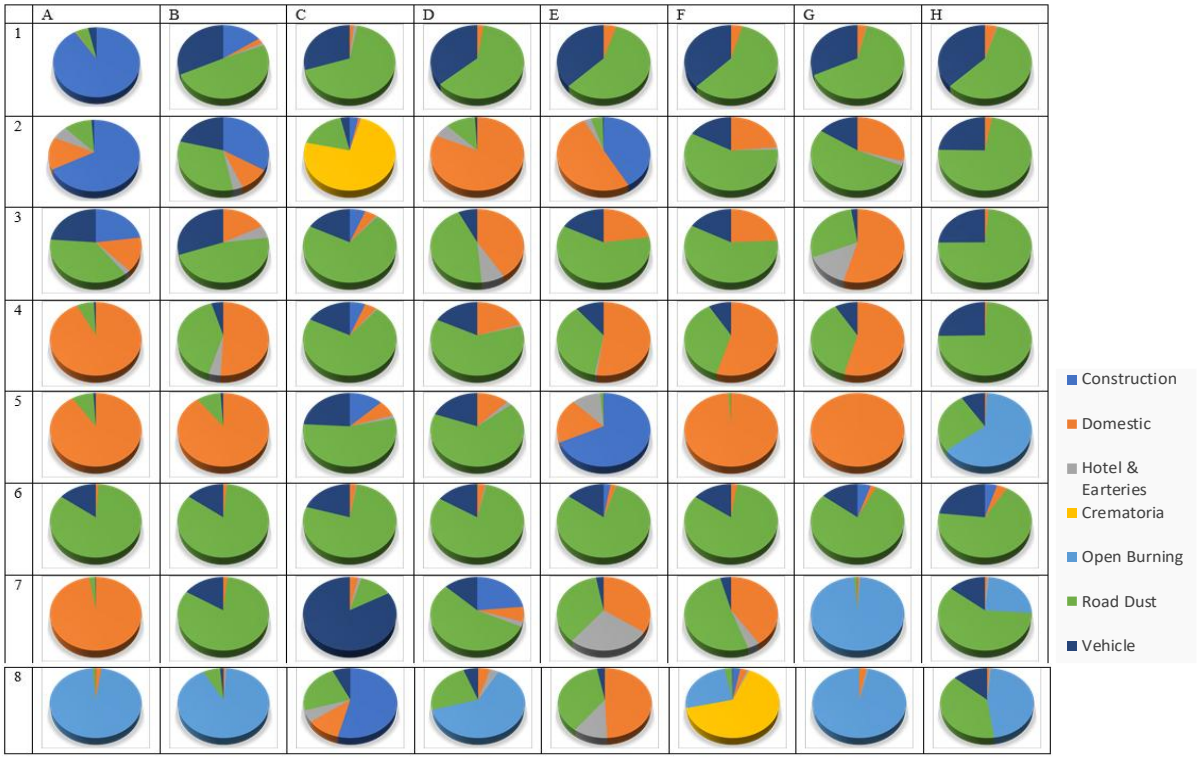


Fig. 4.14: Grid-wise source contribution in overall Emission load of $PM_{2.5}$

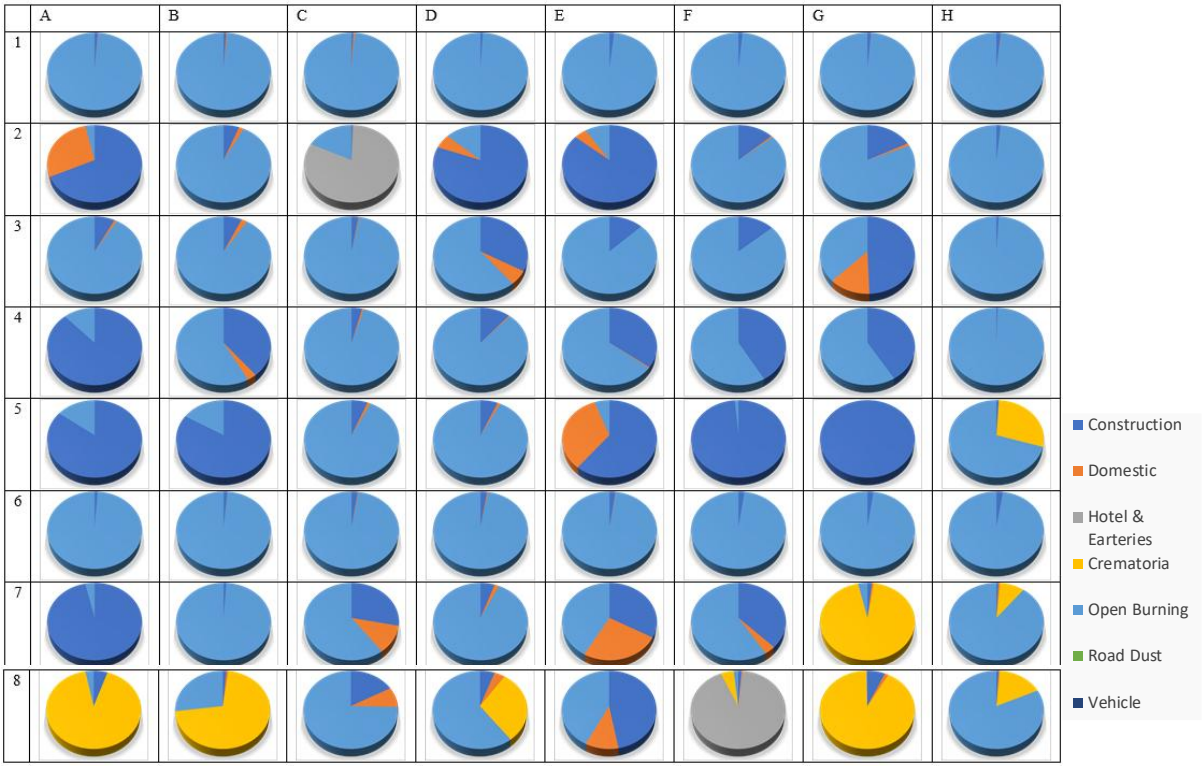


Fig. 4.15: Grid-wise source contribution in overall Emission load of NO_2

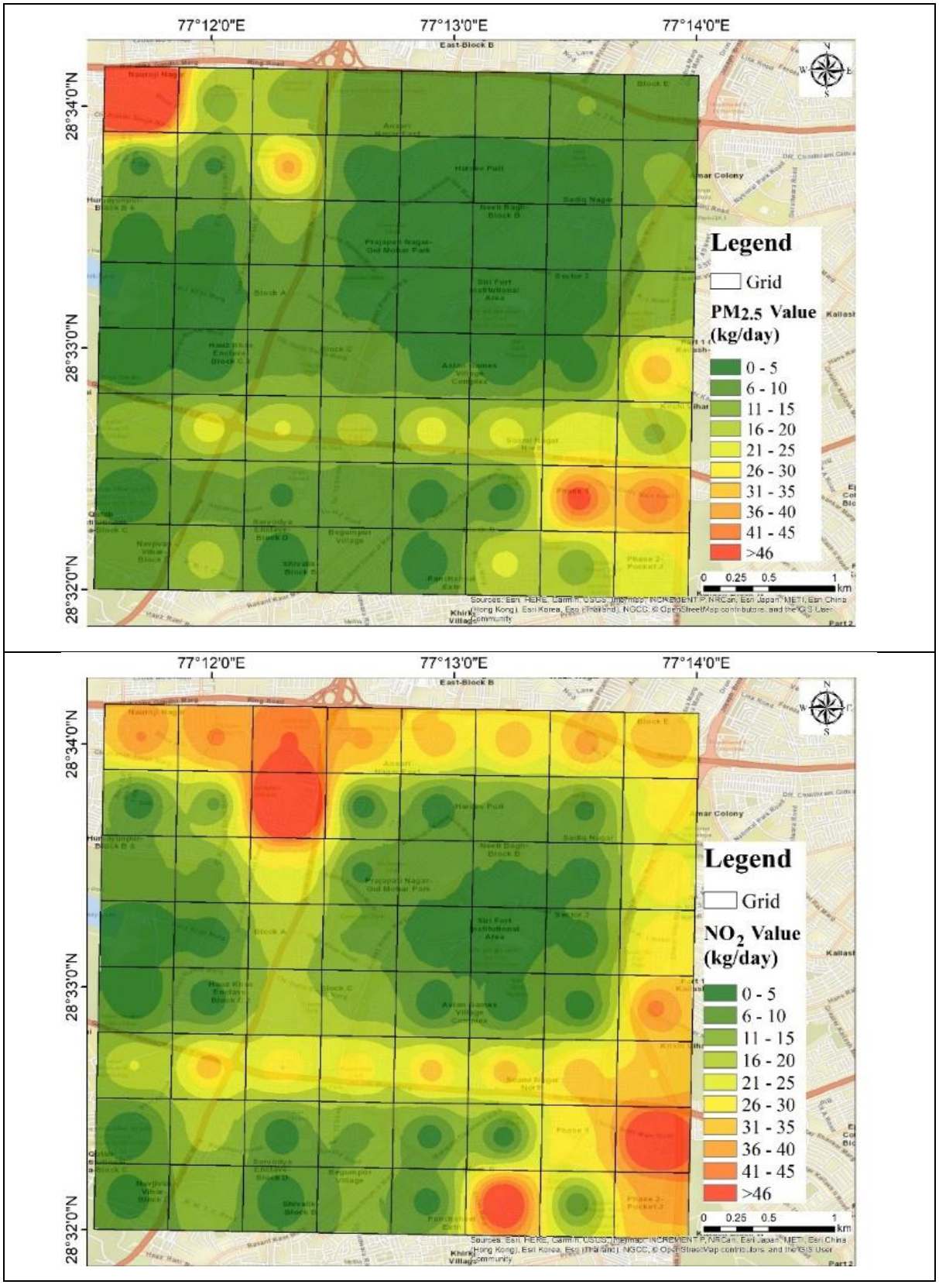


Fig. 4.16: Overall Emission map of different pollutant from different sources

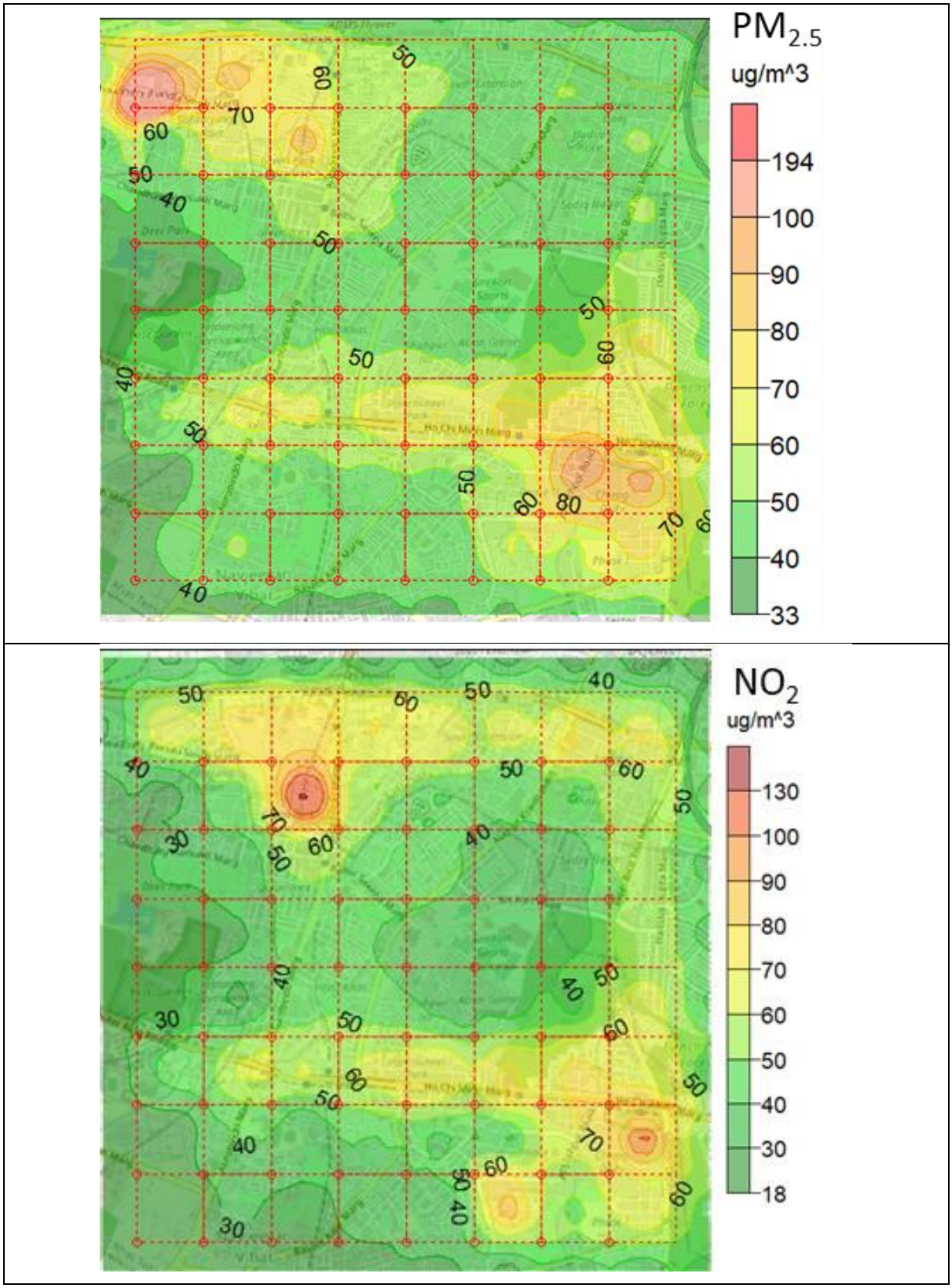


Fig 5.2: Base case spatial distribution of predicted $PM_{2.5}$ and NO_2 concentration

Table 5.3: Description of the Control options in 10 scenarios

Scenario	Scenario Description
Base	Present Scenarios
S1	**Replacement of Diesel Cars with CNG cars:** It is proposed to replace all Diesel cars with CNG cars in the study area. Out of total cars, the diesel cars were 22% which replaced with CNG cars and proportion of CNG cars increased from 9% to 30%. This can be possible by declaring **low emission zone** for cars.
S2	**Replacement of Diesel Cars with Electric Vehicles (EV) cars:** Diesel cars were substituted with Electric cars. The electric cars usages increased to 24% of total cars. This can be possible by declaring the study area as **zero emission zone** for car.
S3	**Reduce Diesel (100%), Petrol (50%) & Motor Bike (50%) to Electric Vehicles:** Diesel car (22%), Petrol car (67%), Electric car (3%) and 9% CNG cars were present in base scenarios. Now after this scenario, the new fuel composition in traffic would be 75% Petrol cars, 0% diesel car, 6% electric cars and 20% CNG cars, along with 50% petrol and 50% electric bikes.
S4	**Reduce Vehicles count to 90%:** A total of 1,243,169 vehicles in a day were estimated on all major and minor roads. After reducing 90% of the total vehicles, the remaining vehicle counts on different roads would be 124317 in a day.
S5	**Road dust cleaning through mechanical road sweeper (silt load reduction by 80%):** For the major roads, the silt load was initially 1.6 g/m^2, 0.9 g/m^2, 0.7 g/m^2, and 1.1 g/m^2 which further reduced to 80%. The revised silt load will be 0.32 g/m^2, 0.18 g/m^2, 0.14 g/m^2 and 0.22 g/m^2, respectively.
S6	**Replacement of LPG based stove/tandoors with Induction based stove/tandoors in Hotel and Eateries: In the study area, t**otal 852 numbers of Hotels, Restaurants and open eateries are being operated. Out of which 221 were Hotel & Restaurants and 498 were Open eateries and 133 Dhaba's. Approx. 84 numbers of Hotels and Eateries were operating LPG stove/tandoors. Most of the open eateries uses LPG as fuels. It is proposed to shift LPG base stove/tandoor with induction-based stove/tandoor in all open eateries and Restaurants.
S7	**Hotel and Eateries: Zero Emission from Hotel and Eateries** Emission from all types of fuel used should be taken as Zero.
S8	**Restriction of Open Solid Biomass burning:** During winter season in Delhi, open biomass burning is a common practice for heating purposes. Most of the families in road side shelter burns the biomass. The security guards also use to burn on wood for heating purposes. During the field survey, the small scale burning observed by the study team. It is proposed to strict ban on this type of open biomass burning in the study area. The open burning can be stopped by spreading the awareness, strict monitoring and by supplying electric heaters to security guards and road side shelters resident.

S9	**Replace Crematoria with electric crematoria (fuel emission = 0, body emission as per previous one):** It is proposed to ban the use of wood in the crematoria and replace with electric crematoria.
S10	**Reduce emission from Construction activities by 70% by applying best practices at construction sites.**

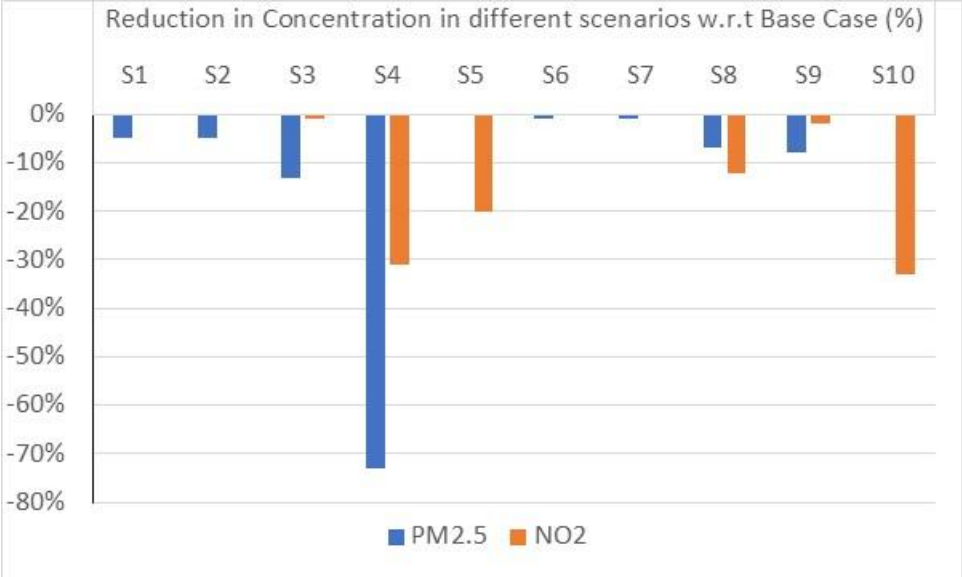


Fig. 5.5: Reduction in Pollutant concentration due to implementation of different Scenarios w.r.t Base