Indicators and Approaches Used for Air Quality and Health in 3 cities

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LCMP Program
Udaipur, August, 2013

Application of SIM-air Tools

Local transport and non-transport sector emissions

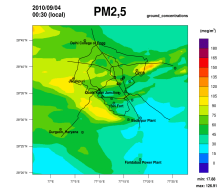
Calculations extended to 2030 and flexible

Modeled total PM pollution – linked to a dispersion model

Prognostic health impacts for scenarios

Monitoring

Dispersion Modeling



PM, SO2, NOx, CO, Ozone, VOC

Concentrations

Contributions

Evaluation

Emissions

SIM-air Program

Impacts

Pollution Control

Economic Technical Policy

Decisions

Costs & Benefits

Public Awareness & Dialogue with Policy Makers

Mushrooming brick kilns, stone quarries major air polluters in city, says study

SUSHANT KULKARNI
DECEMBER 27

RAPIDLY mushrooming brick kilns and stone quarries along the city boundaries are major contributors to air pollution within the city, reveals a study by a Delhi-based research group which has used data provided by the Pune Municipal Corporation and the Maharashtra Pollution Control Board.

The researchers have stressed the need to [illegible] for the [illegible] pushing them away from cities.

A Delhi-based research group named urbanemmissions.info did a detailed study of the pollution in six cities including Pune, Chennai, Indore, Ahmedabad, Surat and Rajkot. The study says the areas around Pimpri-Chinchwad and Hadapsar, where brick kilns are coming up, and areas along [illegible] Road where there are a large number stone quarries, are major contributors of the suspended particulate matter found in the city's air.

Pune – Dec/28/2011

study Pune's pollution, we considered 32X32 km area, which include both Pune and Pimpri-

that in the central part it's around 111 micro gram per cubic meter. "It is very interesting to note that

Diesel generators, stone quarries, brick kilns adding to pollution level, says study

Dipannita Das | TNN

Pune: A recent study has shown that brick kilns, stone quarries and diesel generators contribute to a city's pollution level in a major way. Even though kilns and quarries are located on the outskirts, the pollution travels to [illegible] the city.

The study 'Urban [illegible] pollution and co-benefits analysis in India' was carried out in six cities, including Pune, in 2011. Conducted by New Delhi-based independent [illegible] group Urbanemissions.info, [illegible] of the study was to better understand sources of air pollution.

In case of pollutant particulate matter PM 10 (10 micrometre or less in size) in the city, it was found that around 47% of PM 10 is contributed from road dust, nearly 17% from vehicles close to 13% each from [illegible]ilns and rural bio-mass [illegible]g/ kerosene use and al[illegible]% from generators and [illegible]y. In case of PM 10, all [illegible]es exceed the annual am[illegible]tandard of 60 ug/ m3 (grams per cubic metre).

[illegible] study was initiated [illegible]pport from the Climate [illegible] Foundation (USA) and [illegible]kti Sustainable Energy

HIGHLIGHTS

- There are 600 brick kilns in Chennai, followed by 400 in Pune, 320 in Ahmedabad, 200 in Surat and 120 in Indore
- The pollutant level was measured by using five monitoring stations in Pune [illegible] other cities where the [illegible] carried out included Chennai, Indore, Ahmedabad, Surat and Rajkot

RECOMMENDATIONS

- [illegible]
- [illegible]
- [illegible] public transport
- Introducing alternate fuel for public transport and three-wheeler sectors
- A reduction in re-suspended road dust
- A change in technology used for baking bricks
- A reduction in truck movements within city limits

Foundation (New Delhi). The research group used the SIM-Air (Simple Interactive Models for Bette[illegible] of tools f[illegible] help est[illegible] tant emi[illegible] involve[illegible] Sarat[illegible] der of

and developer of the SIM-Air family of tools, who was in the city recently to deliver a talk organised by the Pune Municipal Corporation (PMC), said that a majority of the 400 brick kilns located in the Pimpri-Chinchwad Municipal Corporation (PCMC) areas add to the pollution level in Pune city and that the central parts of Pune city are the most polluted. There is use of light- and heavy-duty vehicles in and around the brick kilns too adds to pollution.

"Diesel generators sets used in hotel, apartments, hospitals and markets is a new source contributing to pollution. Diesel generator sets are a common sight in most parts of the six cities and are a significant source of pollutant emissions and green house gas emissions," he said.

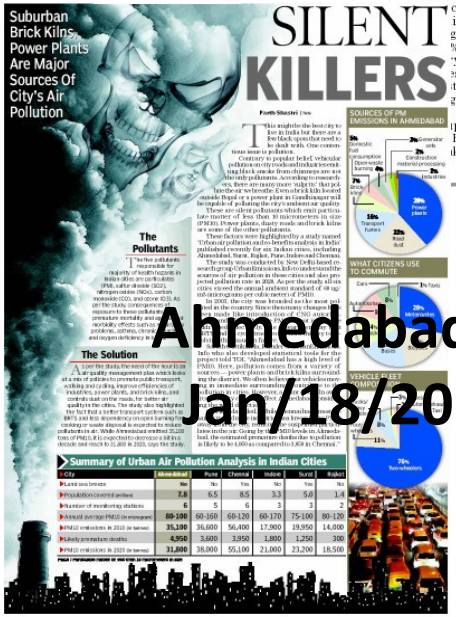
Guttikunda, who is also an affiliate associate research professor at the Desert Research Institute, Reno, USA, pointed out that the pollution from fossil and bio-mass fuel usage at brick kilns is a growbient air and human health.

In Pune, most of the brick baking is conducted as a pile with no chimney to support to movement of the burning emissions, whereas in Chennai, the same process is supported with a chimn[illegible] allows for release of [illegible] at a higher altitude, states.

Besides the bri[illegible] stone quarries are a[illegible] sight in these cities [illegible] stone quarry area i[illegible] was observed that on[illegible] sis around 500 truc[illegible] stone, black boulder[illegible] rum are extracted a[illegible] ported to various pa[illegible] district and the st[illegible] health risks associ[illegible] constant exposure t[illegible] particles in these ar[illegible] der study. Also, qua[illegible] tions account for ther[illegible] sion of dust due to [illegible] and handling of rock [illegible] sions from the truck n[illegible] and use of diesel gene[illegible] said.

The study with re[illegible]

Pune – Dec/29/2011

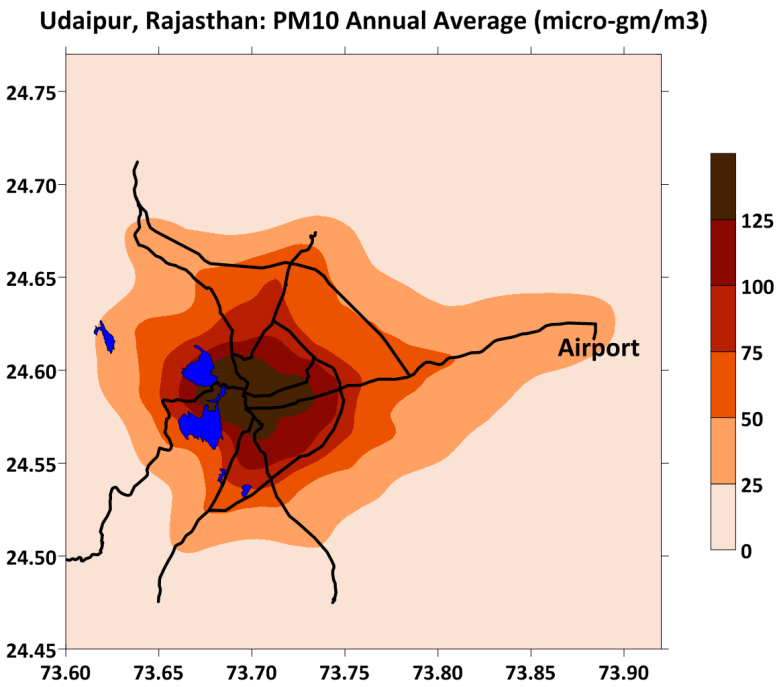


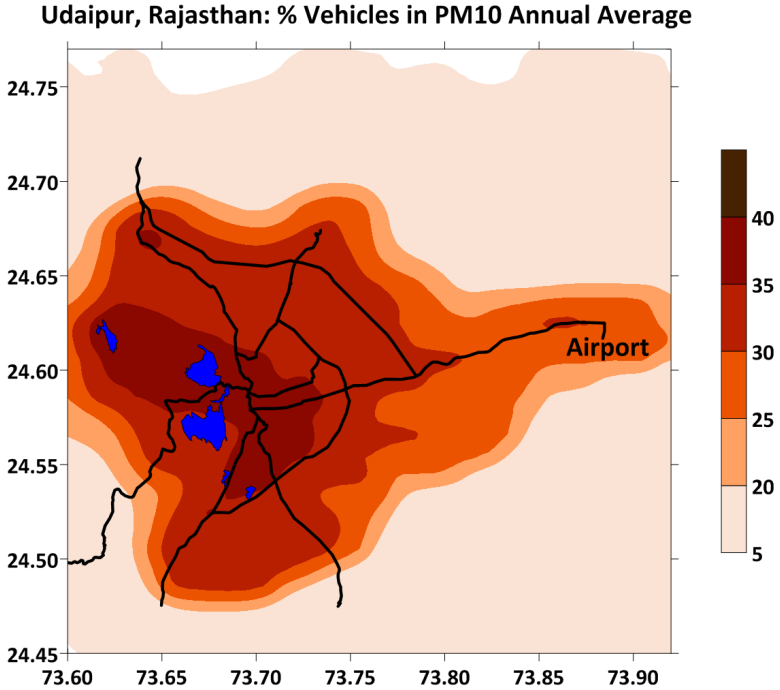
Ahmedabad – Jan/18/2012

Indore – Jan/21/2012

Delhi – Jan/3/2012

Udaipur, Rajasthan

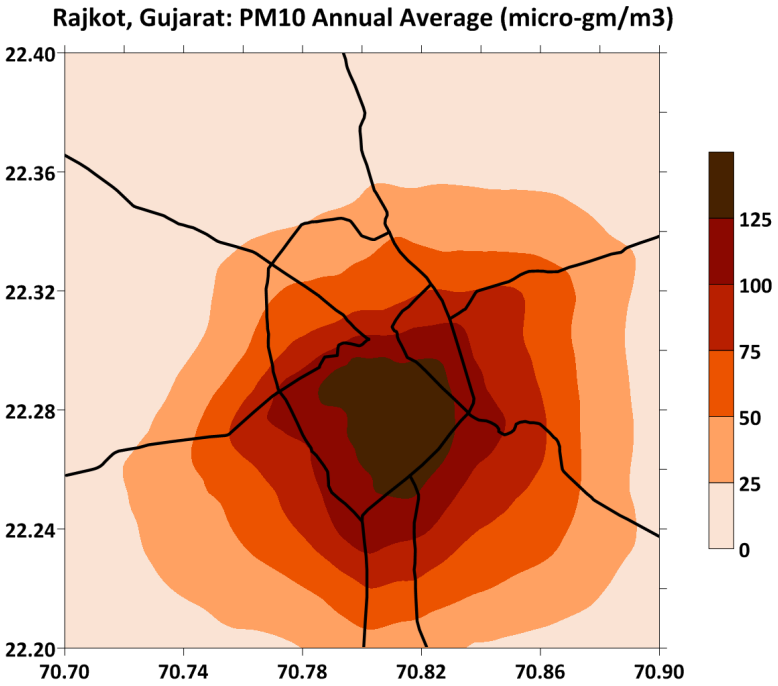


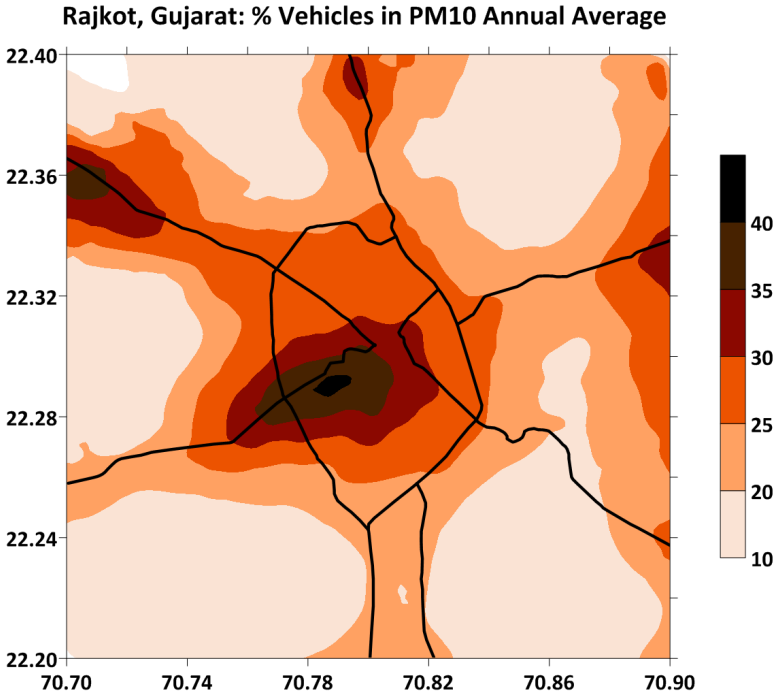


All the databases are maintained on GIS platforms

Modeled % pollution from vehicle exhaust emissions in 2010

Rajkot, Gujarat

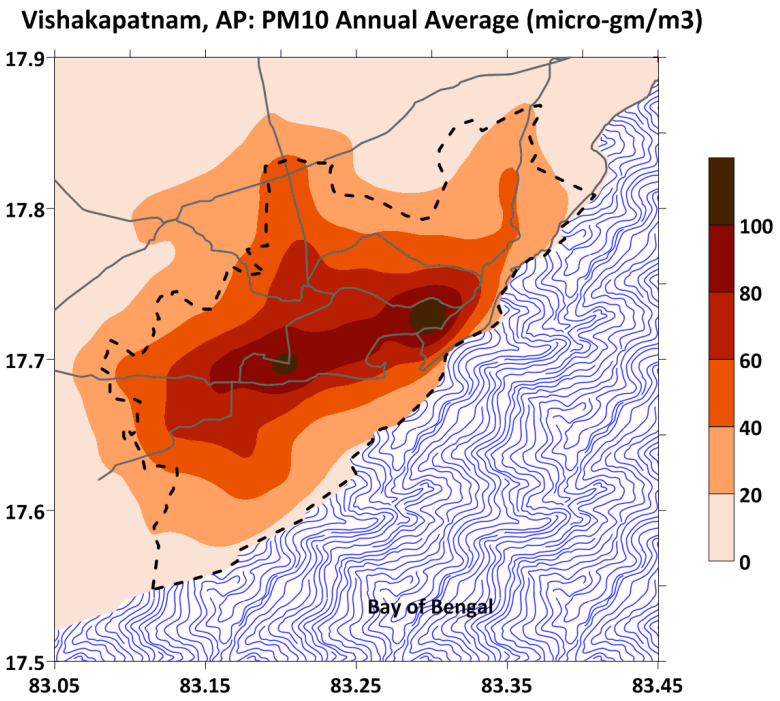


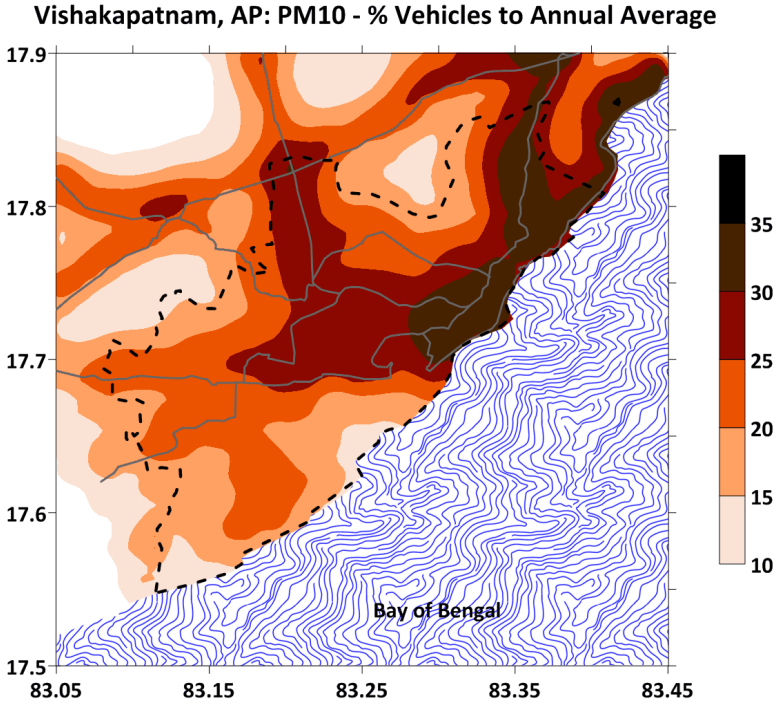


All the databases are maintained on GIS platforms

Modeled % pollution from vehicle exhaust emissions in 2010

Vizag, Andhra Pradesh



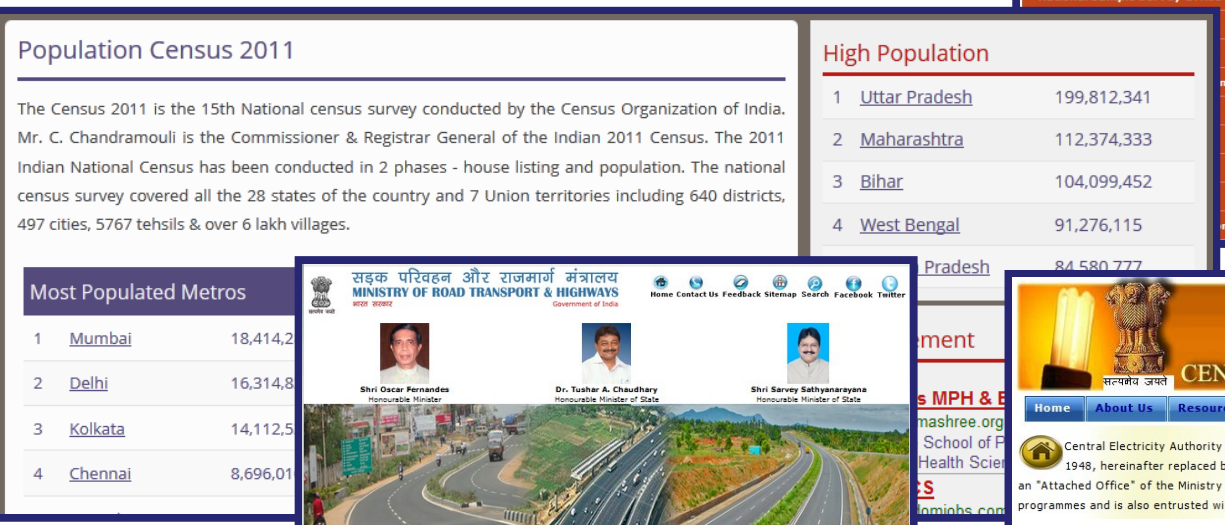


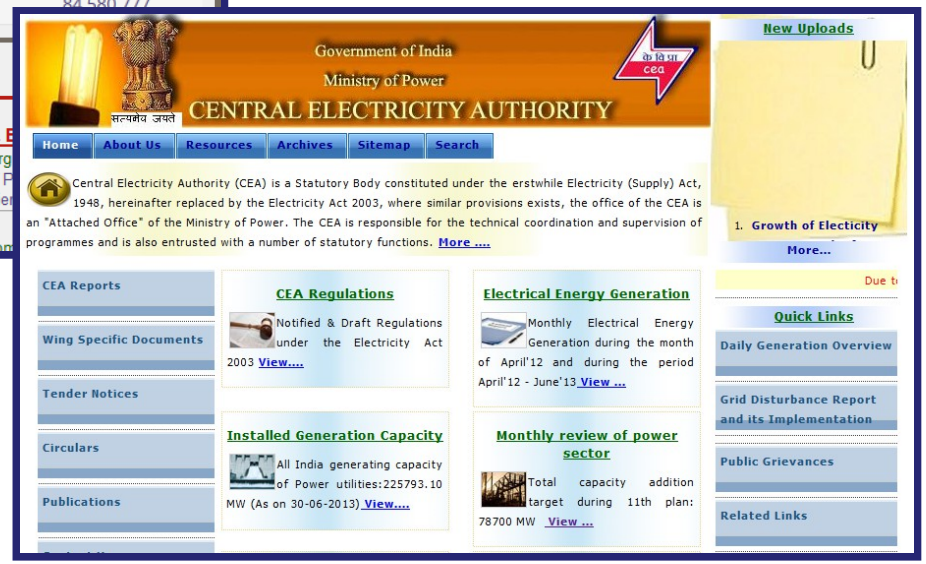
All the databases are maintained on GIS platforms

Modeled % pollution from vehicle exhaust emissions in 2010

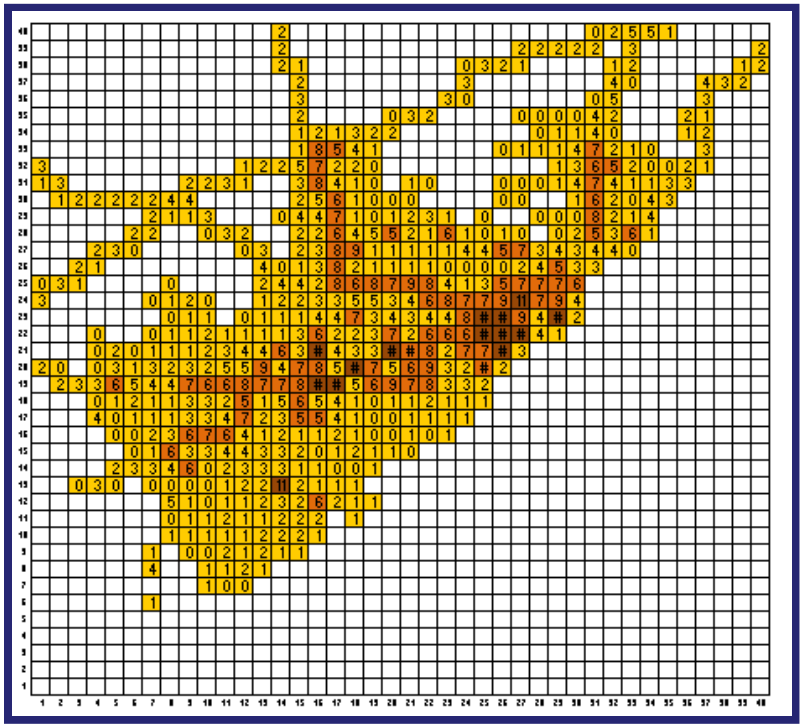
Emissions Modeling - Sectors

Domestic
Vehicle exhaust
Road dust
Industries





Emissions Modeling - Results

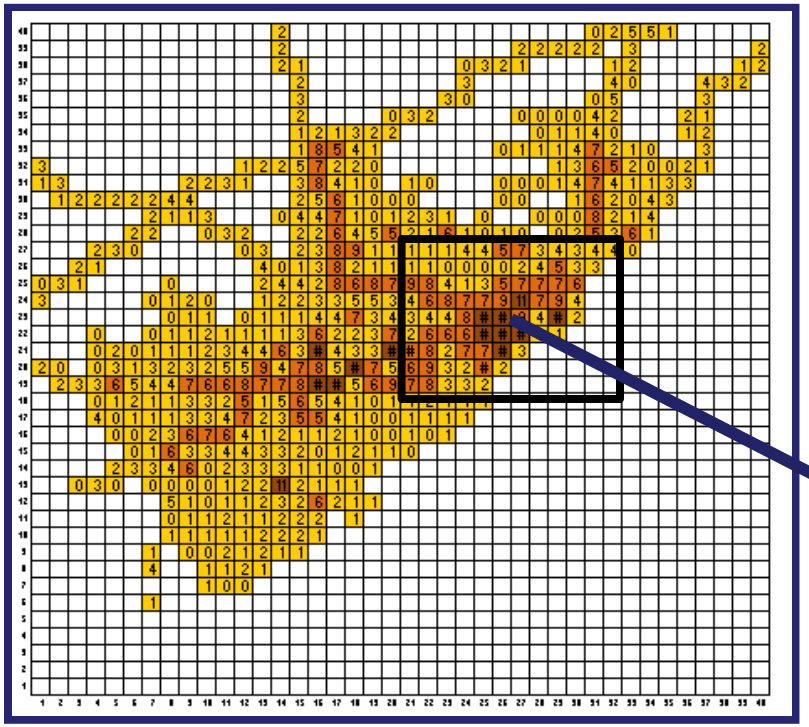


Gridded Emissions

Total Emissions

PM, SO2, NOx, CO, VOC, and CO2

Emissions Modeling - Results

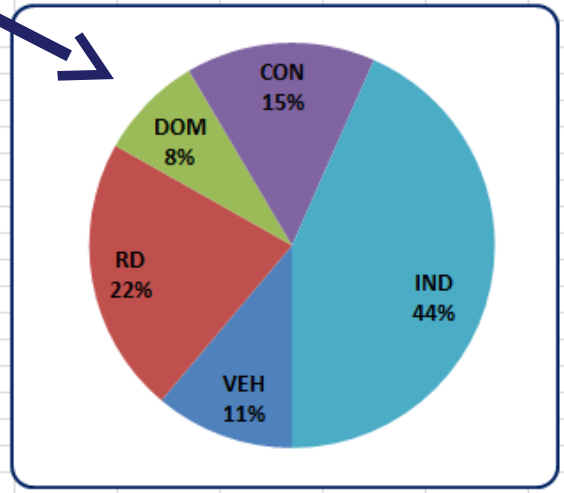


Gridded Emissions

Total Emissions
PM, SO2, NOx, CO, VOC, and CO2

no.of.sectors	5	central	port-pp	east-Ind
no.of.regions	3	1	2	3
	xlow	10	22	25
	ylow	16	21	21
	xhigh	31	29	28
	yhigh	28	28	25
Vehicles	VEH	1141.7	395.4	202.8
Dust	RD	2318.9	783.3	401.1
domestic	DOM	1391.4	295.8	89.4
construct	CON	1451.5	536.2	277.3
industry	IND	4773.1	1540.4	895.0
		11076.6	3551.1	1865.8

PM10 Emission Totals



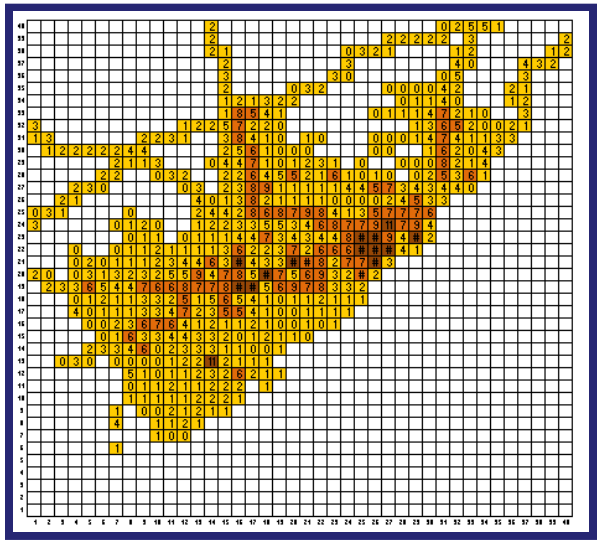
Emissions Modeling - Results

More details for vehicle exhaust emissions

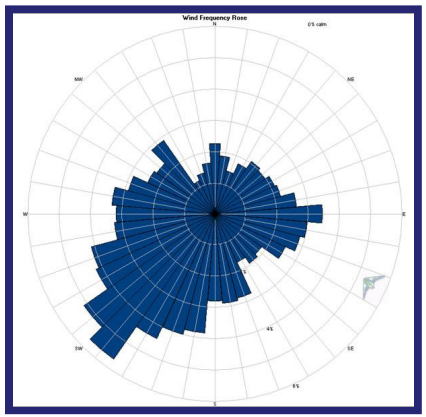
	Vehicle Type	Total No. Of	% Fuel Type						VKT/year	Avg PKT	PKT	% check	%VKT projection	% in-use
			Petrol	Diesel	GAS	ELEC	BIO	AAA	km	per km	mil/year			
1	2Ws	501,045	60%	40%	0%	0%	0%	0%	13,200	1.2	7,937	100%	0.0%	100%
2	Cars	70,747	50%	30%	10%	0%	10%	0%	12,000	2.0	1,698	100%	0.0%	100%
3	MUVs	6,095	20%	80%	0%	0%	0%	0%	18,000	1.5	165	100%	0.0%	100%
4	Taxis	4,800	0%	100%	0%	0%	0%	0%	20,000	1.5	144	100%	0.0%	100%
5	3Ws	36,124	80%	20%	0%	0%	0%	0%	54,750	1.5	2,967	100%	0.0%	100%
6	Buses	6,275	0%	100%	0%	0%	0%	0%	36,500	50.0	11,452	100%	0.0%	100%
7	HDVs	17,036	0%	100%	0%	0%	0%	0%	43,800	-	-	100%	0.0%	100%
8	LDVs	10,885	0%	100%	0%	0%	0%	0%	45,000	-	-	100%	0.0%	100%
9	Others	-	0%	100%	0%	0%	0%	0%	-	-	-	100%	0.0%	100%
10	AAA	-	0%	100%	0%	0%	0%	0%	-	-	-	100%	0.0%	100%
		653,007												

Vehicle Type	EF improvement	Average PM2.5 (gm/km)						Annual PM2.5 emissions (tons)						
		Petrol	Diesel	GAS	ELEC	BIO	AAA	Petrol	Diesel	GAS	ELEC	BIO	AAA	
2Ws	0.0%	0.032	0.026	-	-	-	-	127	69	-	-	-	-	195.8
Cars	0.0%	0.005	0.175	0.003	-	-	-	2	45	0	-	-	-	46.9
MUVs	0.0%	0.005	0.175	0.003	-	-	-	0	15	-	-	-	-	15.5
Taxis	0.0%	0.005	0.188	0.003	-	-	-	-	18	-	-	-	-	18.0
3Ws	0.0%	0.212	0.194	0.032	-	-	-	335	77	-	-	-	-	412.2
Buses	0.0%	-	0.629	0.203	-	-	-	-	144	-	-	-	-	144.1
HDVs	0.0%	-	0.569	-	-	-	-	-	425	-	-	-	-	424.6
LDVs	0.0%	0.114	0.175	0.114	-	-	-	-	86	-	-	-	-	85.7
Others	0.0%	-	-	-	-	-	-	-	-	-	-	-	-	-
AAA	0.0%	-	-	-	-	-	-	-	-	-	-	-	-	-

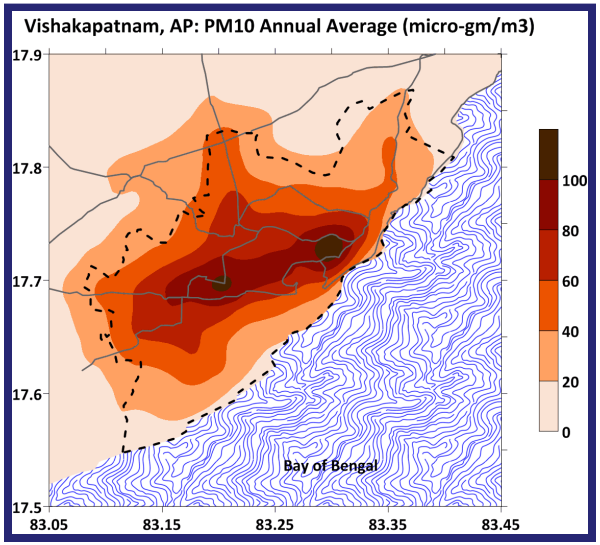
Emissions to Concentrations



Gridded Emissions



NCEP Reanalysis Meteorology



Gridded Concentrations

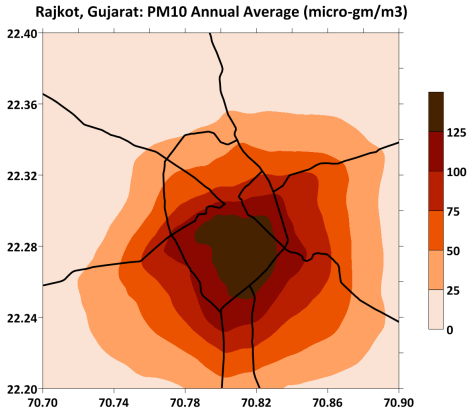
ATMoS Dispersion Model
Lagrangian puff transport

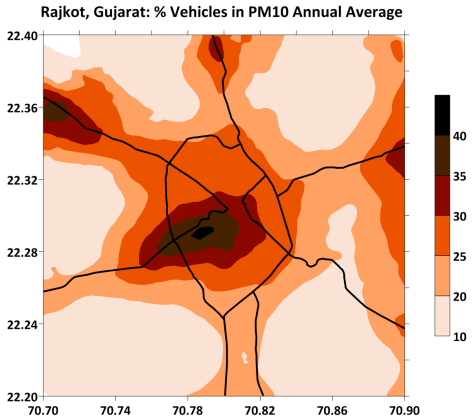
Source-Receptor matrix included

Extract results to selected grids

Total PM10 and PM2.5
(including secondary)

Concentrations to Health Impacts



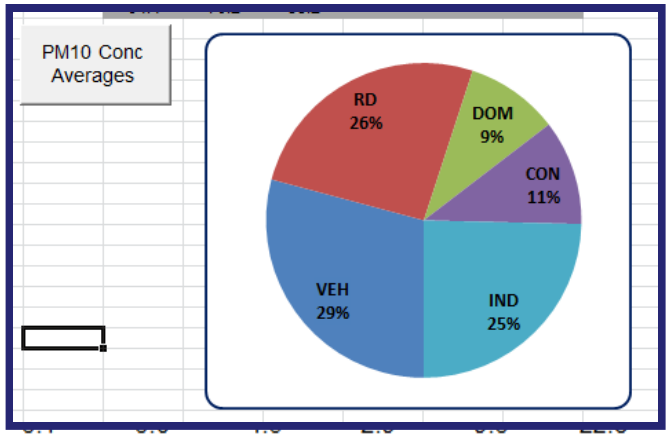


POP

Premature mortality
Asthma cases
Chronic bronchitis cases
Heart ailments
Hospital visits
Hospital admissions

Disaggregated Results in GIS

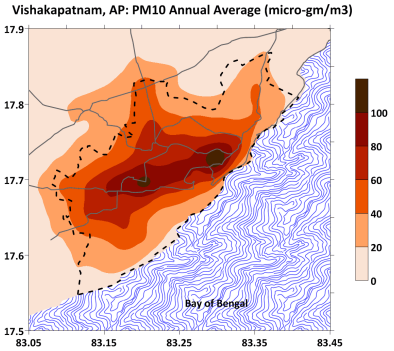
X	Y	Longitude	Latitude	VEH	DUST	DOM	CON	IND	TOTAL	%PM2.5	%VEH	%IND	POP	Mortality
4	15	83.0850	17.6450	4.1	3.2	4.5	2.1	10.1	23.9	77.0	17.0	42.4	659	0.23
5	15	83.0950	17.6450	5.7	4.7	5.5	3.0	11.5	30.3	74.9	18.6	37.9	1838	0.79
6	15	83.1050	17.6450	7.9	7.0	6.7	3.8	13.5	38.9	73.3	20.3	34.8	6434	3.47
7	15	83.1150	17.6450	10.4	9.4	7.8	4.4	15.9	47.8	72.4	21.6	33.2	8367	5.48
8	15	83.1250	17.6450	12.9	11.8	8.4	3.9	19.3	56.3	72.5	22.9	34.3	8666	6.69
9	15	83.1350	17.6450	12.5	11.7	8.6	3.5	20.8	57.0	73.2	21.9	36.5	8671	6.84
10	15	83.1450	17.6450	11.8	11.5	8.5	3.1	23.4	58.4	73.9	20.3	40.1	8667	7.08
11	15	83.1550	17.6450							73.5	20.7	40.2	8657	7.27
12	15	83.1650	17.6450							73.9	20.4	43.1	8570	7.53
13	15	83.1750	17.6450							73.8	21.2	43.3	7588	6.66
14	15	83.1850	17.6450							73.6	21.3	43.0	8517	7.06
15	15	83.1950	17.6450							74.4	19.6	44.9	9128	6.66
16	15	83.2050	17.6450							74.3	18.9	43.3	7376	4.36
17	15	83.2150	17.6450							74.7	16.4	44.9	5577	2.79
18	15	83.2250	17.6450							74.3	17.1	41.0	2577	1.09
19	15	83.2350	17.6450							74.8	15.2	40.9	480	0.18
20	15	83.2450	17.6450										8182	2.65
21	15	83.2550	17.6450	2.6	2.5	4.1	2.6	7.9	19.7				10940	0.00
22	15	83.2650	17.6450	2.3	2.0	3.3	2.2	6.9	16.7				1965	0.00
23	15	83.2750	17.6450	2.0	1.7	2.4	1.8	6.3	14.1	76.2	13.8	44.7	0	0.00
24	15	83.2850	17.6450	1.5	1.2	1.8	1.5	5.1	11.1	76.5	13.9	45.9	0	0.00

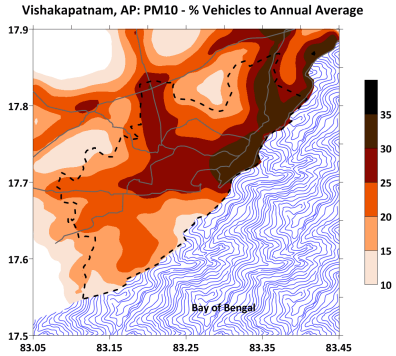


Vizag

Health Impacts Under Scenarios

Vizag





Base case annual mortality in 2010 = 1700

Base case annual mortality in 2030 = 2400

(assumed no change in the non-transport sectors)

Base case annual mortality in 2030 = 2200

(assumed 30% reduction in VKT for passenger vehicles)

Air Quality Indicators

Total emissions

Total emissions per PKT

Total emissions per VKT per mode

% contribution of exhaust emissions per mode

% contribution of emissions for select area

Total PM pollution

% contribution of sectors

% contribution by mode

Health impacts

Mortality per ton (of released or saved emissions)

Application of SIM-air Tools

Local systems were developed and delivered to the city groups

City groups were trained in March, 2013 for further scenario analysis

Models are in MS Excel platform with GIS interfaces

Programs can be extended spatially and sectorally depending on data available

Thank you

Questions?

Dr. Sarath Guttikunda

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