

# ENVIS-IITM NEWSLETTER

Indian Institute of Tropical Meteorology, Pune

Acid Rain and Atmospheric Pollution

(The project of Ministry of Environment, Forest & Climate Change, Govt. of India)

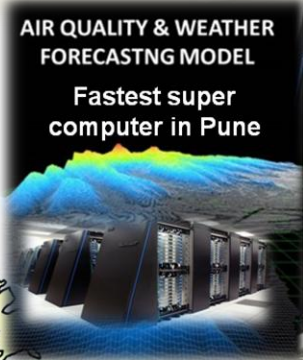
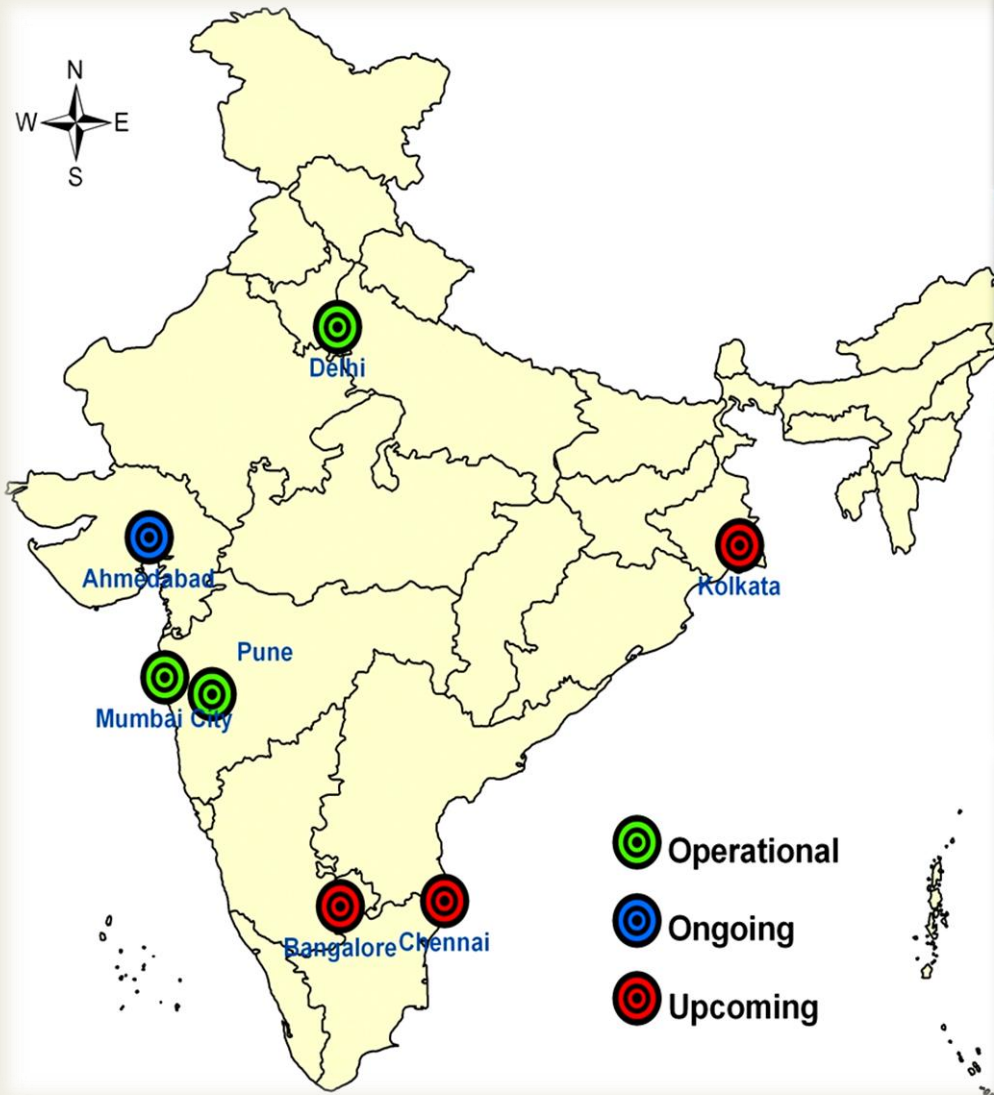


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## Advances in Air Quality Forecasting – SAFAR-INDIA



$$g(x) y(x) = f(x) + \int_a^b K(x,t) y(t) dt$$

unknown upper lim  
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12/01/2016 18:51

**CAMP**  
**AIR QUALITY - NOW**  
Pollutants AQI Quality

Ozone	35	Good
CO	34	Good
NOx	110	Moderate
PM10	146	Moderate
PM2.5	265	Poor
UV Index	1	No Risk

d, Oxides of Nitrogen: Good, PM2

EDITORIAL TEAM

Gufran Beig

Neha S. Parkhi; Ranjeeta Gawhane; Gaurav Shinde

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## EDITORIAL

*The ENVIS centre at IITM, Pune deals with thematic area Acid Rain and Atmospheric Pollution, this field has gained momentum because of increased pollution levels in India specifically in most of the urban areas. . It is well known fact that our atmosphere is being polluted to an extreme level by unplanned and uncontrolled development and human interference. In recent period Indian Metropolitan cities are hit worst due to atmospheric pollution. The air pollution problem faced today is directly related to the human health, agriculture and ecosystem and hence it need to be tackled on priority. To improve air quality in any region one should develop effective air quality management plan which can only be build up upon four components (1) Air Quality Monitoring (2) Air quality forecasting (3) Emission inventory development and (4) Public awareness. Scientific evaluation of these four components is very essential before developing any mitigation strategy. Current issue will provide you brief information about India's first early warning system "System of Air Quality Forecasting and Research (SAFAR)". The system is implemented in three metro cities of India viz. Delhi, Pune and Mumbai and provides current as well as forecast of air quality and weather parameters along with valuable inputs on health effects and advisories. We hope this issue will help you to find out various ways to know air quality status in India and help you to take precautionary measures in case of extreme air pollution and weather events.*

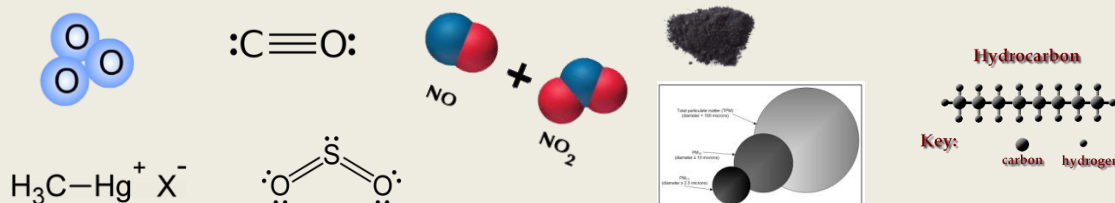
*-Gufran Beig*



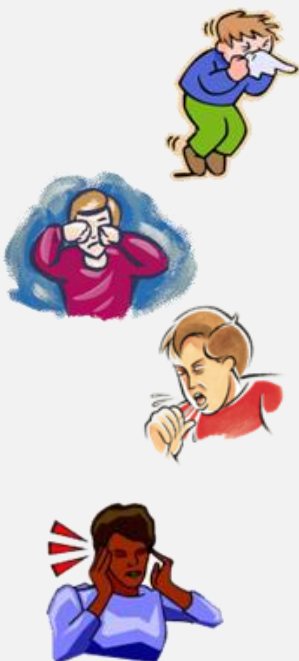
## INDIA : AIR POLLUTION FACTS

The Air (Prevention and Control of Pollution) Act was passed in India in 1981 and since then actions has been taken to improve over all air quality in India, however, as per Environmental Performance Index, 2013, India ranked 155 out of 178 countries. Today India is 9<sup>th</sup> largest in the world by nominal Gross Domestic Production (GDP) and the 3<sup>rd</sup> largest by Purchasing Power Party (PPP), this rapid economic growth has brought many benefits to India, but on another hand it has imposed notable adverse impacts on the local and regional air quality and other environmental parameters. The economic and social development in India has been reflected in the rapid growing industrialization, urbanization, increased transportation etc. which on other hand have put 1.27 billion population at the risk of heart and lung diseases by altering normal composition of air. The combustion of fossil fuel- Coal & petroleum products, Biofuels for energy generation, heating and other purposes results in the release of major green house gases & air pollutants including CO<sub>2</sub>, NO<sub>x</sub>, CO, SO<sub>2</sub>, particulate matter etc. in to the atmosphere results in the increase in their concentration than the normal.

### MAJOR AIR POLLUTANTS



### AIR POLLUTION EFFECTS



***When the local concentrations of these substances exceed certain threshold limit they have adverse effect on plants, animals, human health & cause discomfort to life.***

As per the report of WHO, in India the annual cost of environmental damage is around \$ 80 billion, equivalent to 5.7% of the country's GDP, out of which 28% damage is due to outdoor air pollution and 23 % damage is due to indoor air pollution. WHO data base on ambient air pollution showed that out of 20 most polluted cities in the world, 13 are in India and they have the highest levels of particulate matter PM<sub>10</sub> (PM having diameter ≤ 10 μm) and PM<sub>2.5</sub> (PM having diameter ≤ 2.5 μm) which is of great concern. In 2013, a report released by global burden of disease said that outdoor air pollution was the 5<sup>th</sup> largest killer in India. Nearly one lakh premature deaths happen annually due to air pollution in India. Moreover as per WHO recent study, the world's most polluted city is in India, Delhi has surpassed Beijing, Isn't it showing?

## India's first air quality forecasting system-SAFAR

In India, the problem of air pollution is more intense particularly in metropolitan cities like Delhi, Pune, Mumbai, Chennai, Kolkata, Hyderabad, Bangalore, etc. There is urgent need of air quality management (AQM) to improve the ambient air quality within a city or state. Effective air quality management can only be achieved through a comprehensive approach built upon four key areas viz. air quality monitoring, emissions inventories, air quality modeling, and control strategy development. In addition, there is a need for combining core scientific research with latest technological advances to develop robust early warning system which will help to reduce the cost involved in the damage caused by air pollution episodes and extreme weather condition and associated risks to human health and agriculture. It will help people to prepare themselves to deal with the situation if the information is available in advance.

Considering the benefits of an early warning system, Government of India has taken up an initiative and implemented India's first air quality forecasting system "System of Air Quality and weather Forecasting and Research –SAFAR" in major metropolitan cities in India. This is a planned project of Ministry of Earth Sciences, conceived by Pune based Indian Institute of Tropical Meteorology and implemented jointly with India Meteorological Department and local government authorities in 3 metro cities of India viz. Delhi, Pune and Mumbai.

### SAFAR-INFORMATION PRODUCTS

- 1. AIR QUALITY:**  
*Color-coded Index based Current & 3-days forecast with health advisories.*
- 2. HARMFUL RADIATION:**  
*Severity of UV radiation (UVI) with associated skin advisories.*
- 3. WEATHER:**  
*Current & 3 days advance forecast, sea, tide and severe weather*
- 4. EXTREME EVENTS:**  
*Alert for extreme pollution and weather events.*
- 5. EMISSION SCENARIO:**  
*Accounting location-wise sources of air pollution*

SAFAR envisages a research based management system where strategies of air pollution mitigation go hand in hand with Nation's economic development and it integrates Air Quality Health Advisories and Food security.

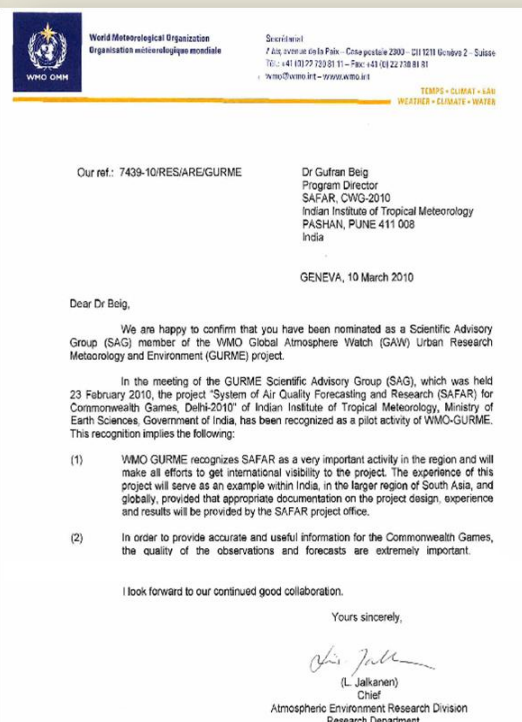
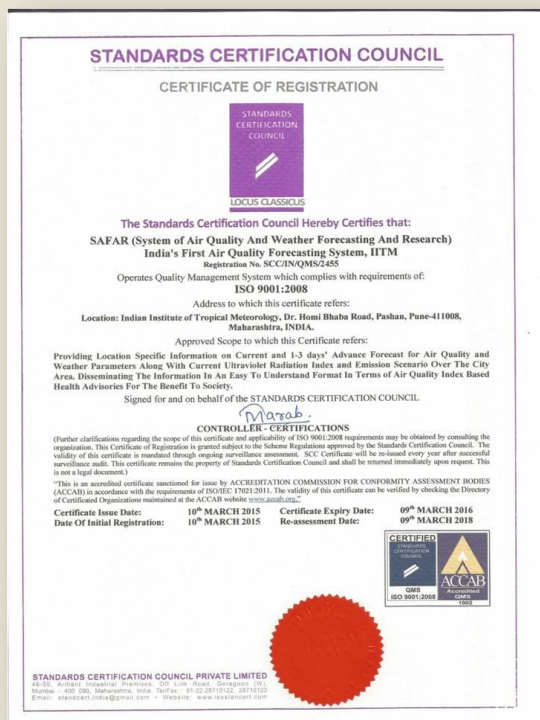


# SAFAR RECOGNITION

## National Certification - ISO 9001:2008

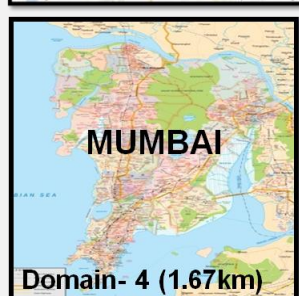
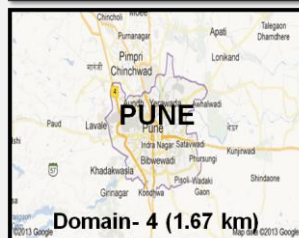
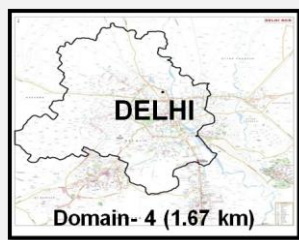
## International Recognition - World Meteorological Organization

### (GURME - Pilot)



## SAFAR-CITIES

- **Delhi** : The country's capital with a population of 16.75 million is one of the most polluted city in the world. Scientists say coal-fired power plants, vehicles, construction dust, crop burning and cooking fuel use all contribute to high pollution levels in Delhi. SAFAR-Delhi is operational in Delhi since 2010.
- **Pune** :The cultural capital of Maharashtra is one of the fastest growing cities in the Asia-Pacific region. The city is known for its manufacturing & automobiles industries, educational & research institutes, IT hub etc. which attract migrants, students, and professionals from India as well as abroad. Thus, the rise in growth and development leads to many problems and air pollution being one of them. The SAFAR-Pune system is operation since 2013.
- **Mumbai** : Mumbai being the capital of Maharashtra state and occupying a 440 sq. km. area is one of the vital regions of India which has been subjected to mammoth developmental activities, population growth, vehicular traffic etc. The SAFAR system made operation in Mumbai as SAFAR-Mumbai since June 2015.



## SAFAR-COMPONENTS

1.

### Observational Network

To provide an AQI representative of a city, single station data is not suitable. As per international guidelines, correct way to know ONE index for a city air quality is to consider different microenvironments. The SAFAR observational network of Air Quality Monitoring Stations (AQMS) and Automatic Weather Stations (AWS) established within the metro city limits represents selected microenvironments of the city including industrial, residential, background/ cleaner, urban complex, agricultural zones etc. as per international guidelines which ensures the true representation of city environment.



#### Pollutants monitored:

*PM1, PM2.5, PM10, Ozone, CO, NO<sub>x</sub> (NO, NO<sub>2</sub>), SO<sub>2</sub>, BC, Methane (CH<sub>4</sub>), Non-methane hydrocarbons (NMHC), VOC's, Benzene, Mercury.*

#### Meteorological Parameters:

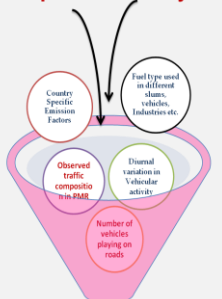
*UV Radiation, Rainfall, Temperature, Humidity, Wind speed, Wind direction, Solar radiation.*

2.

### Emission Inventory Development

Under the project high resolution emission inventories (1.67km\*1.67km) has been developed for 60km\*60km domain for **8 air pollutants** namely, Oxides of Nitrogen (NO<sub>x</sub>); Carbon Monoxide (CO); Black Carbon (BC); Organic Carbon (OC); Particulate Matter <2.5 micron (PM<sub>2.5</sub>); Particulate Matter <10 micron (PM<sub>10</sub>); Sulfur Dioxide (SO<sub>2</sub>) and Volatile Organic Compounds (VOCs) over Delhi, Mumbai and Pune.

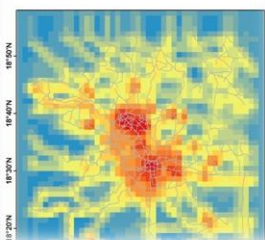
#### Region specific activity data



#### GIS Based Statistical Model

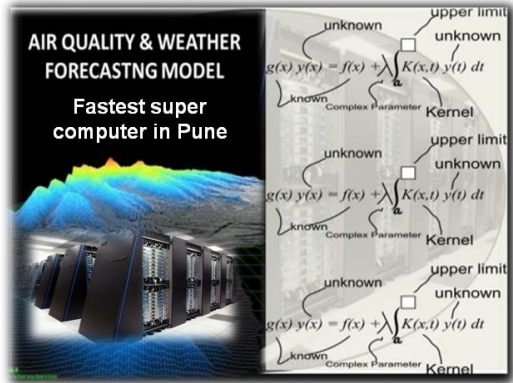
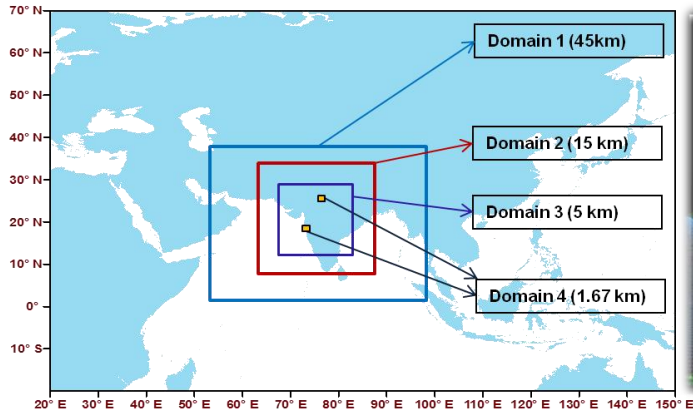
High Resolution gridded Emission Inventory  
(1.67 x 1.67 km resolution)

Total PM<sub>2.5</sub> Emission in Pune Region  
(At 1.67 km Resolution)



### 3. Air Quality Forecasting model

Complex computer model which handles millions of calculations in seconds provide the required tool for air quality forecasting at city level.



### 4. Communication to public

Complex scientific data generated through SAFAR system then converted in to simple numbers and colour codes which can be easily understand by common citizens, such as Air Quality Index (AQI) & associated health advisories, UV Index (UVI) and associated skin advisories and then disseminated through various interactive user friendly dissemination media.

#### BENEFITS TO END USERS



#### COMMUNICATION MEDIA FOR SOCIETY

LED DISPLAY BOARDS

SAFAR TOLL FREE NO.  
18001801222  
TOLL FREE

DYNAMIC WEBPORTAL

<http://safar.tropmet.res.in>

MOBILE APP

DATA ON YOUR FINGERT TIPS

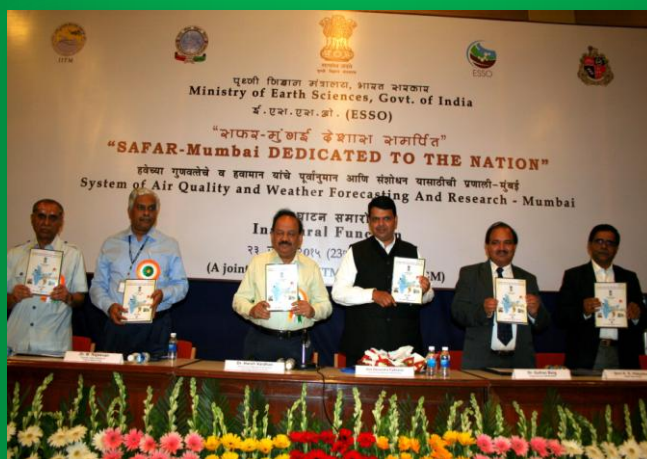
On 23<sup>rd</sup> June 2015 – The System of Air Quality & Weather Forecasting and Research (SAFAR) – Mumbai, dedicated to the Nation by Dr. Harsh Vardhan, Hon'ble Union Minister of Science and technology and Earth Sciences, Govt. of India and Shri. Devendra Fadnavis, Hon'ble Chief Minister of Maharashtra.



Release of SAFAR-Air-Mobile App



SAFAR-LED system dedicated to the Nation



Release of scientific reports

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