Earth System Science Organization
Ministry of Earth Sciences
Government of India

PRESS RELEASE

Scientific Perspective on the Status of the Air Quality of Delhi

The Delhi Air Quality (AQ) issue need to be understood in proper scientific perspectives as it is governed by three complex scientific processes namely local emissions, local weather and long to short range transport which are highly coupled and status of AQ, especially for Delhi, cannot be understood in isolation by ignoring one over other. The System of Air Quality and Weather Forecasting and Research (SAFAR) prediction system of the Ministry of Earth Sciences (MoES) developed indigenously and made operational since 2010 in Delhi consists of dense network of 8-10 monitoring stations coupled with high resolution (1.67 x 1.67 km) chemistry-transport (CT) forecasting model and emission inventories of pollutants, thus account for all three processes, concludes the following based on the results obtained during 2010-2014:

(1) The results of emission inventory developed under the SAFAR shows that the emissions from local pollution sources has been increased by 10 to 20 % from 2010 (94.26 Gg/Yr) to 2014 (107.49Gg/yr) from various sectors lead by transport sector but their reflection in concentration level of pollutant is highly non-linear and steady and cannot lead to sudden extremes in pollution. Considering these scientific issues, SAFAR data for 2010-2014 reveals that there is no systematic increasing or decreasing trend in the level of PM2.5 during past 4 years in Delhi but frequency of extreme pollution events are on increase. PM10 level of January 2014 is highest so far (Fig. 1 and Table 1).

(2) Diagnostic studies using complex CT-model and homogeneous data set of past 3-4 years indicates that unusual meteorological conditions are playing a pivotal role in increased frequency of extreme pollution events dominated by fine particulates, especially in winter and make air quality bad which greatly impact the average concentration. Frequency of these events has increased in recent time. Since two winter characteristics namely- (a) ***cooler temperature*** which brings down boundary layer where pollution get trapped near the surface) and (b) ***calm wind*** which prevents pollutant to drift and get mixed, have direct effect on air quality processes, winter air quality becomes more venerable in Delhi.

(3) One of the extreme events took place in November 2012 which lasted for 12 days and made the average November value highest (275$\mu g/m^3$) in 2012 which is higher by ~40% from earlier and later years. It was purely due to worst extreme pollution events in the history of Delhi caused due to untimely synoptic weather when western disturbance introduced lot of moisture to Delhi followed sudden fall in temperature by 4-5^oC overnight along with dense fog. What was unique?

A sudden change in wind direction emerging from North instead of usual North-Easterly and directly from crop-residue burn areas which pumped huge amount of fire smoke. Then suddenly calm wind prevailed. This made ventilation coefficient near zero forcing fringe formation enveloping Delhi sky to elevate levels of PM10 and PM2.5 to ~800µg/m^3 and ~480µg/m^3 respectively, the highest 24h mean value of the year lasted for few days followed by Diwali firework on 13th Nov.

(4) While inferring the impact of air pollution on health or crops, it is crucial that we must follow the standard norms like using 24h mean value for PM2.5 and PM10 while comparing with national standards or WHO standards (that are given for 24h average or annual). We should not make conclusion by comparing instant reading or 1hr reading with PM2.5 national standard threshold value (NAAQS). Picking-up the peak (highest) value of the day and comparing it with NAAQS or 24h average of any other country data is misleading. A point value cannot be a representative of prevailing ambient air quality as it may get influenced by sudden exposure of source at that time or due to known external factor like Diwali firework.

(5) The Air Quality Monitoring network reveal that at any day and in any location in Delhi so far during January 2014, maximum value of PM2.5 hardly touched ~350 microgram /m^3 on a daily average basis. Majority of the time during January on all locations of Delhi PM2.5 level was ranging between 100-300 µg/m^3. The average of all 9 stations which may be considered as representative of Delhi air quality was around 184 µg/m^3 which is well predicted by the SAFAR AQ forecasting model as displayed regularly in SAFAR website (http://safar.tropmet.res.in) (Fig.2). PM2.5 level remained much lower in Delhi (150-270µg/m^3) as compared to Beijing where PM2.5 level reached as high as 500 to 670 µg/m^3 between 14th to 17th January (Fig. 3). This Beijing level is the level which reaches rarely in Delhi.

(6) This winter so far has witnessed lot of ups and down in Delhi pollution levels. Particulate pollutants are observed to be highly variable from one location to another mainly due to prevailing typical weather conditions. Pollution tend to get trapped near the surface and boundary layer came down to as low as 50-70 meters during many days in January due to fall in temperature. Pollution also get modulated by unusual and erratic wind directions coming and going out of Delhi.

(7) It should be stressed here that the concept of AIR QUALITY INDEX is the best tool to simplify the uncertainty for common public as it is always given for standard averages like PM10 and PM2.5 given for 24 hr average basis. It may be mentioned here that the concept of AQI for India has been provided by MoES after extensive research, through its technical report (Scientific Evolution of Air Quality Standards and Defining Air Quality Index for India by Beig et al., *Special Scientific Report SAFAR-2010-B, Ministry of Earth Sciences (Govt. of India), September' 2010*) which is available in public domain at SAFAR site, usage of which need to be encouraged for easy understanding.

Fig. 1

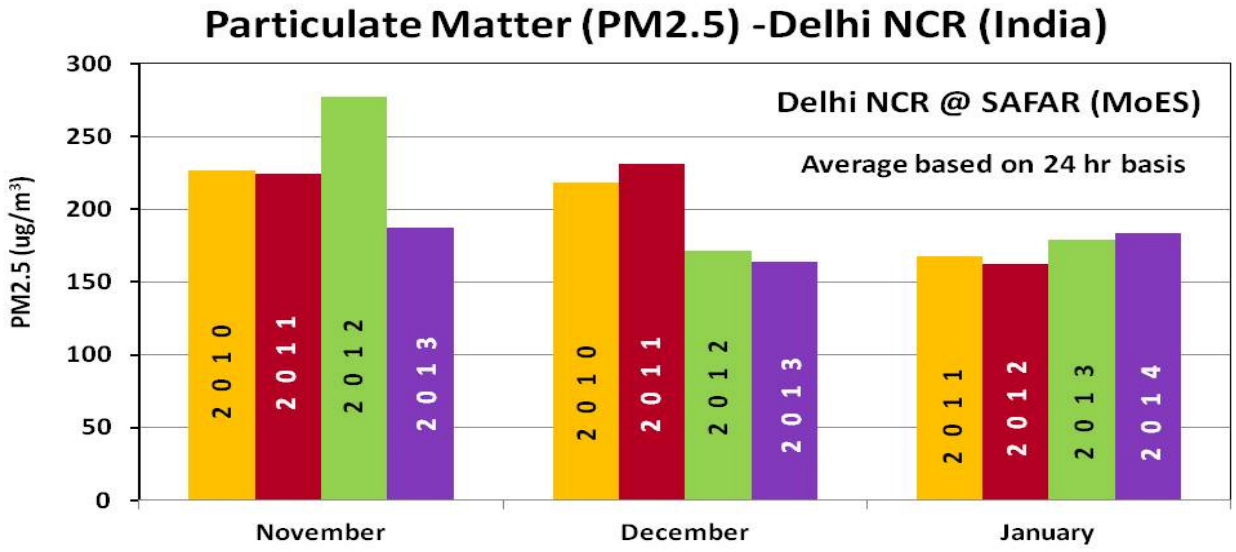
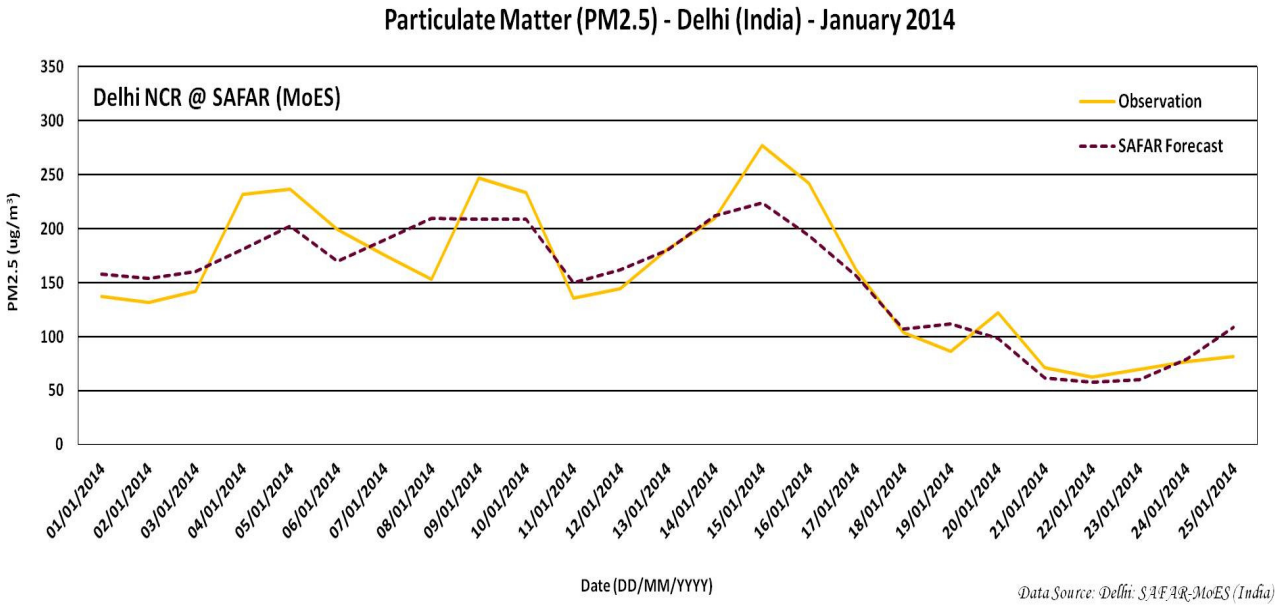


Table 1

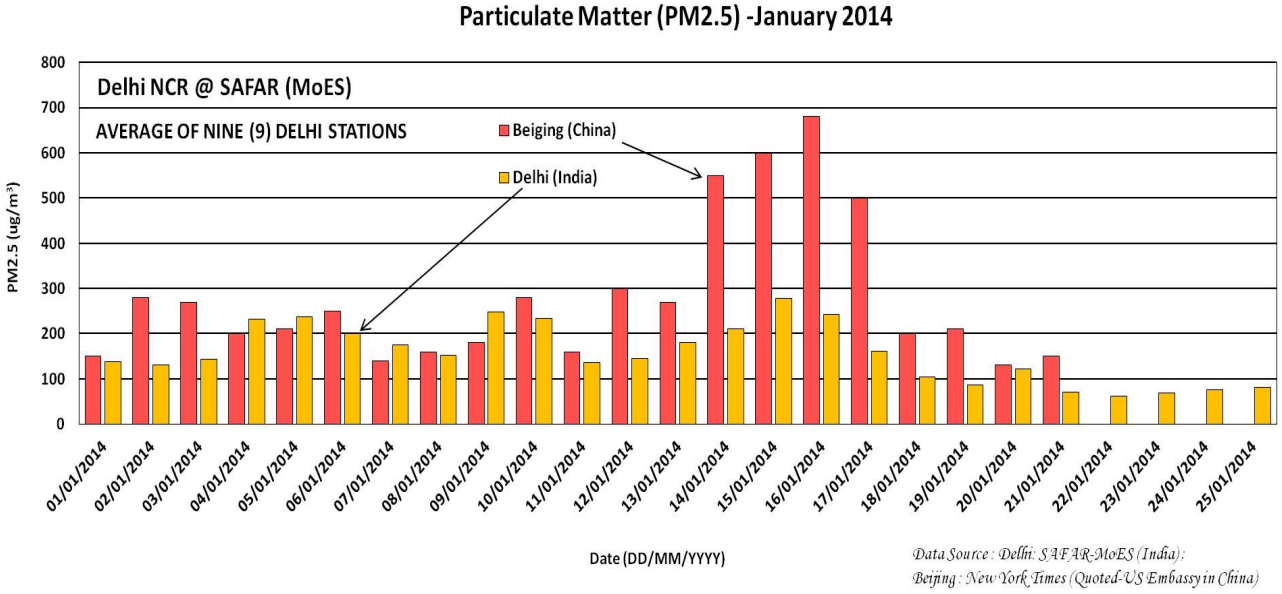
Delhi NCR @ SAFAR (MoES) Particulate Matter (PM2.5)-ug/m³ - (Average on 24 hr basis)			
Year	**November (Year)**	**December (year)**	**January (Year)**
2010-11	**226.72** (2010)	**218.01** (2010)	**167.58** (2011)
2011-12	**224.14** (2011)	**230.77** (2011)	**162.25** (2012)
2012-13	**277.16** (2012)	**171.43** (2012)	**178.91** (2013)
2013-14	**187.39** (2013)	**163.76** (2013)	**183.29** (2014)

Fig. 2



Data Source: Delhi: SAFAR-MoES (India)

Fig. 3



Data Source : Delhi: SAFAR-MoES (India);
Beijing : New York Times (Quoted-US Embassy in China)