Air Quality Monthly Report

January, 2013

Department of Environment
Ministry of Environment, Forest and Climate Change
Bangladesh

Content

1. Introduction

Air quality management plans based on knowledge of sources, appropriate air quality standards, accurate air quality data, and effective incentives and enforcement policies is therefore needed to be adopted.

At this backdrop, real-time measurements of ambient level pollutants were made at 8 major cities (Namely, Dhaka, Narayangonj, Gazipur, Chittagong, Rajshahi, Khulna, Barisal and Sylhet) of Bangladesh. The data generated will be used to define the nature and severity of pollution in the cities; identify pollution trends in the country; and develop air models and emission inventories.

The program encompasses operation of the sampling and monitoring network, and quality assurance activities to ensure the quality of the data collected and disseminated by the CASE project.

The CASE project monitors the criteria pollutants such as carbon monoxide, nitrogen dioxide, ozone, and sulfur dioxide, PM10 and PM2.5. Monitoring is performed to demonstrate attainment or non-attainment of national ambient air quality standards to assess the trends of air pollution levels.

The main purpose of this report is to present, analyze and make available of these data to the general public, stakeholders, researchers and policy makers to develop effective air pollution abatement strategies. This report summarizes the air quality data collected at the CAMS in Darus-Salam, Dhaka, which is one of the eleven (11) CAMS in operation under the project.

The basis for discussion of air quality has been the data collected from the Air Quality monitoring Network stations under Department of Environment (doE). The data have been quality controlled and the air pollution levels have been compared to the Bangladesh Ambient Air Quality Standard as adopted in 2005. Table 1 represents the current and approved particulate matter (PM) standards for Bangladesh.

Table 1: National Ambient Air Quality Standards for Bangladesh

Pollutant	Objective	Average
CO	10 mg/m^3 (9 ppm)	8 hours(a)
	40 mg/m^3 (35 ppm)	1 hour(a)
Pb	0.5 µg/m^3	Annual
NO_2	100 µg/m^3 (0.053 ppm)	Annual
PM10	50 µg/m^3	Annual (b)
	150 µg/m^3	24 hours (c)
PM2.5	15 µg/m^3	Annual
	65 µg/m^3	24 hours
O_3	235 µg/m^3 (0.12 ppm)	1 hour (d)
	157 µg/m^3 (0.08 ppm)	8 hours
SO_2	80 µg/m^3 (0.03 ppm)	Annual
	365 µg/m^3 (0.14 ppm)	24 hours (a)

Notes:

(a) Not to be exceeded more than once per year

(b) The objective is attained when the annual arithmetic mean is less than or equal to 50 ug/m^3

(c) The objective is attained when the expected number of days per calendar year with a 24-hour average of 150 µg/m^3 is equal to or less than 1

(d) The objective is attained when the expected number of days per calendar year with the maximum hourly average of 0.12 ppm is equal to or less than 1 (Source: AQMP, DOE).

2. Monitoring Network

The main objective of the Bangladesh AQM network is to provide reliable information to the authorities and to the public about the air quality in most populous cities in Bangladesh.

As a part of the air quality monitoring strategy, several objectives can be achieved, including:

- Establish source/receptor relationships;
- Identify which pollutants are of greatest concern and their current status;
- Show how widespread air pollution problems are and indicate the general extent of the public exposure;
- Provide benchmarks against which trends in overall air quality can be compared and devise performance indicators for assessing the impact of an air quality management plan or strategy;
- Provide a data base for evaluation of effects; of urban, land use, and transportation planning; of development and evaluation of abatement strategies; and of development and validation of atmospheric processes and models.

Another objective in the monitoring and management programme can be to provide input data for modeling. These data will serve as a background for performing air quality planning and abatement studies. Model results may also serve as input to other studies such as health related investigations and exposure assessments.

The ambient air quality monitoring network Bangladesh consists of ten (11) fixed Continuous Air Monitoring Stations (CAMS). The locations of the 11 CAMS are shown in Figure 1. Brief description of the monitoring stations and the list of measured parameters recorded at each station are provided in Table 2.

Table 2: Description of Monitoring Network:

City	ID	Location	Lat/Lon	Monitoring capacity
Dhaka	CAMS-1	Sangshad Bhaban, Sher-e-Bangla Nagar	23.76N 90.39E	PM10, PM2.5, CO, SO2, NOX, O3, and HC concentrations with meteorological parameters.
	CAMS-2	Firmgate	23.76N 90.39E	PM10, PM2.5, CO, SO2, NOX, O3, and HC with meteorological parameters.
	CAMS-3	Darus-Salam	23.78N 90.36E	PM10, PM2.5, CO, SO2, NOX and O3 with meteorological parameters.
Gazipur	CAMS-4	Gazipur	23.99N 90.42E	PM10, PM2.5, CO, SO2, NOX and O3 with meteorological parameters.
Narayangonj	CAMS-5	Narayangonj	23.63N 90.51E	PM10, PM2.5, CO, SO2, NOX and O3 with meteorological parameters.
Chittagong	CAMS-6	TV station, Khulshi	22.36N 91.80E	PM10, PM2.5, CO, SO2, NOX, O3, and HC with meteorological parameters.
	CAMS-7	Agrabad	22.32N 91.81E	PM10, PM2.5, CO, SO2, NOX and O3 with meteorological parameters.
Khulna	CAMS-8	Baira	22.48N 89.53E	PM10, PM2.5, CO, SO2, NOX, O3, and HC with meteorological

City	ID	Location	Lat/Lon	Monitoring capacity
				parameters
Rajshahi	CAMS-9	Supara	24.38N 88.61E	PM10, PM2.5, CO, SO2, NOX, O3, and HC with meteorological parameters.
Sylhet	CAMS-10	Red Crecent Campus	24.89N 91.87E	PM10, PM2.5, CO, SO2, NOX and O3 with meteorological parameters.
Barisal	CAMS-11	DFO office campus	22.71N 90.36E	PM10, PM2.5, CO, SO2, NOX and O3 with meteorological parameters.

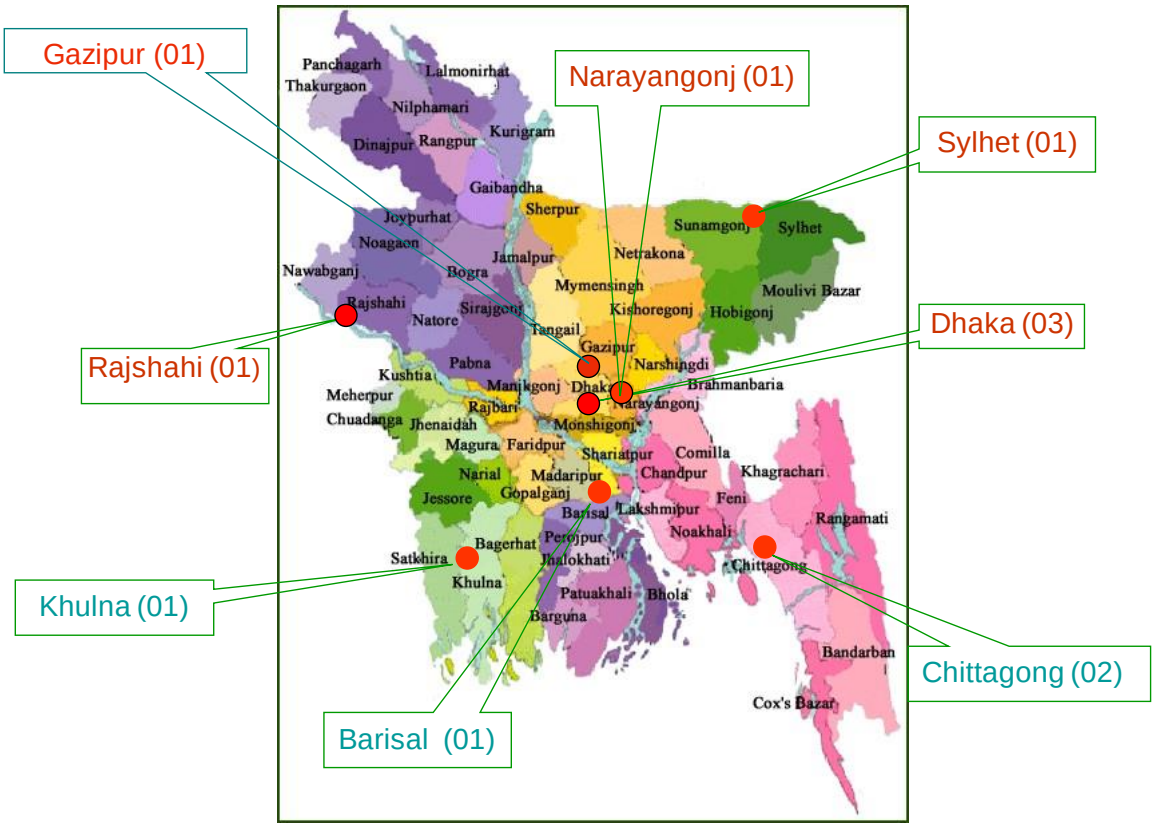

Figure 1: CAMS Location in Bangladesh

Monitoring data from network stations are transferred to a central data centre at the Department of Environment office in Dhaka and transferred to Air Quality Management System based on NILU AIRQuis system established under BAPMAN project. The data are stored in AIRQuis database for quality check, control, evaluation, validation, statistical analysis. Quality controlled data are then stored in the final database for further analysis, reporting, presentations and future use.

3. Monthly Air Quality

The data presented in this report are based on measurements during January 2013 at Darus-Salam, Dhaka CAMS.

Table 3 summarizes the basis statistics of the data along with the data capture rate and the number of days the specific pollutant exceeded the Bangladesh National Ambient Air Quality

Standard (BNAAQS). To assess the effect of data quality control using AIRQuis data without quality control also presented in the last column. During data quality control some data were flagged as invalid and some data which were not included in the analysis fund validTable 1, so few discrepancies were observed. Time series of the data generated (before and after data quality control) in the CAMS also present in Annexes.

The overall data availability (valid data) found to be over 98% except Ozone. This was due to clogging of inlet filter of the Ozone analyzed. It is also observed that all the gaseous pollutant except NO2 did not exceeded the BNAAQS. In case of NO2 2 days were found non-attainment. For the both fraction of particulate matter (PM10 and PM2.5), the concentrations levels exceeded the BNAAQS for all 31 in January.

In general pollution levels in monitored at Darus-Salam CAMS during the reporting month, the air quality in respect of PM was hazardous in respect of public health. Usually in the dry winter months the pollution level reached its peak gradually which reflects in the data monitored by CAMS.

Table 3: Summary Air Quality and Meteorological data measured at Darus-Salam, Dhaka CAMS in January 2013

Parameter	**unit**	**NAAQO**	**Summary**	**CAMS-3 (D-salam) AIRQUIS**	**CAMS-3 (D-salam) Manual**
SO_2 -24 hr	**ppb**	**140**	Average	21.14	19.45
			Max	39.45	39.45
			Min	7.60	8.54
			Excedance Days	0.00	0.00
			%Data capture	99.23	
NO_2 -24 hr	**ppb**	**53 (Annual)**	Average	39.90	39.80
			Max	57.95	51.37
			Min	26.35	26.87
			Excedance Days	2.00	0.00
			%Data capture	99.83	
CO- 1 hr	**ppm**	**35**	Average	3.62	3.54
			Max	11.85	4.49
			Min	1.83	2.63
			Excedance hr	0.00	0.00
			%Data capture	99.93	
CO-8hr	**ppm**	**9**	Average	3.61	3.54
			Max	8.44	4.72
			Min	2.13	2.65
			Excedance hr	0.00	0.00
			%Data capture	99.93	
O_3-1hr	**ppb**	**120**	Average	13.47	11.46
			Max	63.63	32.79
			Min	3.16	3.69
			Excedance hr	0.00	0.00

Parameter	unit	NAAQO	Summary	CAMS-3 (D-salam) AIRQUIS	CAMS-3 (D-salam) Manual
			%Data capture	42.51	
O_3-8hr	**ppb**	**80**	Average	13.61	9.17
			Max	48.76	24.40
			Min	3.86	2.66
			Excedance hr	0.00	0.00
			%Data capture	42.51	
$PM_{2.5}$ -24hr	**µg /m^3**	**65**	Average	231.36	227.42
			Max	355.17	297.39
			Min	90.29	131.88
			Excedance Days	31.00	31
			%Data capture	93.25	
PM_{10} -24hr	**µg /m^3**	**150**	Average	339.39	330.67
			Max	498.42	443.78
			Min	193.00	200.50
			Excedance Days	31.00	31
			%Data capture	97.61	
Solar rad. 24 hr	**watt/m^2**	**NA**	Average	139.82	128.70
			Max	185.45	166.38
			Min	80.74	85.66
			%Data capture	99.87	
Relative Humidity 24 hr	**(%)**	**NA**	Average	67.66	68.01
			Max	83.65	81.60
			Min	56.58	58.73
			%Data capture	99.87	
Ambient Temperature 24 hr	**(°c)**	**NA**	Average	18.18	17.29
			Max	22.82	20.99
			Min	10.59	10.97
			%Data capture	99.97	
Rainfall 24hr	**(m.m.)**	**NA**	Average	0.02	0.08
			Max	0.03	0.12
			Min	0.00	0.02
			%Data capture	98.32	

Wind frequency distributions, also called Wind roses for the Darus-salam CAMS is presented in Figure 2. There is a large tree situated on the northern side of the station, so wind pattern may be influenced by the obstruction. From the wind rose pattern it is observed that the predominant wind direction during the January as measured at Darus-salam CAMS was from around southwest-northwest.

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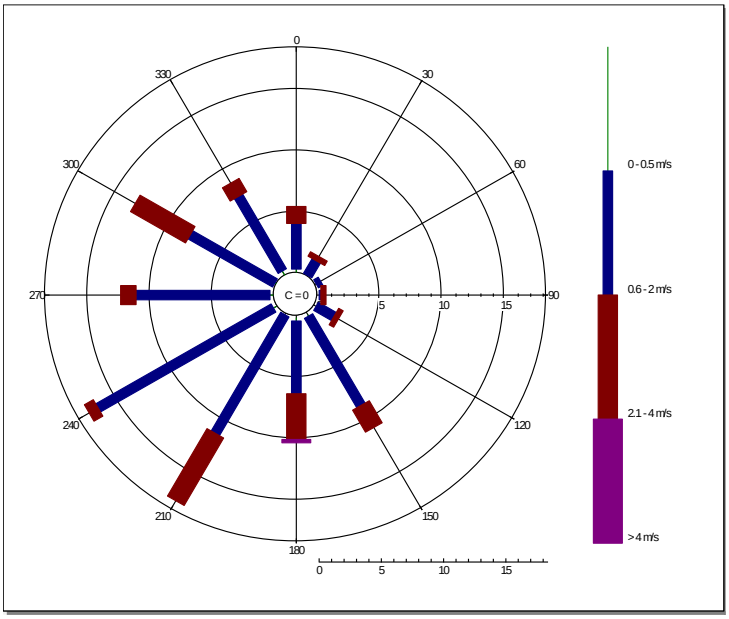


Figure 2: Wind frequency distributions (wind roses) from Darus-salam for January 2013.

The measured PM concentrations in both size fractions exceeded the BNAAQS limit values for those pollutants. The highest daily concentrations for PM 2.5 and PM10 were measured 355µg/m3 and 493µg/m3 respectively which are 3-5 times than the limit values. Usually in the dry winter months the pollution level reached its peak due to lower precipitation rate and relatively prevailing calm wind situation.

The Breuer diagram (PM10 and PM2.5 concentration rose) in Figure 3 and Figure 4 indicates that most of the PM10 as well as PM2.5 concentration at Darus-salam Air came from northeast and south east. These are the directions where brick kilns, recognized as a major source of PM during winter time.

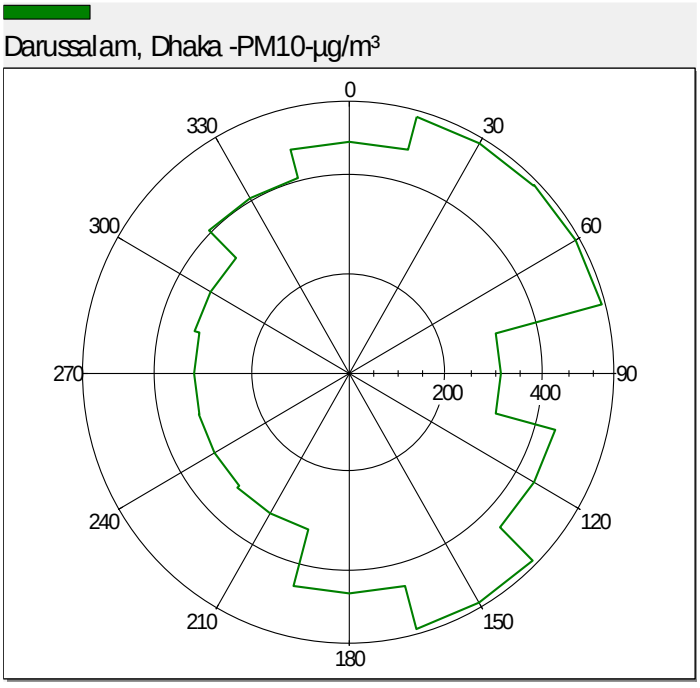


Figure 3: PM10 Breuer diagram (PM10 concentration rose) from Darus-salam data for January 2013

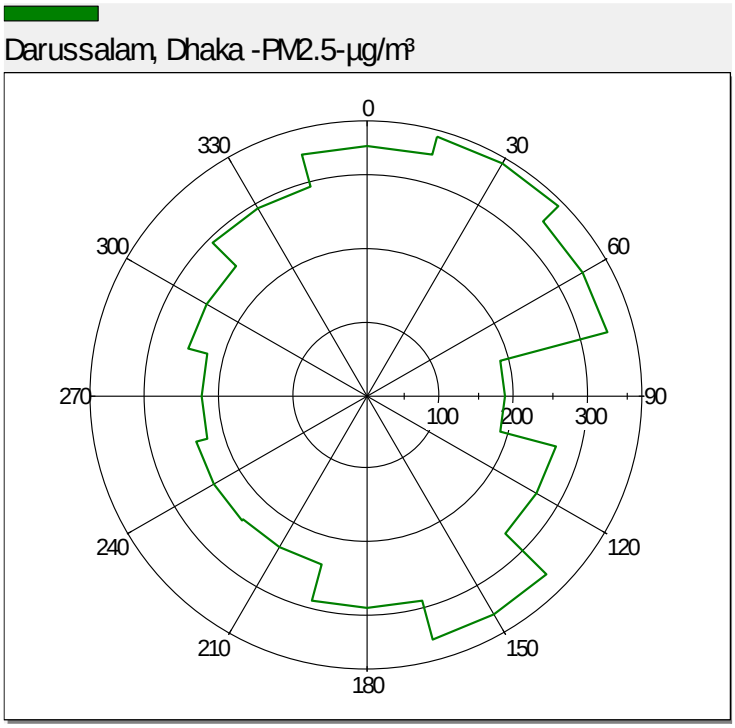


Figure 4: PM2.5 Breuer diagram (PM2.5 concentration rose) from Darus-salam data for January 2013

4. Summary and conclusion

Data from the air quality monitoring station at Darus-salam in Dhaka for January 2013 have been analyzed reported. Data availability was over 98% for all the parameters monitored except Ozone (42.5%). From the analysis of the data following conclusion can be drawn:

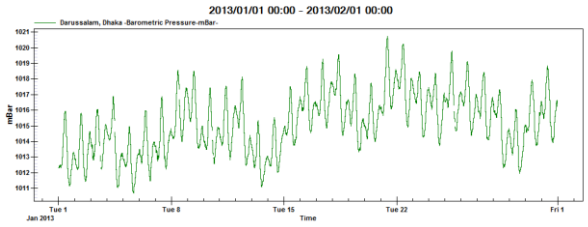
- PM_{10} and $PM_{2,5}$ are the most critical pollutants and 24-hour average for both PM10 and PM2.5 exceeded the BNAAQS for all days in January.
- Gaseous pollutants except NO2 did not did not exceed limit values. NO2 concentration exceeded the limit values for only two days in the month.
- PM concentrations (both PM10 and PM2.5) are expected to be influenced by emissions from north and southeast cluster of brick kilns around Dhaka city.

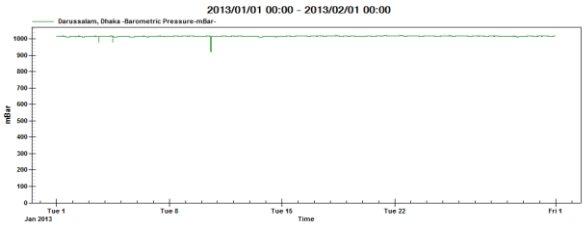
This report represents the first data analyzed during BAPMAN training on air quality data validation and reporting using AIRQuis system. There are evidently still some questions linked to the quality of some of the parameters, which need further checking. However, this shows that the AIRQuis system can be effectively used data validation and reporting of the air quality generated from all eleven CAMS operated under DoE. we are sure that the strict quality assurance programme that will be developed for this programme will improve the data quality.

Annex

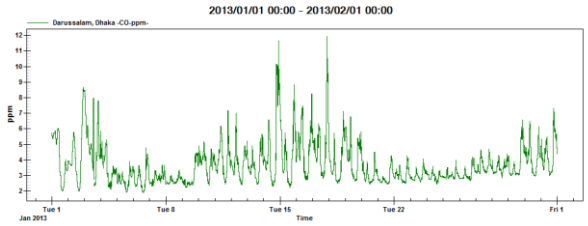
QUALITY CONTROLLED DATA BEFORE QUALITY CONTROLL

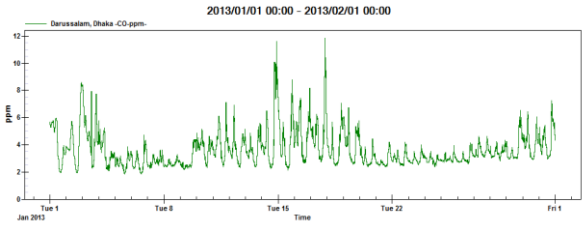
Pressure



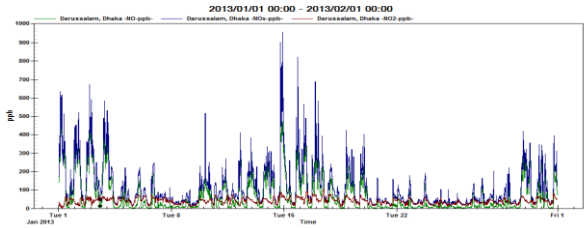


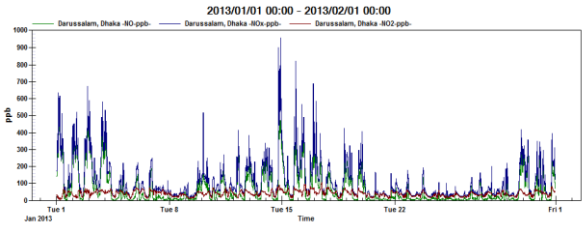
CO



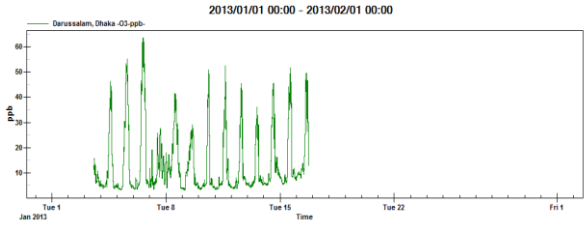


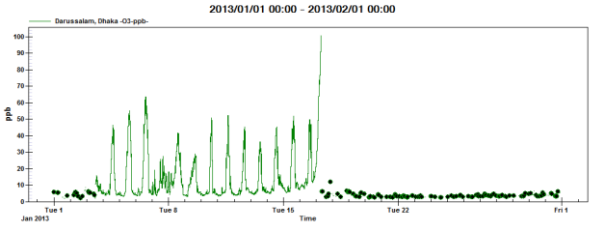
NO/NO2/NOx



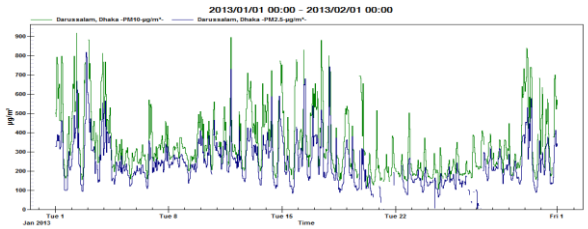


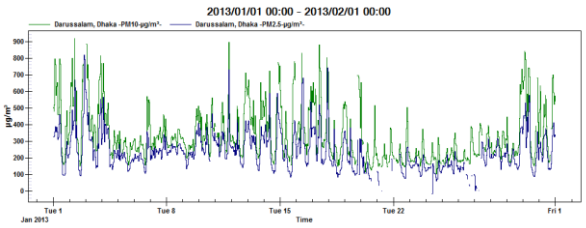
O3



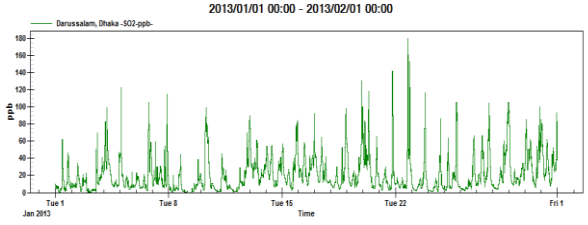


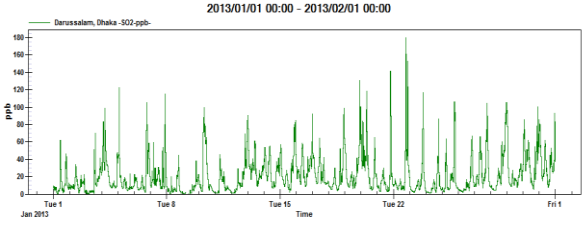
PM10





SO2



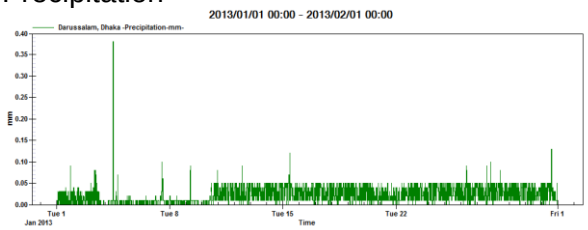


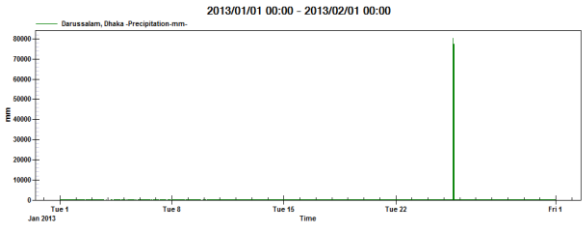
Annex

QUALITY CONTROLLED DATA

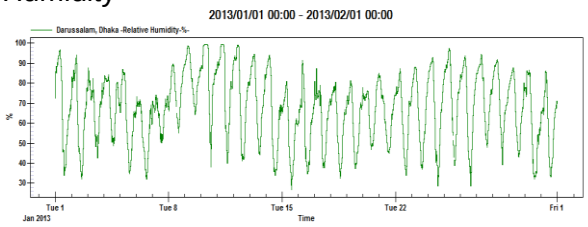
BEFORE QUALITY CONTROLL

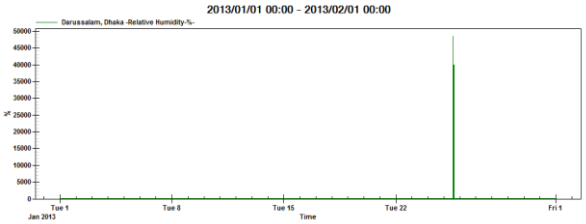
Precipitation



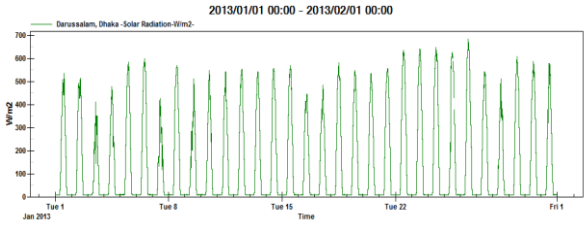


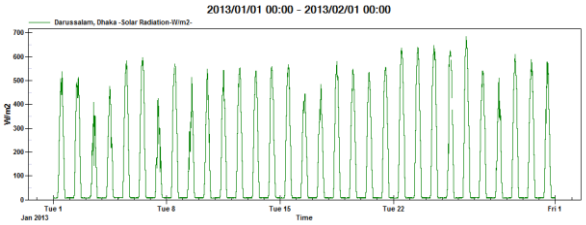
Humidity



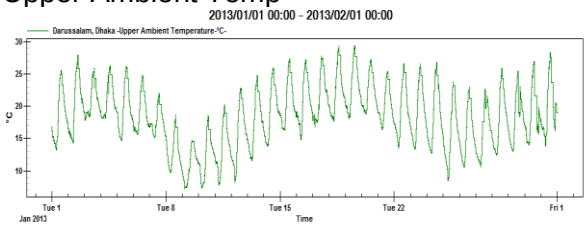


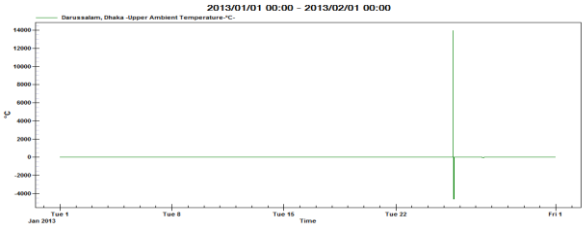
Solar radiation



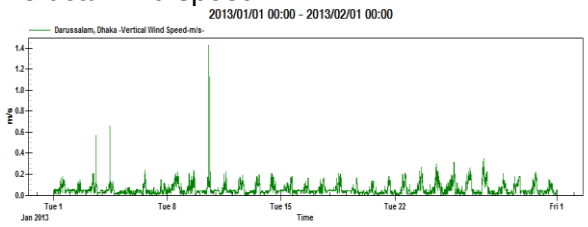


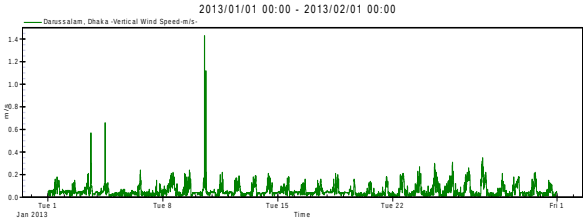
Upper Ambient Temp



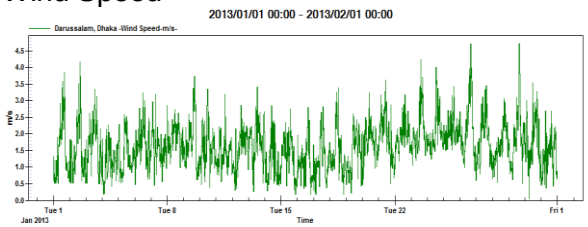


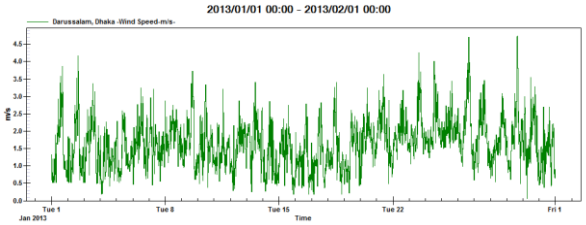
Vertical wind speed





Wind Speed



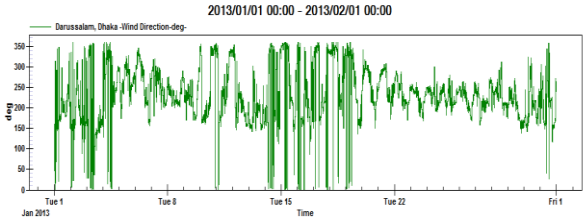


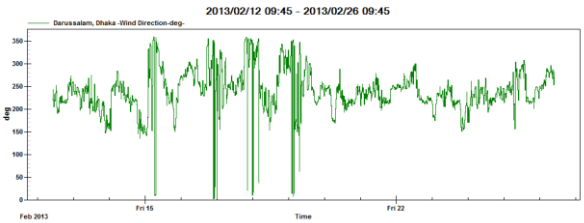
Annex

QUALITY CONTROLLED DATA

BEFORE QUALITY CONTROLL

Wind Direction





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