Project of Strategic Interest NEXTDATA

Scientific Report for the reference period 01-01-2013 /31-12-2013

WP 1.1 – High altitude climate observation system

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1. Planned activities and expected results

Within WP1.1, the *in-situ* measurement activities of meteo-climatic parameters and atmospheric composition will be continued in the mountain regions considered by the project, also favouring the technical and scientific implementation of the measurement programmes already activated. In particular, the following activities are planned:

- Continuation and upgrade of the in-situ measurement programmes in the regions considered by the project.
- Activation of new measurement programmes to support climate and environmental studies in the regions considered by the project.
- Use of a transportable system for the measurements of atmospheric compounds and climate-environmental parameters in a remote high-elevation region in Karakorum (Pakistan), in collaboration with other national and international Projects (e.g. ABC-UNEP).
- Integration and exchange of data with other international initiatives on measurement networks (e.g. GMES, GEO, SusKat, ABC, CCAC) and strengthening of the relationships with the international agencies focal points for these initiatives (e.g. UNEP)

2. Deliverables expected for the reference period

D1.1.1: Report on the activities of the second year and transmission of data to the archives and to the General Portal (PM24).

3. Activities actually carried out during the reference period

Within WP1.1, the in-situ activities of mountain meteo-climatic measurements in the regions of interest (Alps, Italian Apennines, Hindu-Kush Karakoram Himalayas, Rwenzori, Andes) have been prosecuted (Tab. 1). The Automatic Weather Station (AWS) at Mt. Stanley (Rwenzori) was re-activated. Due to the very challenging operative conditions, the possible re-activation of the SouthCol AWS (Himalayas) requires further in-depth analysis. New measurement programmes concerning atmospheric composition investigation, were started in Nepal (Kathmandu) and in Pakistan (Deosai Plateau) with the aim of reinforcing the investigation of Short Lived Climate Forcers/Pollutants (SLCF/SLCP) in these climatic hot-spot regions. During the current year of activity, the Atmospheric Observatory at Chacaltaja (Bolivia), managed by the La Paz University, was upgraded to Regional Station of the GAW/WMO programme. Thus, the related activities will be described in the WP1.2 Report.

Measurement site	Country/Continent		Class	Elevation (m a.s.l.)
Forni glacier (Central Alps,)	Italy	Europe	AWS	2,669
Dosdè Glacier (Central Alps,)	Italy	Europe	AWS	2,740
Gigante Glacier (Western Alps)	Italy	Europe	AWS	3,500
Osservatorio Portella del Gran Sasso (central Apennines)	Italy	Europe	ATM	
SusKat Observatory (Kathmandu, Nepal)	Nepal	Asia	ATM	1,250
Pyramid Laboratory Observatory (Khumbu valley, Himalayas)	Nepal	Asia	AWS	5,050
Pheriche (Khumbu valley, Himalayas)	Nepal	Asia	AWS	4,258
Namche Bazaar (Khumbu valley, Himalayas)	Nepal	Asia	AWS	3,560
Lukla (Khumbu valley, Himalayas)	Nepal	Asia	AWS	2,660
Kala Patthar (Khumbu valley, Himalayas)	Nepal	Asia	AWS	5,600
Changri Nup Station (Khumbu valley, Himalayas)	Nepal	Asia	AWS	5,700
Urdukas (Baltoro glacier, Karakorum)	Pakistan	Asia	AWS	3,926
Askole (Baltoro glacier, Karakorum)	Pakistan	Asia	AWS	3,015
Concordia (Baltoro glacier, Karakorum)	Pakistan	Asia	AWS	4,700
Mt. Stanley (Elena glacier, Rwenzori)	Uganda	Africa	AWS	4,700

Table 1. Measurement stations (AWS: automatic weather stations, ATM: observatories for atmospheric composition measurements) supported by NextData.

During the reference period, URT Ev-K2-CNR and ISAC-BO participated to Institutional meetings in the framework of international initiatives on atmospheric composition networks in mountain regions (ABC-UNEP, GAW/WMO, GEO, CCAC).

3.1 Research activities

During the second year of the project, ISAC-BO coordinated the activity within WP1.1, while the URT Ev-K2-CNR was directly in charge of the station management and data handling for the Automatic Weather Stations (AWS) listed in Table 1 and Figure 1. These data are gathered in the archive of the SHARE monitoring network, currently hosted at URTEv-K2-CNR, and were already transmitted to the Geonetwork of the General Portal (WP 2.6). Deliverable D1.1.1 reports, for each AWS, the current status of the available measurements together with the availability of validated data and transmission of data to the archives and to the General Portal. A fellowship was activated at ISAC-BO (Bologna) in December 2013, to collaborate on the validation, archiving, dissemination and analysis of AWS data. With the aim of pointing out possible discontinuities in the measurement data series due to sensor replacements or validation guidelines upgrade, a complete revision of the historical AWS data-set is currently on going.

In the following, for each mountain regions covered by the project, a summary of the activities is provided.

3.1.1 Nepal (Himalaya and Kathmandu)

During 2013, the ordinary maintenance activity of the AWSs along the Khumbu Valley was guaranteed, thanks to the intervention of the local technical staff, that works in close collaboration with the Italian staff. The observation sites require daily checks, as well as periodical technical interventions, also concerning the management of the data transmission systems both in Nepal and in Italy.

Moreover, the calibration and checking activities were performed by using the "travelling AWS standard". In particular, during 2013, intercomparison exercises were carried out at the AWS Namche and Lukla, allowing the identification of possible sensor malfunctioning. In June 2013, the "reference" AWS was sent to Italy for the maintenance activity to be performed and the sensors to be recalibrated. The reactivation of the intercomparison activities is scheduled for Spring 2014.

Thanks to the collaboration with the METEOMET EMRP-funded Joint Research Project, an experimental campaign started in October 2012 at the Pyramid International Laboratory. The objective is to install a specifically-designed device for calibrating meteorological sensors (especially for air-temperature and atmospheric pressure) under "controlled" working conditions. The device was tested under operative conditions; the Italian National Institute of Metrology (INRIM) is currently working together with URT Ev-K2-CNR, in order to upgrade the system on the basis of the test results. The climatic chamber was designed to calibrate the sensors in the range of typical conditions at the Himalayan site: -30/+25°C for temperature and 30-100 KPa for atmospheric pressure. Before the field campaign in Pyramid, a training seminar was organized at NAST, in Kathmandu, to advise the local research institutions involved in climate monitoring studies about certified calibration procedure and equipment installation and maintenance.

In 2013 continued the collection of lake samples to study the effects of climate change on these ecosystems. Moreover, personnel from IRSA-CNR collected hydrological data and water samples of the main streams and tributaries along Khumbu Valley, in order to investigate the presence of issues related to water quality.

Concerning lake studies, the comparison between the data collected in '90s and the recent analysis confirms the increasing trend of solutes concentrations. Lake chemistry variations are observed at regional scale and could be related to climate variations. Pyramid lakes have short water exchange time; the observed trend is therefore caused by the variations of the runoff chemical composition. Runoff is here depending on processes occurring at catchment scale, such as glacier retreat.

As for hydrological studies, a preliminary determination of potential evaporation was done at these high elevations for the first time. This information could contribute to the study of energy balance at high altitude at global scale. In the framework of collaborations with local Institutions (ICIMOD -International Centre for Integrated Mountain Development) and the ABC-UNEP Project, ISAC-BO and URT Ev-K2-CNR participated to the SusKat (Sustainable Atmosphere for the Kathmandu Valley) ABC field campaign. The aim of this international initiative (hold in Kathmandu from January to July 2013) was to increase basic knowledge on air pollution in the Kathmandu valley and its possible recirculation to the Himalayas and the free troposphere. In this context, in January 2013, a new measurement station was installed at the Ev-K2-CNR building in Kathmandu (Fig. 1). The station was furnished with suitable systems for the air sampling and UPS system for avoiding any loss of data or instrument failures due to power loss or electrical discharges (very frequent in Kathmandu). It was equipped with state-of-art instruments for the continuous determination of atmospheric

composition variability: an integrated weather station (WXT520, Vaisala), a pyranometer (CMP21, Kipp & Zonen), an optical particle counter (FAI Instruments), a condensation particle counter (TSI), a β-absorption system for the near-real-time determination of PM1 and PM10 (FAI Instruments), a Multi Angle Absorption Photometer MAAP 5012 (Thermo Electron), a UV-absorption ozone analyser (Thermo Electron). Besides providing an accurate picture of the Kathmandu air quality, this station will provide useful hints to investigate the processes (emissions, meteorology, transport) affecting atmospheric composition variability in Nepal. It represents a "reference point" for the heavy polluted conditions affecting the Himalaya foothills, which is also very useful to better investigate the influence of vertical pollution transport in determining the variability of atmospheric composition at the Nepal Climate Observatory –Pyramid (NCO-P, see WP1.2).

Fig. 1. Upper picture: landscape of Kathmandu valley from the SusKat Observatory at the Ev-K2-CNR Representative Office n Pakanajol. On the right: Internal view of the SusKat Station at Pakanajol: condensation particle counter, OPC, MAAP and ozone analysers.

The preliminary analysis of the first 7-months measurement period (presented at the Workshop on atmospheric composition and the Asians summer monsoon, Kathmandu, 9-12 June, 2013 and at the SusKat-ABC Data Workshop, Kathmandu, 27-29 August, 2013) allowed to define the typical diurnal and seasonal variability (from winter to summer monsoon) of short-lived climate pollutants (SLCP), i.e. ozone (O3) and equivalent black carbon (eqBC), besides mass concentration (PM1, PM2.5 and PM10) and number concentration of aerosol particles (see Deliverable D1.1.1).

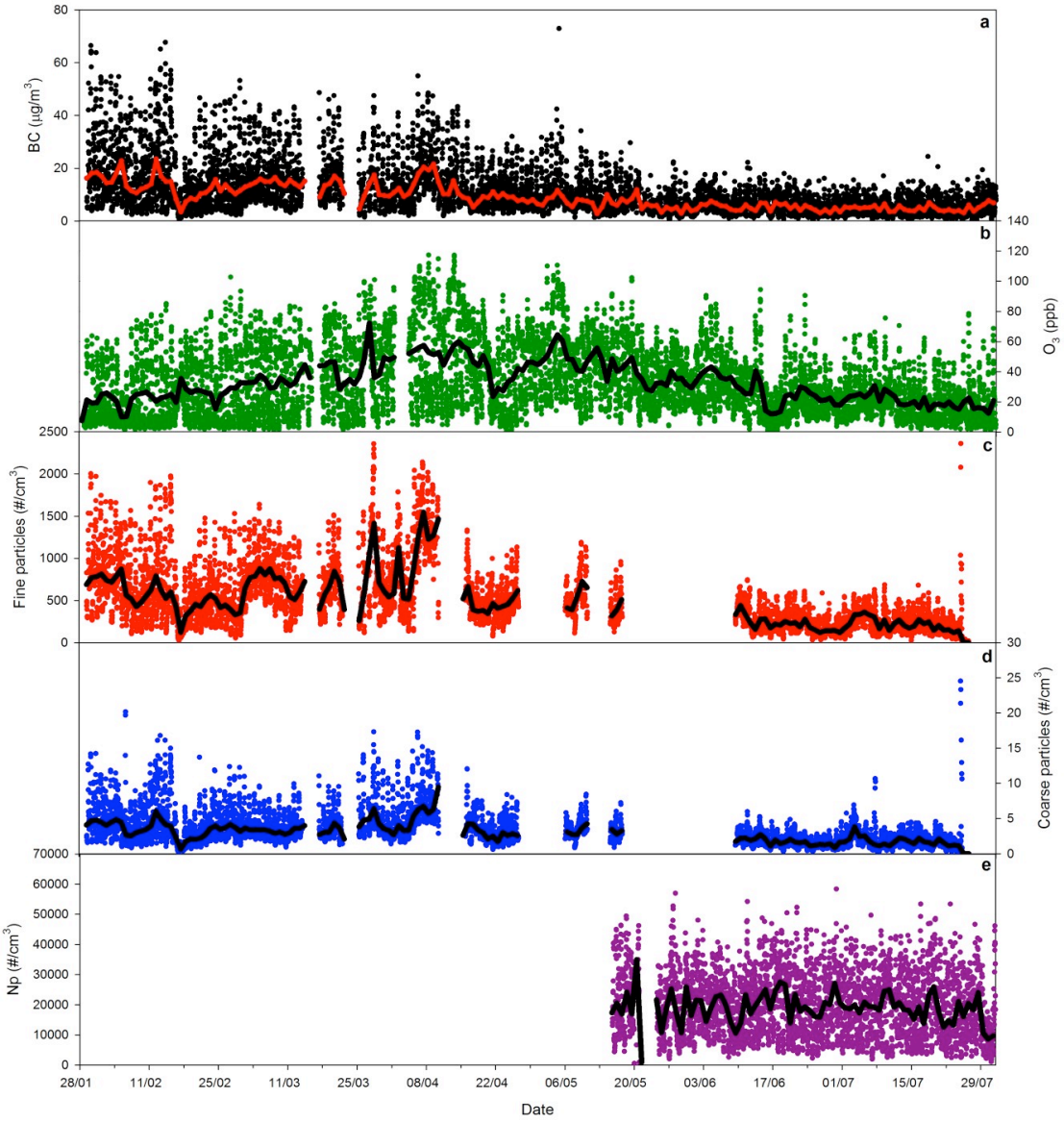

Fig. 2. Hourly average values for eqBC (plate a), surface O3 (plate b), fine (0.28 µm≤ Dp < 1 µm; plate c), coarse (1 µm ≤ Dp < 10 µm; plate d) and total (20 nm ≤ Dp < 3 µm; plate e) aerosol particle number concentration (Np) at Pakanajol – Kathmandu from February to July 2013. The tick black lines represent the daily average values.

The preliminary analysis of the first set of measurements (Fig. 2) pointed out that very high values of eqBC were observed during the dry winter season, with hourly average values exceeding 60 µg/m^3 (average value from February to July 2013: 10.6 ± 9.1 µg/m^3). Extremely high aerosol mass concentrations were also observed, with PM1 and PM10 showing average concentration equal to 41.2 ± 145.4 µg/m^3 and 152.8 ± 203.4 µg/m^3 respectively. On a seasonal basis, O3 hourly values peaked during pre-monsoon (up to 100 ppb) compared to an average value of 32.6 ± 22.9ppb during the period from winter to monsoon. More details about this first set of measurements are provided in the Deliverable D1.1.1. These observations highlight the need of implementing appropriate mitigation measures to reduce the amount of SLCP in Kathmandu (and Nepal). Since these SLCP represent also dangerous atmospheric pollutants, the adoption of reduction measures will also create benefit in term of impacts on regional climate, air-quality, ecosystems and population health.

3.1.2 Pakistan (Karakorum)

In *Pakistan*, in collaboration with the Pakistan Meteorological Department (PMD), the URT Ev-K2-CNR continued the activity of the AWS network already existing in the Baltoro region: Askole, Urdukas and Concordia (Tab.1). During the summer and the autumn 2013, URT EV-K2-CNR technicians performed two in-situ maintenance campaigns and prosecuted the training of the local staff for the execution of routinely AWS checks.

The analysis of the data recorded by the NANO-SHARE system, that operated at Askole from August to October 2012, was completed (a paper was submitted to the *ISI journal Atmospheric Environment*). The validated data (formatted according with the GAW-WDCGG format) were submitted to the NextData data Archives.

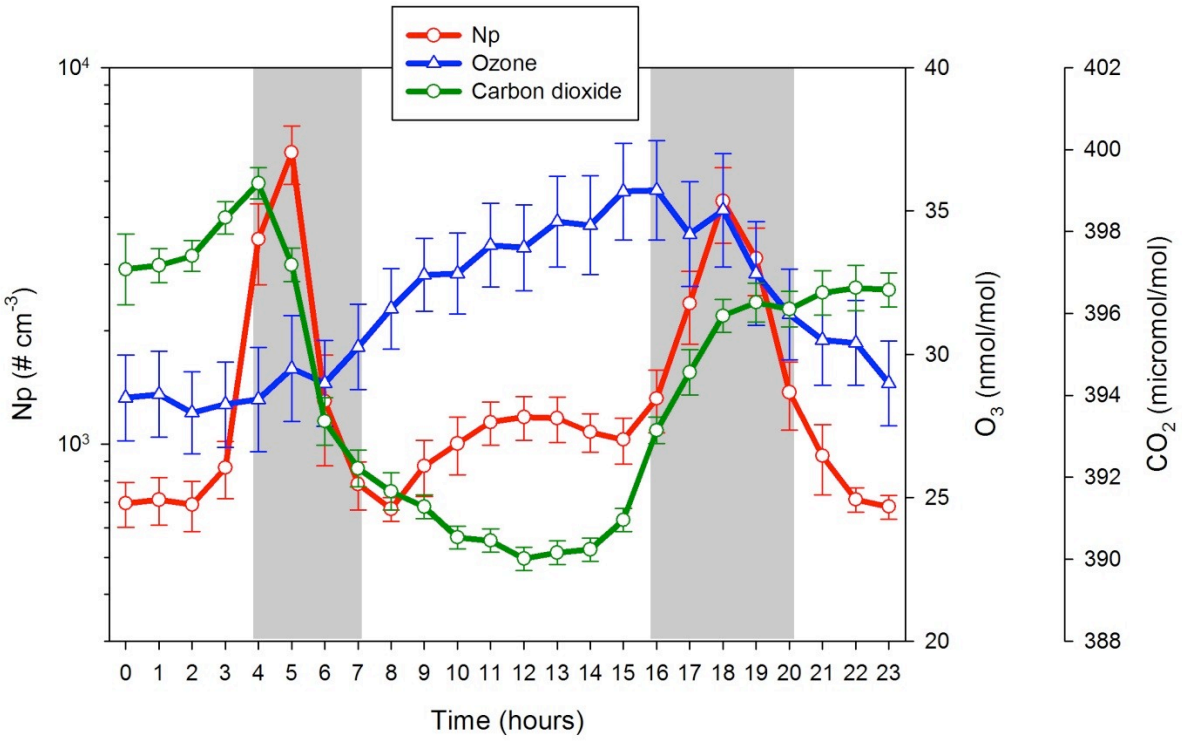

Fig. 3. Typical diurnal variations for Np (red), O3 (blue) and CO2 (green). The vertical bars denote the expanded uncertainties ($p<0.05$) of the mean, while the shadow areas indicate the periods possibly affected by the "local contamination events".

Based on this analysis, the domestic combustion from the Askole village emerged as a possible systematic source of contamination in the valley, with short-lasting pollution events likely related to domestic cooking activities and characterized by high values of fine (20 nm ≤ Dp < 3 μm) aerosol particle number concentration (Np = 6070 ± 5900 cm^{-3}). Apart from these local contamination events, mountain thermal wind regime dominated the diurnal variability of Np, O3 and CO2 (Fig. 3). Compared to night-time, during the central part of the day we observed higher Np (+ 354 cm^{-3}) and O3 (+7 ppb) but lower CO2 (-8 ppm) in air-masses coming from the lower valley. Nevertheless, the variability of the observed climate forcers appeared to be dominated by day-to-day changes for trace gases and aerosol particles. Part of the day-to-day atmospheric composition variability can be ascribed to synoptic circulation variability. In particular, low O3 and high CO2 values were observed with possible air-mass transport from

South Asia and Taklamakan desert, while higher O3 were mostly tagged with air-masses possibly from the free troposphere. This indicated that the emission of climate forcers occurring at very different scales (from local to the long range) represents a source of pollution for the Karakorum area.
Except this experimental campaign, systematic activities devoted to the characterization of atmospheric composition variability in the Karakorum region are still extremely sparse up to now and there is the need of a more comprehensive documentation and assessment about the quantification of polluted air-mass transport to the Pakistani mountain regions. To contribute in filling the gap of information over Karakorum, a Remote Climate Station (i.e. an improved version of the transportable system used in the summer 2012 experimental campaign) was installed at the Deosai Plateau (4200 m a.s.l.) in summer 2103, in collaboration with the PMD and WAPDA - Water and Power Development Authority. This station represents the first ABC-UNEP measurement site existing in the Karakorum region. The installation activity started in July 2013; two technicians from EV-K2-CNR, together with personnel from PMD and WAPDA, managed the activities in Pakistan. From Italy, ISAC-BO supported the installation activity providing daily indications about the data quality. Moreover, ISAC-BO contributed to implement the communication firmware of the portable system for the near-real time data transmission. Since September 2013, the Remote Climate Station provides the first continuous measurements of pollutant/climate-altering compounds (O3, eqBC, aerosol size distribution from 0.28 nm to 10 μm) and meteorological parameters. At the end of October 2013, technicians from URT EV-K2-CNR and WAPDA performed a maintenance work to replace electronic boards and to set-up the station configuration for the winter season. After a stop due to technical problems, the observations restarted in December 2013. Nevertheless, the most recent data appeared rather discontinuous due to problems still affecting the batteries and the occurrence of heavy snowfalls which prevent the photovoltaic system to produce enough power to run the Station.

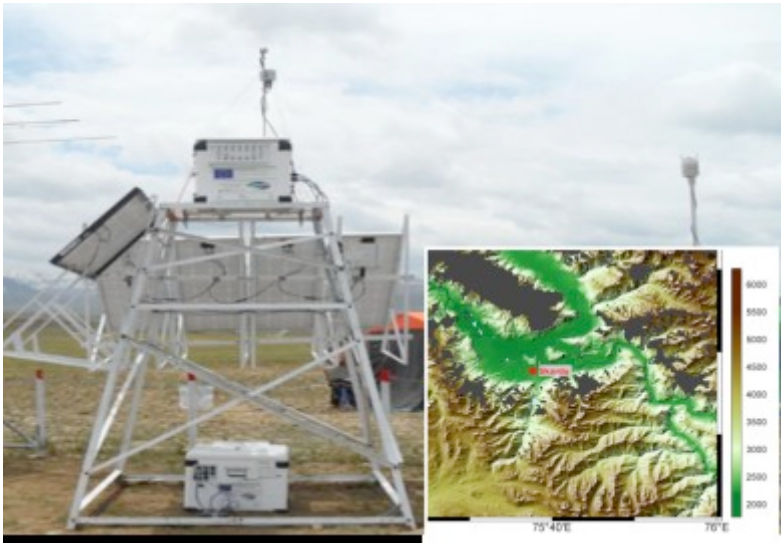

Fig. 4. The Remote Climate Station installed at the Deosai Plateau in Pakistan. A trellis was used to reduce the possibility that the Station is covered by snow accumulation.

3.1.3 Uganda (Rweznori)

In *Uganda*, the AWS at 4.700 m a.s.l on Rwenzori was re-activated in January 2013. In addition to monitoring standard meteorological parameters (air temperature, atmospheric pressure,

relative humidity, wind speed and direction, rain precipitation), the new AWS was equipped with sensors for measuring broadband long-wave and short-wave albedo, as well as the snow level. Moreover, an upgraded acquisition system allows the daily data delivery to Ev-K2-CNR headquarters. Data evaluation and validation are currently on-going. In this framework URT Ev-K2-CNR started a scientific collaboration with the University of Nairobi, which is in charge of the local coordination of ABC-UNEP Project in Africa. The old AWS (dismissed) was offered to the Nairobi University to perform training activities.

3.1.4 Italy (Alps and Apennines)

In Italy, the analysis of data collected by the stations on Forni, Dosdè and Gigante-Mt. Bianco Glaciers continued, allowing to improve the knowledge of the micrometeorology of Alpine glaciers. The retrieval of data collected at the SHARE glacial stations is regularly managed by the URT Ev-K2-CNR staff. During the reference period, three missions on the Forni and Dosdè Glaciers were organized for the maintenance of the AWSs.

The Monte Portella station (42°26'52.96 "N, 13°33'02.41", elevation 2401 m. a.g.l.) on the Gran Sasso chain (Central Italy), was installed at the beginning of July 2012; continuous measurements of meteorological parameters and atmospheric composition have been going on since 19 July, 2012. The observed parameters are: temperature, relative humidity, pressure, velocity and wind direction, rain precipitation, O3, NO and particle size distribution (0.28 μm ≤ Dp ≤ 10 μm). A network connection with the University of L'Aquila allows real time transfer of data to a local server. A web page with information about the station and 5-min updated data can be found in the following link:
http://www.aquila.infn.it/lif/high-altitude-observatory.html.
Based on the technical details provided by ISAC-BO, in June 2013 a common inlet for O3, NO and future gas measurements was installed. The gas analysers and the optical particle counter (for the aerosol size distribution measurements) are routinely calibrated. Data are inspected weekly and now are under final validation to be submitted to the NextData archives.

Several technical issues affected the station and the instrument operations, mainly due to the harsh environmental conditions which characterizes Monte Portella (high wind speed, heavy snowfall and lightning). To cope, some actions will be undertaken to upgrade the data transmission system, the lightning protections as well as the instrumental set-up (see the Deliverable D11 for more details).

3.2 *Applicative, technological and information developments*

Improved version of a portable and energetically autonomous system (Remote Climate Station) for the measurement of meteorological variables and atmospheric composition at remote measurement sites.

- Implementation of an upgraded version of the communication firmware for the portable and energetically autonomous measurement systems (Remote Climate Station);
- data acquisition hardware and software to be implemented in portable and energetically autonomous measurement systems (Remote Climate Station);
- installation of a new ABC-UNEP station at the Deosai Plateau (Pakistan);
- installation of a new permanent Observatory in Kathmandu (Nepal);
- installation of an improved AWS at the Mt. Stanley, Rwenzori (Uganda);

- improvement of methodologies for the execution of the semi-automatic QA/QC flagging of meteorological and radiometric data from the AWS (in collaboration with ENEA-UTMEA). Definition of new algorithms for flagging the rain precipitation, snow level and solar radiation data.

3.3 Training activities

The training of the local staff involved in managing and maintaining the AWS in Nepal, Pakistan and Uganda is carried on. The training activities were carried out by Italian personnel both in-situ (during the maintenance campaigns) and remotely (during tele-controlled activities).
In collaboration with METEOMET EMRP-Project, a workshop about metrological issues in the meteorology was organized in Nepal at the NASTHQs on September 10th, 2013. The workshop was open to Nepali scientific institutions (i.e. DHM, Universities, NAST).

3.3 *Dissemination*

EV-K2-CNR organized the *International Conference on Mountains and Climate Change*, Lecco, Italy, 23-25 October, 2013, (see http://www.highsummit.org/en/).

Side Event, *Criosfera, Cambiamenti Climatici E Sviluppo: Rischi e Soluzioni*; seminario, *Climate Change Today In Polar And Mountain Regions*", COP 19, 16-17, Varsaw (Poland), November 2013.

The changing mountains of Europe: water resources and ecosystems at risk. Brussels, (Belgique), European Parliament. 15 October, 2013,

3.4 Participation in conference

BONASONI P., MARINONI A., CRISTOFANELLI P., ADHIKARY B., PUTERO D., DUCHI R., CALZOLARI F., DECESARI S., LANDI T., LAJ P., MAIONE M., ARDUINI J., VUILLERMOZ E., VERZA G., ALBORGHETTI M., SPRENGER M., FUZZI S: Aerosol and trace gas observations from the NCO-P station: a multi-year analysis.

Workshop on atmospheric composition and the Asian summer monsoon, Kathmandu (Nepal), 9-12 June, 2013.

CRISTOFANELLI P.: Atmospheric Brown Cloud studies in the high Himalayas at the GAW/WMO global station Nepal Climate Observatory - Pyramid (5079 m a.s.l.). *GAW 2013 Symposium,* Geneva, (Suisse), WMO Secretariat, 18-20 March, 2013.

CRISTOFANELLI P.: Ozone and black carbon: short-lived climate forcers in Himalaya-Karakorum. *Karakoram Resources and Climate Change: Glacier, Water and Ecosystem,* Islamabad, (Pakistan) 10 September, 2013

PUTERO, D., VUILLERMOZ, E., ADHIKARY, B., MARINONI, A., CRISTOFANELLI, P., DUCHI, R., CALZOLARI, F., FUZZI, S., LANDI, T. C., VERZA, G. P., ALBORGHETTI, M., BONASONI, P.: Aerosol and ozone observations at Pakanajol, Kathmandu, and NCO-P, Himalaya, during the SusKAT-ABC field campaign. *SusKat-ABC Data Workshop,* Kathmandu (Nepal), 27-29 August, 2013.

VUILLERMOZ E., ADHIKARY B., PUTERO D., MARINONI A., CRISTOFANELLI P., DUCHI R., CALZOLARI F., FUZZI S., LANDI T., VERZA G., ALBORGHETTI M., PANDAY A. K., RUPAKHETI M., LAWRENCE M., BONASONI P.: First black carbon and ozone observations at Pakanajol, Kathmandu, during the SusKAT - ABC field campaign. *Workshop on atmospheric composition and the Asian summer monsoon*, Kathmandu (Nepal) 9-12 June, 2013.

VUILLERMOZ E., SENESE A., DIOLAIUTI G., SMIRAGLIA C., CRISTOFANELLI P., MARINONI A., BOCCHIOLA D., VERZA G. P., BONASONI P.: Studying Himalayan Glaciers to understand atmospheric dynamics and ongoing cryosphere variations. Data and findings from the Changri Nup Glacier (Nepal, Himalaya). *EGU General Assembly 2013,* Wien (Austria), 7-12 April, 2013.

VUILLERMOZ, E: *7th GEO European Projects' Workshop,* Barcelona (Spain), 15-16 April, 2013.

4. Results obtained during the reference period

4.1 *Specific results (databases, measurements results, models output, etc)*

- Database of measurements and meteo-climatic variables recorded at the AWS stations reported in Table 1.
- Database of surface O3, eqBC, Np, aerosol size distribution (from 280 nm to 10 μm), PM10, PM1, meteorological parameters and solar radiation at Kathmandu – Pakanajol from February to December, 2012.
- Database of surface O3, NO, aerosol size distribution (0.3 – 10μm), meteorological parameters, global short-wave solar radiation at Campo Imperatore – Monte Portella (January– December 2013).
- Database LTER of meteorological, water chemistry (P, N, main anions and cations, metals) and water biology (Phytoplankton, Zooplankton, Benthos) at two Pyramid Lakes (Superior and Inferior) from 1992 to 2013.
- Database of river discharge measurement (flow rate) at Pheriche and at Pyramid Lake superior emissary (January – December 2013).

Moreover, the following measurement results were achieved in the framework of the SHARE Project:

- A preliminary characterization of SLCFs/S.
- LCPs variability in Kathmandu urban area has been carried out for the period February – July 2013. This allowed to point out the presence of extremely high level of O3, eqBC and PM10/PM2.5, especially during the winter season. Besides local emissions, the variability of the SLCFs/SLCPs appeared to be strongly modulated by meteorology at diurnal and seasonal scale.
- Based on data recorded during summer 2011 and 2012 in the Baltoro region (Karakorum, Pakistan), the summer average level and variability of PM10, O3, CO2 and Np concentrations were depicted. In particular, possible contributions of long-range transport processes, thermal wind circulation and domestic emissions were investigated.

4.2 Publications

PUTERO D., CRISTOFANELLI P., LAJ P., MARINONI A., VILLANI P., BROQUET A., ALBORGHETTI M., BONAFÈ U., CALZOLARI F., DUCHI R., LANDI T.C., VERZA G. P., VUILLERMOZ E. AND BONASONI P.: *New atmospheric composition observations in the Karakorum region: influence of local emissions and large-scale circulation during a summer field campaign,*inviato a *Atmospheric Environment*.

4.3 Availability of data and modeling outputs (format, support, etc)

- SHARE network AWS: described in the Deliverable D1.1.2.

- Askole, Pakistan (August -October 2012): surface ozone, carbon dioxide, total particle number, meteorological parameters (measurement status: stopped; format: ascii/GAW-WDCGG; status: validated; data provider: URT Ev-K2-CNR; data accessibility of

validated data: Geonetwork);

- Deosai Plateau, Pakistan (September -October 2013): ozone, equivalent black carbon, aerosol number size distribution (280 nm <Dp < 20 μm), meteorological parameters, solar radiation (measurement status: ongoing; format: ascii and csv; status: under evaluation; data provider: URT Ev-K2-CNR, data access: upon request to the data provider).

- Kahtmandu – Pakanajol Station (February – December 2013): surface O3, eqBC, Np (20 nm ≤ Dp < 3 μm): aerosol particle size distribution (0.28 nm ≤ Dp < 10 μm), PM10, PM2.5 (only February – March 2013), PM1 (April – December 2013), meteorological parameters, global short-wave solar radiation; (measurement status: ongoing; format: ascii; status: raw data; data provider: ISAC-BO, URT EV-K2-CNR; data accessibility: upon request to the data provider).

- Campo Imperatore – Monte Portella (July 2012 – December 2013); surface ozone, NO, aerosol size distribution (0.3 – 10μm), meteorological parameters, global short-wave solar radiation (measurement status: ongoing; format: ascii; status: raw data; data provider: CETEMPS, URT Ev-K2-CNR; data accessibility of validated upon request to the data provider).

- Superior and Inferior Lakes at Pyramid (1992-2012): meteorological, chemical and biological parameters (measurement status: ongoing; format: Excel, DBMS format only for Phytoplankton; status: validated data; data provider: ISE-CNR, URT Ev-K2-CNR; data accessibility of validated: upon request to the data provider).

- Pheriche and Pyramid Lake superior emissary (2012 – ongoing): database of river discharge measurement (measurement status: ongoing; format: ascii; status: raw data; data provider: IRSA-CNR, URT Ev-K2-CNR; data accessibility of validated data: upon request to the data provider).

4.4 Completed Deliverables
D1.1.4 (PM16): Report describing the activities, data transfer to archives and to the General Portal

5. Comment on differences between expected activities/results/Deliverables and the actually performed ones

The validation activities of the SHARE meteorological network was suspended provisionally from June to December 2013, due to the give-up of the person in charge of this task. This also caused a delay, for a few specific data series, in the data submission to the NextData Archives (see Deliverable D1.1.4, annex 1). To cope, ISAC-BO opened a fellowship position that was appointed in December 2013.

6. Expected activities for the following reference period

Continuation and upgrade of the in-situ measurement programmes in the regions considered by the project.

Publication of validated series of data for the (i) SHARE AWSs, (ii) Campo Imperatore – Monte Portella high mountain Observatory, (iii)Kathmandu – Pakanajol Station, (iv) Deosai Plateau ABC Observatory.

Analysis of atmospheric composition variability at Kathmandu and comparison with baseline observations at the NCO-P station for the investigation of vertical transport of pollutants from the ABC to the high Himalayas.
Analysis of atmospheric composition variability at Campo Imperatore – Monte Portella high mountain Observatory and results publication.

List of acronyms

ABC: Atmospheric Brown Cloud
ABC-UNEP: Atmospheric Brown Cloud Project by Unite Nations Environmental Programme
AWS: Automatic Weather Station
CCAC: Climate and Clean Air Coalition
CETEMPS: Centro di Eccellenza di Telerilevamento E Modellistica numerica per la Previsione di eventi Severi
DHM: Department of Hydrology and Meteorology (Nepal)
eqBC: equivalent Black Carbon
EMRP: European Metrology Research Programme
ENEA-UTMEA: Italian National Agency for New Technology, Energy and Sustainable Economic Development - Unit for Environment and Energy Modeling
GAW-WDCGG: World Data Center for Greenhouse Gases by GAW/WMO
GAW/WMO: Global Atmosphere Watch of the World Meteorological Organization
GEO: Group on Earth Observations
GMES: Global Monitoring for Environment and Security
HQ: Head Quarter
ICIMOD: International Centre for Integrated Mountain Development
INRIM: Italian National Institute of Metrology
IRSA-CNR: Water Research Institute - National Research Council
ISAC-BO: Institute of Atmospheric Sciences and Climate – Bologne
ISE-CNR: Institute of Ecosystem Study – National Research Council
ISI: Institute for Scientific Information
LTER: Long Term Ecological Research
METEOMET: Metrology for Meteorology, EMRP Project
MAAP: Multi Angle Absorption Photometer
NAST: Nepal Academy of Sciences and Technologies
NCO-P: Nepal Climate Observatory – Pyramid
OPC: Optical Particle Counter
PM: Particulate Matter
PMD: Pakistan Meteorological Department
QA/QC: Quality Assurance/Quality Control
SHARE: Station at High Altitude for Research on the Environment
SLCF: Short Lived Climate Forcers
SLCP: Short Lived Climate Pollutants
SusKat: Sustainable Atmosphere for the Kathmandu Valley
UNEP: United Nations Environment Programme
WAPDA: Water and Power Development Authority