Project of Strategic Interest NEXTDATA

Deliverable D1.1.4
Report describing the activities, data transfer to archives and to the General Portal

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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) were 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 South Col AWS (Himalayas) necessitates further in-depth analysis. New measurement programmes, concerning atmospheric composition investigation, were started in Nepal (Kathmandu) and in Pakistan (Deosai Plateau). 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 and data transfer status are explained by the WP1.2 Report. The status of station (AWS) operations, data validation and data transmission to the NextData archives are described in the Annex 1.

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 S (central Apennines)	Italy	Europe	ATM	
SusKat Observatory (Kathmandu, Nepal)	Nepal	Asia	ATM	1,250
Pyramid Laboratory Observa (Khumbu valley, Himalayas)	Nepal	Asia	AWS	5,050
Pheriche (Khumbu valley, Himalay	Nepal	Asia	AWS	4,258
Namche Bazaar (Khumbu va Himalayas)	Nepal	Asia	AWS	3,560
Lukla (Khumbu valley, Himalayas)	Nepal	Asia	AWS	2,660
Kala Patthar (Khumbu va Himalayas)	Nepal	Asia	AWS	5,600
ChangriNup Station (Khumbu va Himalayas)	Nepal	Asia	AWS	5,700
Urdukas (Baltoro glacier, Karakoru	Pakistan	Asia	AWS	3,926
Askole (Baltoro glacier, Karakorum	Pakistan	Asia	AWS	3,015
Concordia (Baltoro gla Karakorum)	Pakistan	Asia	AWS	4,700
Mt. Stanley (Elena glacier, Rwenzoı	Uganda	Africa	AWS	4,700

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

1 Activities in Nepal

1.1 Meteorological observations in Himalayas

Activities carried out in the Himalayan areas are located mainly in Nepal, thanks to the presence of the International Pyramid Laboratory-Observatory, installed by Ev-K2-CNR in 1990, at 5,050 m a.s.l. in the Sagarmatha National Park, in collaboration with the Nepal Academy of Science and Technology. This facility represents a strategic logistic base for supporting monitoring activities carried out along the Khumbu Valley, in the region of Mt. Everest, where the AWS network and the GAW/WMO Nepal Climate Observatory Pyramid (NCO-P) (see WP1.2) are located (Tab. 1).

The AWS observations require daily checks, as well as periodical technical interventions, also concerning the management of data transmission systems both in Nepal and Italy. During 2013, in-situ calibration and checking activities were performed using a "travelling standard", which was set-up in 2011 in the framework of the SHARE activities (for more details about this AWS, see Deliverable D1.1.2). During 2013 intercomparison exercises were carried out at the AWS Lukla (2660 m a.s.l.) and Namche, (3560 m a.s.l.) allowing the identification of possible sensor malfunctioning or drifts. URT Ev-K2-CNR, in close collaboration with CNR-ISAC, was in charge of the analysis of the intercomparison results, also performing the necessary actions to re-establish the correct operation of the AWSs (e.g. by changing sensors not working properly) or to improve the AWS functionality (e.g. by modifying data acquisition procedures). For this purpose, collaboration with ENEA-UTMEA was also undertaken in order to check and calibrate the broadband short-wave and long-wave radiation sensors working at the AWSs. The "reference" AWS was sent to Italy for carrying out the scheduled maintenance activity and recalibrating the sensors. With the aim of ensuring the calibration of the radiometric sensors, avoiding long stop of intercomparison activities in Nepal, URT Ev-K2-CNR supplied with a couple of new travelling reference sensors (pyranometer and pyrgeometer). During the reference period, the data transmission system was upgraded: three AWSs (Kala Pattar, ChangriNup, Pyramid) are currently operating in near-real time mode.

New sensors for measurements of soil temperature and soil moisture were purchased to be installed at the AWS Lukla and NCO-P.

Concerning the post-processing activity of the AWS data, in collaboration with ISAC-BO and ENEA-UTMEA, the guidelines for validation and flagging of meteorological data were updated. In particular, new validation criteria were defined for rain precipitation, solar and thermal global radiation and snow level measurements. The data recorded along 2012 were preliminary inspected and elaborated.

In 2013, the collection of lakes samples allowed to continue the study of 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, therefore the observed trends are caused by variations of runoff chemical composition. Runoff is here depending on processes occurring at catchment scale, such as glacier retreat.

Concerning 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.

1.2 Contribution to the ABC-SusKat field campaign and establishment of a new permanent Observatory in Kathmandu

Fig. 1. On the top: aerosol inlets and meteorological mast on top of the Ev-K2-CNR Representative Office at Kathmandu. PM_{10} and PM_1 (right), O_3 and eqBC (center), wheather station and pyranometer (left). On the left: internal view of the station with the β-absorption PM_{10}-PM_1 sampler and the acquisition system.

In the framework of collaborations with local Institutions (ICIMOD - International Centre for Integrated Mountain Development) and the UNEP-ABC and SHARE-Ev-K2-CNR projects, CNR-ISAC and URT Ev-K2-CNR participated in the SusKat (Sustainable Atmosphere for the Kathmandu Valley) ABC field campaign. The aim of this international initiative (hold in Kathmandu from January to March 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 framework, a new measurement station was installed at the Ev-K2-CNR building in Kathmandu in January 2013 (Fig. 1). The station was furnished with suitable systems for the air sampling and with an UPS to avoid 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, i.e. an integrated weather station (WXT520, Vaisala), a pyranometer (CMP21, Kipp & Zonen), an optical particle counter (FAI Instruments), a condensation particle counter (3772 TSI), a β-absorption system for the near-real-time determination of PM_1 and PM_{10} (FAI Instruments), a Multi Angle Absorption Photometer MAAP 5012 (Thermo Electron), a UV-absorption O_3 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 the atmospheric composition variability in Nepal. It represents a “reference point” for the heavy polluted conditions affecting the Himalaya foothills, which is very useful also 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).

The preliminary analysis of the first 7-months measurement period (presented at the *Workshop on atmospheric composition and the Asian 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

Fig. 2. Upper picture: landscape of Kathmandu valley from the Suskat Observatory at the Ev-K2-CNR Representative Office in Pakanajol. On the right: Internal view of the Suskat Station at Pakanajol: condensation particle counter, OPC, MAAP and O3 analyser.

pollutants (SLCP), i.e. Ozone (O_3) and eqBC, of the mass concentration (PM_1, $PM_{2.5}$ and PM_{10}) and of the number concentration of aerosol particles. Moreover, a preliminary comparison with the corresponding data series recorded at the WMO/GAW Station NCO-P was carried out.

The preliminary analysis of the first set of measurements (Fig. 3) pointed out that very high values of eqBC (average value from February to July 2013: 10.6 ± 9.1 $\mu g/m^3$), particle number concentrations (fine: 17.6 ± 11.4 10^3 cm^{-3}; accumulation: 507.5 ± 382.6 cm^{-3}; coarse: 3.3 ± 2.5 cm^{-3}), PM_{10} (152.8 ± 203.4 $\mu g/m^3$), $PM_{2.5}$ (from February to March 2013: 195.4 ± 80.4$\mu g/m^3$); and PM_1 (from April to July 2013: 41.2 ± 145.4 $\mu g/m^3$) were observed. Please note that fine particle concentration measurements by CPC are available from May 2013. In addition, surface O_3 (average value 32.6 ± 22.9 ppb) showed high hourly values exceeding 100 ppb during the pre-monsoon season (from March to May up to 100 ppb). Even if a significant day-to-day variability exists (see the thick lines, representing the daily average values), eqBC and aerosol particle number concentrations showed a decreasing trend from winter towards summer-monsoon. This is especially evident for the eqBC which was characterized by hourly mean concentration exceeding 60 $\mu g/m^3$ in February and not exceeding 20 $\mu g/m^3$.

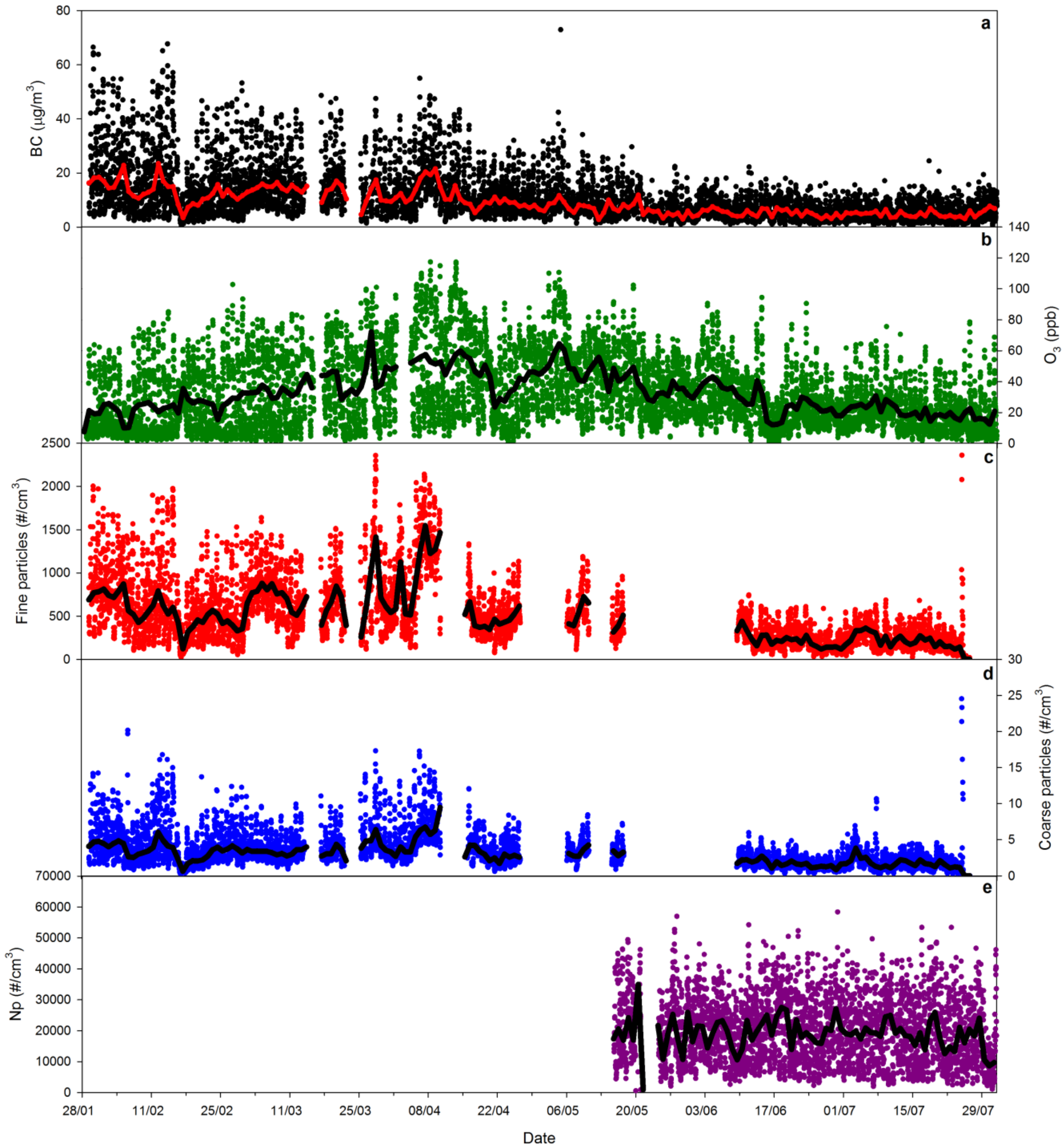

Fig. 3. Hourly average values for eqBC (plate a), surface O_3 (plate b), fine (0.28 μm ≤ Dp< 1 μm; plate c), coarse (1 μm ≤ Dp< 10 μm; plate d) and total (20 nm ≤ Dp< 3 μm; plate e) particle number at Pakanajol – Kathmandu from February to July 2013. The tick black lines represent the daily average values.

Conversely, surface O_3 showed a seasonal maximum during the pre-monsoon, from March to May, which is likely due to more efficient photochemistry and vertical mixing. These seasonal cycles are related both to emission and meteorological variability. Indeed, during winter months the strong atmospheric stability favoured the trapping of primary emissions in the Kathmandu PBL (Planetary Boundary Layer). Moving towards spring and summer, the vertical mixing is enhanced and surface emissions are more diluted, resulting in lower daily maximum values of aerosol. During summer, the wet scavenging related with monsoon rain further favoured the decline of air pollutant concentrations. The influence of meteorology and emissions on the SLCF/SLCP is particularly evident looking at the average diurnal cycles (Fig. 3). It should be noted that Kathmandu is located within a orographic basin, which drives to the development of diurnal thermal breezes able to significantly and systematically influence local atmospheric circulation and, finally, air quality. In fact, eqBc and aerosol particle number concentration peaked in the early morning (during the rush hours) and were minimized during the central part of the day, when PBL height is maximized and pollutants emitted at the surface are more diluted. Again, surface O_3 appears to be anti-correlated with aerosol particles, showing higher concentration during the central part of the day due to photochemical production and vertical mixing with air-masses from higher residual layers or from the free troposphere. 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.

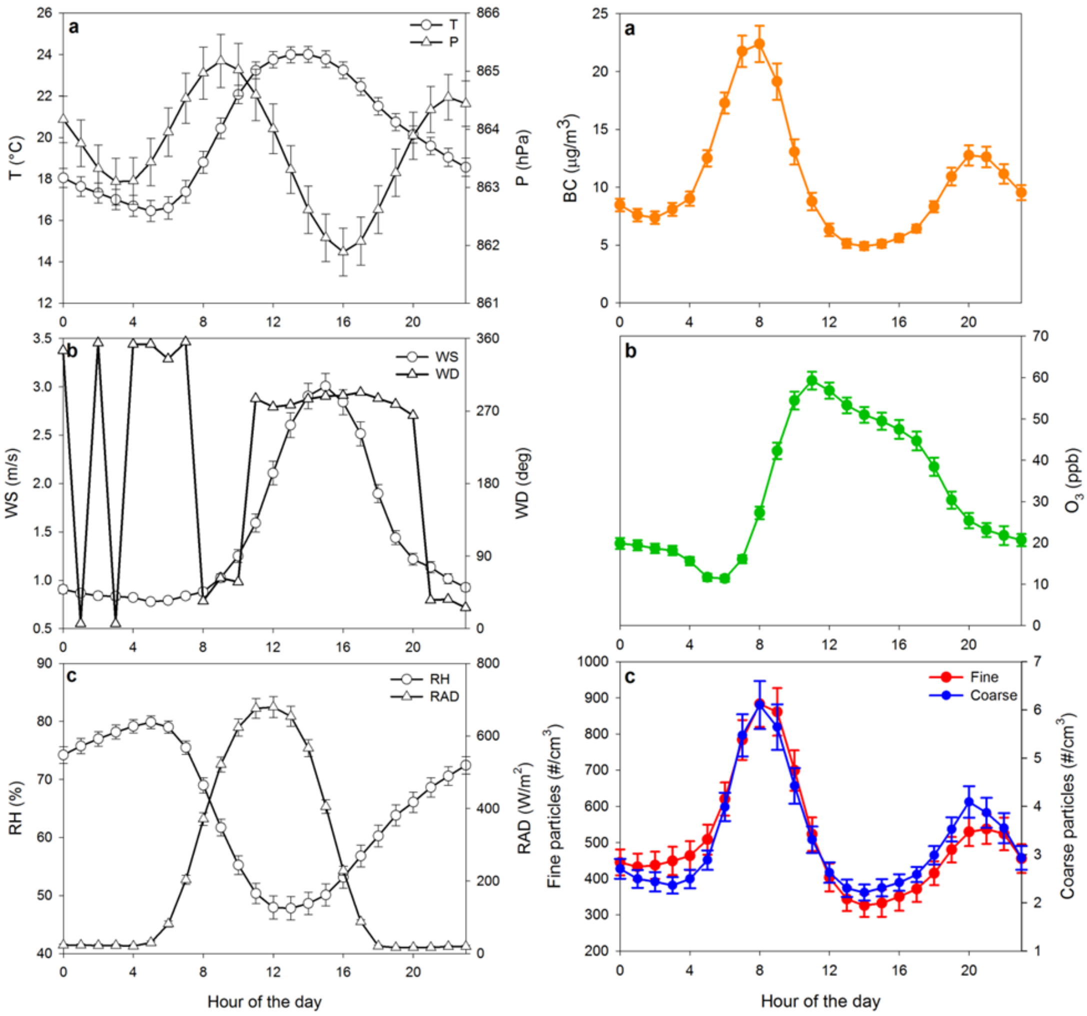

Fig. 4. *Left*: mean diurnal variation of meteorological parameter at Kathmandu-Pakanajol: air-temperature (T), atmospheric pressure (P), wind speed (WS) and direction (WD), relative humidity (RH and global solar radiation (RAD). *Right*: mean diurnal variation of atmospheric composition parameters: eqBC, surface O_3, fine and coarse particle number.

2. Activities in Pakistan

As pointed out by the WP1.1 Activity report, the research activities carried out in Pakistan were related to the maintenance of the meteorological observations at the three AWSs at Askole, Urdukas and Concordia (Baltoro Region), the installation of a new Atmospheric Observatory in the Deosai region and the analysis of atmospheric composition data recorded during the experimental campaign which was hold at Askole in Summer 2012. These activities were carried out in collaboration with local Pakistani Institutions, i.e. the Pakistan Meteorological Department (PMD) and Water and Power Development Authority (WAPDA).

2.1 Meteorological observations in the Baltoro Region (Askole, Urdukas and Concordia)

In 2013 the maintenance of the existing monitoring weather stations in Askole, Urdukas and Concordia was done. URT Ev-K2-CNR personnel carried out two field campaigns (Summer and Autumn) during which technical interventions to the AWSs were performed:

- At Concordia AWS the net radiometer sensor (K&Z CNR1) was replaced by an improved system (K&Z CNR4).

- At Urdukas AWS the Lastem anemometer and the temperature sensor were changed with a Vaisala WA15 anemometer and a Vaisala HMP155 respectively.

Local researchers and technicians were involved in the technical field missions and trained for instruments installation, maintenance and data acquisition.

2.2 Installation of a new remote Atmospheric Observatory on the Deosai Plateau.

Except the experimental campaign carried out at Askole during summer 2012, systematic activities devoted to the characterization of atmospheric composition variability in the Karakorum region have been extremely sparse until today and a more comprehensive documentation and assessment about the quantification of polluted air-mass transport to the Pakistani mountain regions is needed. 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 2013, in collaboration with the PMD and WAPDA. This station represents the first ABC-UNEP measurement site existing in the Karakorum region. As discussed in the WP1.1 Activity Report, the installation activity was extremely complex and challenging. Some factors delayed the installation operations: anomalous snow-falls which affected the investigation area during summer 2013, security problems and technical difficulties during the installation of the Remote Climate Station. Therefore, even if the installation campaign begun in July 2013, the atmospheric measurements started only in September 2013. Two technicians by 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 data quality. Moreover, ISAC-BO helped in implementing the communication firmware of the station for the near-real time data transmission. From September, 25th 2013, the Remote Climate Station started to provide the first continuous measurements of pollutant/climate-altering compounds (O_3, eqBC, aerosol size distribution from 0.28 nm to 10 μm) and meteorological parameters. After a stop due to technical problems occurred to the battery pack on October 20th2013, the observations restarted in January 2014. 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. 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 scientific instrumentation. To sum-up, 25 days of continuous observations are available over the period July – December 2013. Even if the challenging conditions partially explain this unsatisfactory data coverage, during the third year of activity a strict revision of this experiment is mandatory, especially concerning the weakness of the embedded system components (from the power to the telecommunication system) as well as the logistic issues.

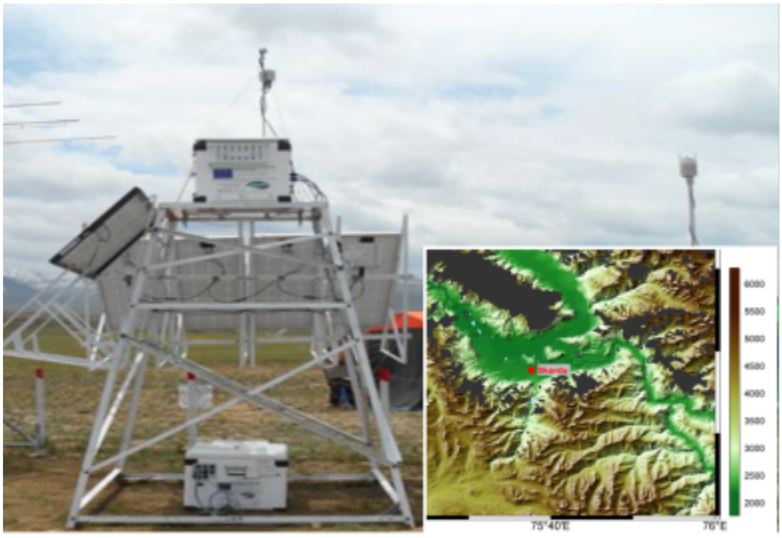

Fig. 5. The Remote Climate Station installed at the Deosai Plateau in Pakistan. A trellis is used to reduce the possibility that the Station is covered by snow accumulation.

2.3 Analysis of atmospheric composition in Karakorum: the Summer 2012 Askole field campaign

During the second year of activity, ISAC-BO analysed the atmospheric composition and meteorological data recorded from 20^{th} August to 10^{th} November 2012 at the village of Askole (3015 m a.s.l., Pakistan Northern Areas, see Figure 6) by using an embedded-transportable monitoring system specifically designed to perform atmospheric observations in remote regions (see the Report of the first year of activity). The field campaign aimed to provide information on SLCF/SCLP variability and driving processes for aclimatic hot-spot region (the Karakorum) where similar information were not available. The results of this analysis were the object of a paper submitted to *Atmospheric Environment* (Putero et al., 2013). Validated data were formatted according to the GAW-WDCGG and GAW-WDCA (World Data Center for Greenhouse Gases and World Data Center for Aerosols) guidelines and were submitted to the NextData archives (by the Geonetwork system).

The measurement system was equipped with an integrated weather station (Vaisala WXT 520), a condensation particle counter (CPC - TSI 3010) able to provide total number concentration for particles (hereinafter Np) with diameter 20 nm <Dp< 3 μm, an O_3 analyser (O_3 Monitor 220 2B Technologies) and with a probe for CO_2 measurements (Vaisala CARBOCA GMP 343). Meteorological parameters and CO_2 data were collected for the whole campaign period (with a major data gap on 19th - 31st October due to a failure of the acquisition system), while O_3 and Np were collected until 7th October and 23rd September respectively.

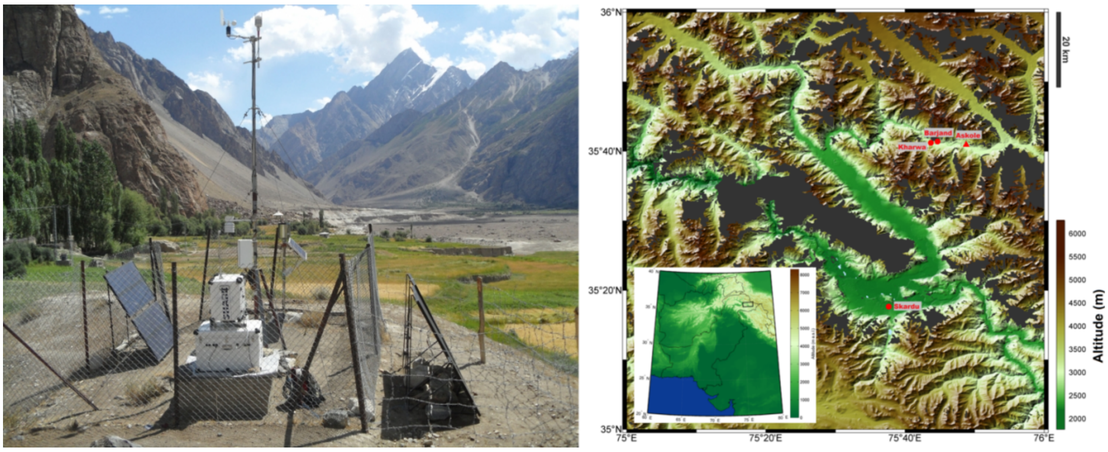

Fig. 6. On the left, the embedded station at Askole. On the right a geographic map of the Braldu valley with Askole position. The insert denotes the Braldu valley position with respect to Karakorum region.

In order to determine the synoptic origin of air-masses reaching the measurement site, 5-day back-trajectories were calculated every 6 hours (at 4:00, 10:00, 16:00 and 22:00) with the HYSPLIT back-trajectories model, provided by NOAA-ARL. The model calculations were based on the GDAS meteorological field produced by NCEP with a horizontal resolution of 1° x 1°. To identify the main synoptic-scale flows occurring at the measurement site, a non-hierarchical cluster analysis was applied to the back-trajectories; this led to the identification of 6 main air-mass circulation classes which affected the investigation area during the field campaign (Fig. 7).

The most striking feature in the Np time series is the presence of systematic concentration peaks which occurred in the early morning (from 4:00 to 7:00) and in the evening (from 16:00 to 20:00), as also pointed out by the analysis of the average diurnal variations (Fig. 8). A detailed inspection of the internal working parameters of the embedded station did not reveal any evident malfunctioning of the system able to explain these anomalous peaks. The time of the day in which these peaks occurred corresponds almost perfectly to the time when people from the village burn wood and other organic material, especially for cooking. At Askole, during the summer season, the population uses very simple cooking systems, often represented by open fires with rough chimneys that guarantee the smoke ventilation from traditional houses to the outdoor. The fuel is typically represented by wood that people collect in the neighbourhoods. It is thus conceivable that the particle peaks could be ascribed to the domestic emissions from the near village. 31% of measurement period was identified as influenced by local pollution (27% of CO_2 and 26% of O_3 data).

Apart from these local contamination events, the mountain wind regime clearly influenced the diurnal behaviour of atmospheric composition at the measurement site. Indeed, aerosol particles and trace gases showed a typical diurnal cycle. In particular, the lowest particle concentration was observed at night (from 22:00 to 02:00, Np = 686 cm^{-3}) while a statistically significant increase (99% confidence level) took place during day-time (from 11:00 to 15:00, Np = 1056 cm^{-3}), when air-masses from the lower valley were transported up to Askole. As pointed out by this analysis, the surface O_3 average diurnal variation was also characterized by lower values during the night (00:00 – 4:00, mean value: 28.5 ppb) and a peak during the afternoon (14:00 – 15:00, mean value: 34.6 ppb), with average diurnal cycle amplitude of 6.1 ppb. On average, the diurnal O_3 peak occurred few hours later than the Np peak and the maximum of the up-valley wind speed: this suggested the transport of air-masses richer in O_3 along the valley, influenced by photochemical production due to the regional-scale anthropogenic precursor emissions. The presence, during day-time (nigh-time), of air-masses representative of the lower troposphere (free troposphere) was also testified by the CO_2 average diurnal variation, which showed lower mixing ratios (on average: -8 ppm) with respect to night-time values. Indeed, during summer season, air-masses from the atmospheric boundary layer were depleted in CO_2 with respect to free-tropospheric or upper tropospheric air-masses due to the vegetation uptake by photosynthesis.

As denoted by the behaviour of daily average values, the atmospheric composition measurements at Askole were also characterised by significant day-to-day variations (Fig. 7), thus indicating that processes occurring at synoptic (or larger) scales can play a role in determining aerosol and trace gas behaviours in this remote region. For a systematic investigation of the possible relationship between synoptic air-mass circulation and atmospheric composition at Askole, Np, O_3 and CO_2 hourly values were analysed as a function of the different air-mass clusters. In order to capture the dominant synoptic-scale circulations and minimize the interference of the regional atmospheric boundary layer, only nigh-time data (less influenced by the development of daytime upward thermal transport processes occurring at mesoscale) not influenced by the local contamination events were considered for this analysis. Figure 8 (panels a-c) reports the statistical distribution of the hourly Np, O_3, and CO_2 values for their whole measurement period (i.e. 35 days for Np, 45 days for O_3 and 72 days for CO_2). For each observed parameter and distribution bin, we also calculated the relative percentage of the air-mass cluster occurrence (Fig. 8, panels d-f). As for Np, it was difficult to find a clear relationship with air-mass circulation clusters. However, it should be noted that the peak of the frequency distribution (600 cm^{-3}) was related to "long-range" circulation (i.e. INS and TAK). INS contributions appeared to be the dominant ones for "intermediate" Np values (from 500 to 900 cm^{-3}). This can be understood as indicative aerosol particles number concentration background in the free troposphere over the Karakorum region, driven by long-range transport. Long-range transport included contribution from TAK, possibly pointing out the role of mineral dust transport in the fine particle range, although this could not be proved by our instrumental setup. In parallel, INS air-masses also contributed for the 50% of the upper Np values (> 1300 cm^{-3}), indicating that long-range transport from South Asia was a major source of fine particles in the Karakorum. This analysis showed that the contribution of TAK and INS air-masses was dominant for low O_3 (< 20 ppb), but still significant up to 30 ppb. This could indicate a possible influence of air-masses originating from the Taklamakan desert or related to the summer monsoon circulation in determining the lowest values to the distribution peak.

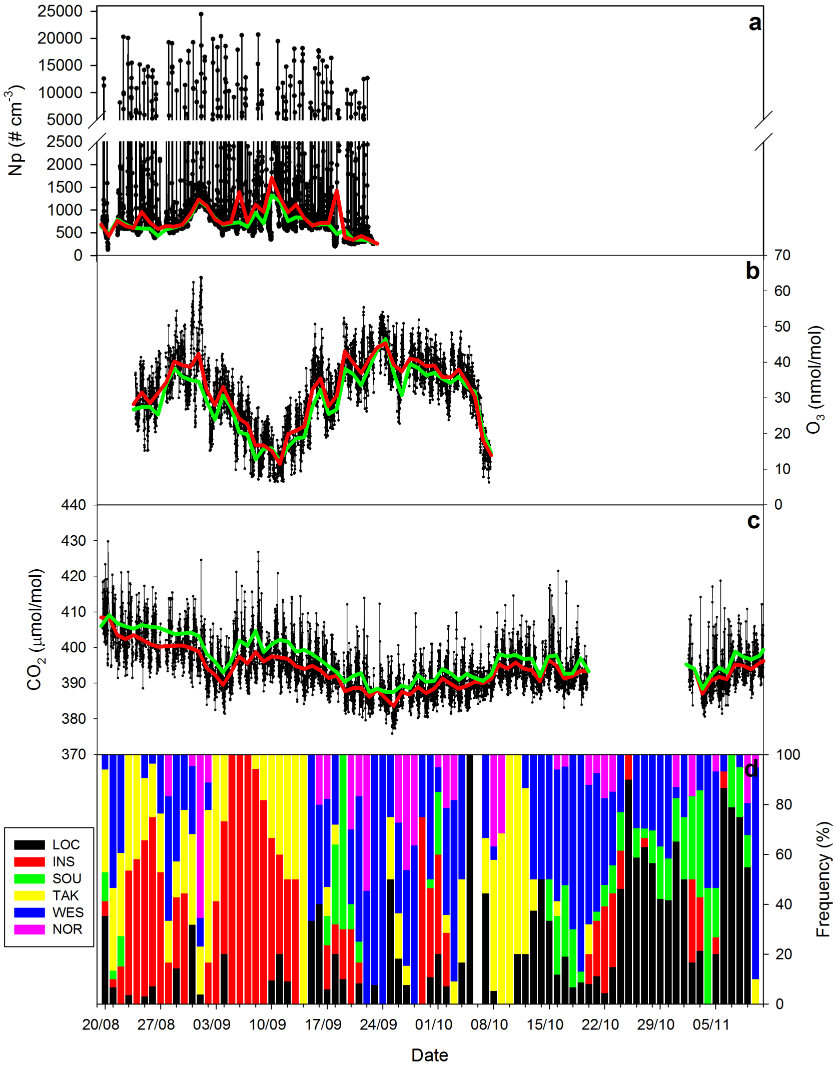

Fig. 7 Time series of CPC particle number concentration (Np, panel a), surface O_3 (O_3, panel b), carbon dioxide (CO_2, panel c) and daily air-mass circulation occurrences (panel d, WES-Westerly; TAK-Taklamakan; LOC-Local; SOU-Southern Pakistan; INS-Indian Subcontinent; NOR-Northerly). Red lines denote daily averages (computed excluding the "local contamination events"), while green lines represent night-time (between 21:00 and 4:00) averages.

As shown in Figure 8d, a generally low occurrence of WES and NOR circulation was observed for the different O_3 values. Only the upper O_3 values (higher than 35 ppb) showed not negligible contribution related to WES and NOR circulations, suggesting that O_3-enriched air-masses from the free troposphere could contribute to the episodic occurrence of these higher O_3 levels at the measurement site. The relationship with air-masses circulation appeared to be almost "reversed" for CO_2. Indeed, the lowest CO_2 mixing ratios were mostly associated with WES circulation (with smaller contributions from LOC, INS and SOU), while the highest values were mostly observed in concomitance with INS and TAK circulations.

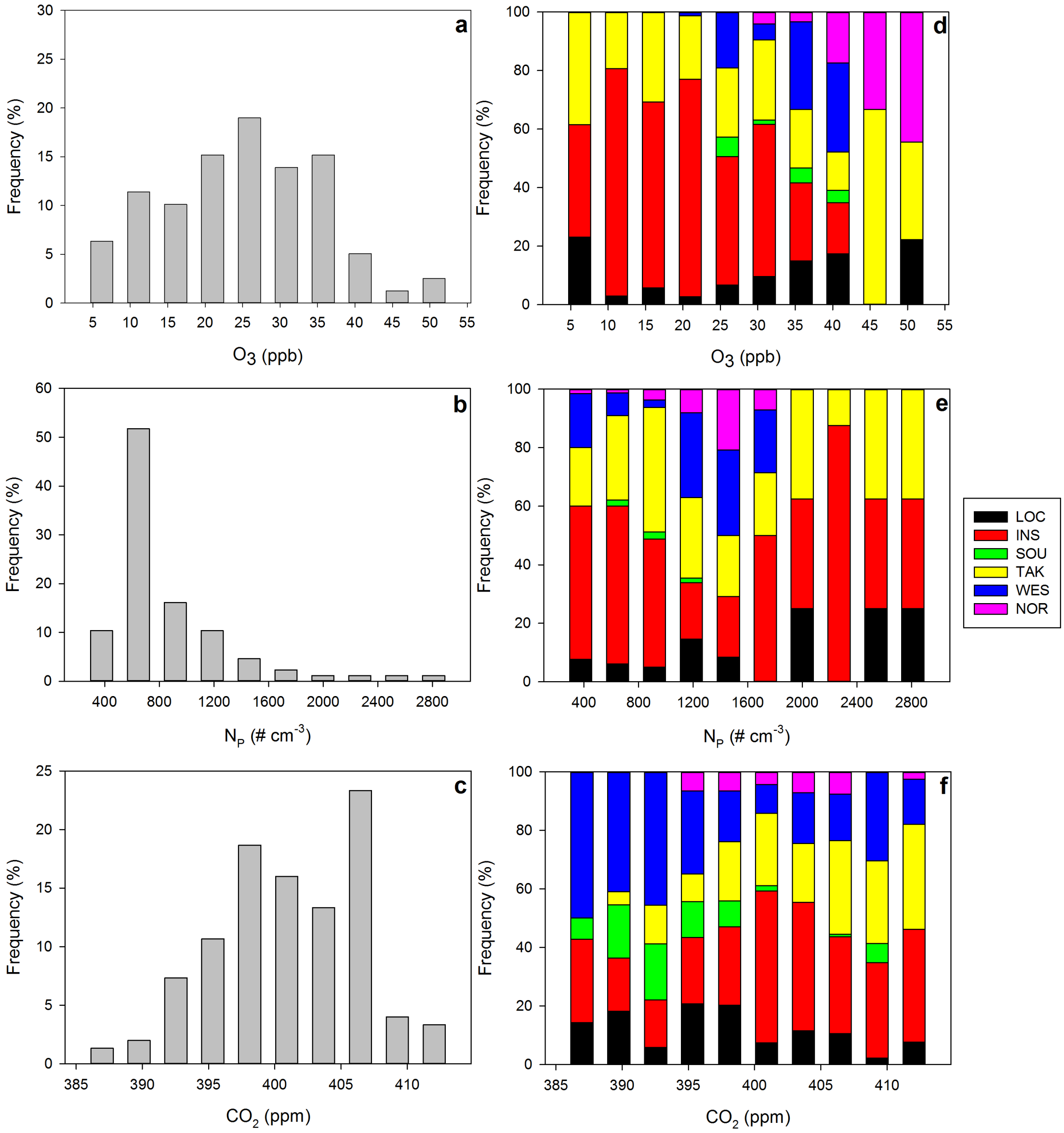

Fig. 8. Statistical distribution of nigh-time hourly Np (a), O3 (b) and CO2 (c) values at Askole during the field campaign. Percentage contribution of air-mass circulation occurrence (LOC–Local; INS-Indian Subcontinent; SOU-Southern Pakistan; TAK-Taklamakan; WES-Westerly; NOR-Northerly) for each bin of the distributions are reported (d-f).

3. Activities in Africa

3.1 Meteorological observations at Ruwenzori Mountains

In Uganda, the AWS at 4.700 m a.s.l. on Rwenzori was re-activated in January 2013. In addition to monitor standard meteorological parameters (air temperature, atmospheric pressure, relative humidity, wind speed and direction, rain precipitation), the new AWS is equipped with sensors for measuring long-wave broadband and short-wave albedo as well as the snow level. Moreover, an upgraded acquisition system allows the daily data delivery to Ev-K2-CNR HQs. Data evaluation and validation are currently on-going.

Fig. 9. The new AWS installed at Mt. Stanley (Rwenzori) on 2013, January.

4. Activities in Italy

4.1 Alps

In Italy, the analysis of data collected by the stations on Forni, Dosdè and Gigante-Mt. Bianco Glaciers continued allowing the improvement of 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 were organized three missions for the maintenance of the AWSs. on the Glaciers Forni and Dosdè

4.2 *Apennines*

The Monte Portella station (42°26'52.96 "N, 13°33'02.41", elevation 2401 m a.s.l.) on the Gran Sasso chain (Central Italy), was installed at the beginning of July 2012: 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, O_3, NO_x and particle size distribution ($0.28\ \mu m \leq Dp \leq 10\ \mu m$). A network connection with the University of L'Aquila allows real time transfer of data to a local server. A webpage 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 O_3, NO and future gas measurements was installed. The system was designed to meet the GAW directives (Pyrex© tube with ID 120 mm, and length 2000 mm).

All the analysers working at the station perform daily zero checks and internal calibrations. In particular, the O_3 analyser is routinely calibrated using a 2b O_3 Calibration Source (Model 306), which is the laboratory standard: it is compared by the factory every few years against other primary standards. Also the OPC (FAI Instruments Srl) is sent to the factory every year for calibration. With the aim of upgrading the measurement set-up of the mountain measurement station at Campo Imperatore – Monte Portella (managed by CETEMPS –University of L'Aquila), ISAC-BO started the procedures for purchasing a state-of-art surface O_3 UV-analyser.

Data are weekly inspected by CETEMPS operators and now are under final validation to be submitted to SHARE network database.

The main issues encountered during the station operation were mainly due to the harsh environmental conditions which characterized Monte Portella (high wind speed, heavy snowfall and lightening). As an instance, measurements were interrupted from November to December 2013 due to a snow slide that damaged the power line. Another power loss was related to lightning strokes which broke the power line again as well as the O_3 analyser. Other technical problems affecting the network connection were experienced by two major transmitter failures due to the very low winter temperatures.

Future plans include: 1) replacing the current O_3 analyser with a state-of-art system (see WP1.2); 2) replacing the network transmitter at the station with a device able to resist to low air temperature; 3) installing other gas and particle analysers to increase the number of the observed species; 4) improving the operation continuity of the station to meet the GAW specifications; 5) provide a first scientific characterization of atmospheric variability at Monte Portella.

Database availability:

- SHARE network AWS: see Annex 1.
- Askole, Pakistan (August - October 2012): surface O_3, CO_2, 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): O_3, eqBC, aerosol number size distribution (280 nm <Dp< 20 mm), 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 O_3, eqBC, total particle number concentration (20 nm ≤ Dp< 3 mm): aerosol particle size distribution (0.28 nm ≤ Dp< 10 mm), PM_{10}, $PM_{2.5}$ (only February –

March 2013), PM_1 (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**)

TABLE 2 - TEMPORAL AVAILABILITYOF THE MEASUREMENTS IN THE FRAMEWORK OF THE SUSKAT-ABC STATION AT KHATMANDU-PAKANAJOL (YEAR 2013)

Measurements	JFM	AMJ	JAS	OND
Air temperature				
Dew point temperature				
Atmospheric pressure				
Relative humidity				
Rain precipitation				
Solar radiation				
Wind speed				
Wind direction				
Coarse particle number				
PM1, PM2.5, PM10				
NOx				
O3				

LEGEND:

◆More than 75 % of data available

◆Data availability between 50 and 75 %

◆Data availability between 25 and 50 %

◆Less than 25 % of data available

◆No data

- 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**).

- Campo Imperatore – Monte Portella (July 2012 – December 2013); surface O_3, NO, aerosol size distribution (0.3 – 10 mm), 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**);

TABLE 3 - TEMPORAL AVAILABILITYOF THE MEASUREMENTS IN THE FRAMEWORK OF THE MT.PORTELLA STATION (YEAR 2013)

Measurements	JFM	AMJ	JAS	OND
Air temperature				
Dew point temperature				
Atmospheric pressure				
Relative humidity				
Rain precipitation				
Solar radiation				
Wind speed				
Wind direction				
Coarse particle number				
PM1, PM2.5, PM10				
NO				
O3				

LEGEND:

♦More than 75 % of data available

♦Data availability between 50 and 75 %

♦Data availability between 25 and 50 %

♦Less than 25 % of data available

♦No data

Project of Strategic Interest NEXTDATA

Deliverable D1.1.4
Report describing the activities, data transfer to archives and to the General Portal

WP Coordinator: Paolo Cristofanelli
CNR-ISAC, Bologna

ANNEX 1
STATUS OF DATA AVAILABILITY
FROM THE SHARE-AWS NETWORK

This document reports the status of data availability for the Automatic Weather Station (AWS) operating within the scientific activities of WP1.1. Availability is intended to describe the status of data transmission to NextData General Portal by their submission to the Geonetwork system(see WP2.1) in January 2013. Shouldn't data be available in the archives NextData yet, data access modality will be illustrated.

Himalaya AWS – 1

Station	**Parameters**	**Measurement period**	**Availability of validated data**
AWS Pyramid *Data resolution: 60-min*	Atmospheric Pressure Air Temperature Relative Humidity Wind Speed Wind Direction Precipitation	1994-ongoing	2002 - 2009
	Global Radiation	2000-ongoing	2002 - 2009
	Incoming Shortwave Outgoing Shortwave Incoming Long wave Outgoing Long wave Soil Temperature 5 cm Soil Temperature 20 cm Soil Heat Flux Soil Moisture Snow Depth	2002-ongoing	2002 - 2009
AWS Periche *Data resolution: 60-min*	Atmospheric Pressure Air Temperature Relative Humidity Wind Speed Wind Direction Precipitation Global Radiation	2001-ongoing	2002 - 2009
AWS Namche *Data resolution: 60-min*	Atmospheric Pressure Air Temperature Relative Humidity Wind Speed Wind Direction Precipitation Global Radiation	2001-ongoing	2002 - 2009

Himalaya AWS – 2

Station	Parameters	Measurement period	Availability of validated data
AWS Lukla *Data resolution: 60-min*	Atmospheric Pressure	2002-ongoing	2002 – 2009
	Air Temperature		
	Relative Humidity		
	Wind Speed		
	Wind Direction		
	Precipitation		
	Global Radiation		
	Incoming Shortwave	2007-ongoing	2007 – 2009
	Outgoing Shortwave		
	Incoming Long wave		
	Outgoing Long wave		
	Soil Temperature 5 cm		
	Soil Temperature 20 cm		
	Soil Heat Flux		
	Soil Moisture		
AWS Kala Patthar *Data resolution: 10 min*	Atmospheric Pressure	2008-ongoing	2008 – 2009
	Air Temperature		
	Relative Humidity		
	Wind Speed		
	Wind Direction		
	Precipitation		
	Global Radiation		
	UVA Radiation		
AWS Chungri Nup *Data resolution: 30 min*	Air Temperature	2010-ongoing	***Upon request to the data provider*** *(Validation on-going)*
	Relative Humidity		
	Wind Speed		
	Wind Direction		
	Incoming Shortwave		
	Outgoing Shortwave		
	Incoming Long wave		
	Outgoing Long wave		

Himalaya AWS – 3

Station	Parameters	Measurement period	Availability of validated data
AWS Colle Sud *Data resolution: 10 min*	Station Pressure	2008-2011	***Upon request to the data provider***
	Air Temperature		
	Relative Humidity		
	Wind Speed		
	Wind Direction		
	Global Radiation		
	UVA Radiation		

Karakorum AWS

Station	Parameters	Measurement period	Availability of validated data
AWS Concordia *Data resolution:60-min*	Atmospheric Pressure	2011-ongoing	***Upon request to the data provider*** *(Validation on-going)*
	Air Temperature		
	Relative Humidity		
	Wind Speed		
	Wind Direction		
	Precipitation		
	Incoming Shortwave		
	Outgoing Shortwave		
	Incoming Long wave		
	Outgoing Long wave		
	Snow Depth		
AWS Askole *Data resolution:60-min*	Atmospheric Pressure	2005-ongoing	2005 – 2008
	Air Temperature		
	Relative Humidity		
	Wind Speed		
	Wind Direction		
	Precipitation		
	Global Radiation		
AWS Urdukas *Data resolution: 60-min*	Atmospheric Pressure	2004-ongoing	2004-2009
	Air Temperature		
	Relative Humidity		
	Wind Speed		
	Wind Direction		
	Precipitation		
	Incoming Shortwave	2011-ongoing	***Upon request to the data provider*** *(Validation on-going)*
	Outgoing Shortwave		
	Incoming Long wave		
	Outgoing Long wave		
	Snow Depth		

Rwenzori AWS

Station	Parameters	Measurement period	Availability of validated data
AWS Elena Glacier *Data resolution: 60-min*	Atmospheric Pressure	2006 - 2009 2013 - ongoing	***Upon request to the data provider***
	Air Temperature		
	Relative Humidity		
	Wind Speed		
	Wind Direction		
	Precipitation		
	Global Radiation		
	Precipitation	2013 - ongoing	***Upon request to the data provider*** *(Validation on-going)*
	Incoming Shortwave		
	Outgoing Shortwave		
	Incoming Long wave		
	Outgoing Long wave		
	Snow Depth		

Italian Alps AWS

Station	Parameters	Measurement period	Availability of validated data
AWS Bianco - Osram *Data resolution: 60-min*	Atmospheric Pressure Air Temperature Relative Humidity Incoming Shortwave Outgoing Shortwave Incoming Long wave Outgoing Long wave Snow Depth	2007-ongoing	***Upon request to the data provider***
AWS Dosdé - Levissima *Data resolution: 60-min*	Atmospheric Pressure Air Temperature Incoming Solar Radiation Outgoing Solar Radiation Incoming Infrared Radiation Outgoing Infrared Radiation	2007-ongoing	***Upon request to the data provider***
AWS 1 Forni *Data resolution: 30 min*	Atmospheric Pressure Air Temperature Relative Humidity Wind Speed Wind Direction Precipitation Incoming Solar Radiation Outgoing Solar Radiation Incoming Infrared Radiation Outgoing Infrared Radiation Snow Depth	2005-ongoing	2005 – 2009