**TITLE**

CAMP_Himalayas_Pyramid_20060101_20061231.sfc

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## 1. 0 DATASET OVERVIEW

1.1 Introduction

Intensive meteorological observations in the Khumbu Valley, Nepal Himalayas, have been conducted since the middle 90's (Ueno et al., 1996; Tartari et al., 1999; Bertolani et al., 2000; Ueno et al., 2001; Bollasina et al., 2002; Ueno and Pokhrel, 2002) in order to provide long-term monitoring of the monsoon at high altitude. This area, being located on the windward side of the Range with respect to the Indian monsoon, is well exposed to the summer winds. The studies conducted have demonstrated that the region is a significant point of observation both of local climate and large-scale circulation. A network of Automated Weather Stations (AWSs) has been established in the Eastern Himalayas: the AWSs are located at different altitudes, over a 40 km stretch oriented approximately south to north. The observations of snow depth and of the four components of radiation are crucial for studying the feedback mechanisms and the physical exchange processes between the land and the atmosphere, very important in the modulation of the monsoon.

1.2 Time period covered by the data

Start: January 1, 2006, 00:00
End: December 31, 2006, 23:00

1.3 Temporal characteristics of the data

All parameters are recoded hourly.

1.4 Physical location of the measurement

Latitude: 27° 57' 33" N
Longitude: 86° 48' 48" E
Elevation: 5035 m a.s.l.

1.5 Data source

Original data provided by the Ev-K2-CNR Committee.

1.6 WWW address references

http://www.evk2cnr.org

## 2.0 INSTRUMENTATION DESCRIPTION

2.1 Platform

The sensors are mounted on a 2-m and a 5-m masts.

2.2 Description of the instrumentation

| Parameter | Model | Manifacturer |
|---|---|---|
| Air Temperature | DMA570 | Lsi-Lastem (Italy) |
| Precipitation | DQA035 | Lsi-Lastem (Italy) |
| Relative Humidity | DMA570 | Lsi-Lastem (Italy) |
| Atmospheric Pressure | CX115P | Lsi-Lastem (Italy) |
| Wind Speed | DNA022 | Lsi-Lastem (Italy) |
| Wind Direction | DNA022 | Lsi-Lastem (Italy) |
| Downward Shortwave Radiation | CM3 | Kipp&Zonen (The Netherlands) |
| Upward Shortwave Radiation | CM3 | Kipp&Zonen (The Netherlands) |
| Downward Longwave Radiation | CG3 | Kipp&Zonen (The Netherlands) |
| Upward Longwave Radiation | CG3 | Kipp&Zonen (The Netherlands) |
| Snow Depth | SLU4/20 | Micros (Italy) |

2.3 Instrumentation specification

| Parameter | Sensor Type | Height of sensor (m) | Accuracy | Resolution |
|---|---|---|---|---|
| Air Temperature | Thermoresistance | 2 | 0.1°C | 0.025°C |
| Precipitation | Tipping Bucket | 1.5 | 1% (0-1 mm/min); 2% (1-3 mm/min) | 0.2 mm |
| Relative Humidity | Capacitive Plate | 2 | 2.5% | 0.2% |
| Atmospheric Pressure | Slice of Silica | 2 | 1 hPa | 0.1 hPa |
| Wind Speed | 3-cup anemometer | 5 | 0.1 m/s | 0.05 m/s |
| Wind Direction | Potentiometer | 5 | 1% | 0.1° |
| Downward Shortwave Radiation | Thermopile | 2 | 10% (daily total) | - |
| Upward Shortwave Radiation | Thermopile | 2 | 10% (daily total) | - |
| Downward Longwave Radiation | Thermopile | 2 | 10% (daily total) | - |
| Upward Longwave Radiation | Thermopile | 2 | 10% (daily total) | - |
| Snow Depth | Ultrasonic | 2 | 1 cm | 0.1 cm |

## 3.0 DATA COLLECTION AND PROCESSING

3.1 Description of data collection

Data are downloaded from the AWS twice every year, in spring and autumn. Then, data are sent to Italy, where they are processed.

3.2 Description of derived parameters and processing techniques used

Temperature, relative humidity and radiation are instantaneous values. Precipitation is accumulated on the previous hour. Atmospheric pressure is averaged over the previous hour. Wind speed and direction are the *resulting* average speed and direction over the previous hour (calculated by the datalogger by means of data recorded every 5 seconds): this to minimize data unreliability due to sudden gusts. Both of them are calculated weighting the frequency distribution of both variables within each hour. Snow depth is averaged over the previous hour.

The four parameters indicated below were computed by using "CEOP Derived Parameter Equations" available at: http://www.joss.ucar.edu/ghp/ceopdm/refdata_report/eqns.html. These data have the flag "I". In the case of calculated by using dubious value flagged "D", the data flag was put D".

Dew Point Temperature was computed by using (Bolton 1980):

es = 6.112 * exp((17.67 * T)/(T + 243.5));
e = es * (RH/100.0);
Td = log(e/6.112)*243.5/(17.67-log(e/6.112));
where:
T = temperature in deg C;
es = saturation vapor pressure in mb;
e = vapor pressure in mb;
RH = Relative Humidity in percent;
Td = dew point in deg C

Specific Humidity was computed by using (Bolton 1980):

e = 6.112*exp((17.67*Td)/(Td + 243.5));
q = (0.622 * e)/(p - (0.378 * e));
where:
e = vapor pressure in mb;
Td = dew point in deg C;
p = surface pressure in mb;
q = specific humidity in kg/kg.

U,V Components were computed by using (GEMPAK):

U = -sin(direction) * wind_speed;
V = -cos(direction) * wind_speed;

Net radiation was computed by using (GEMPAK):

NET_radiation = down(in)short + down(in)long - up(out)short - up(out)long

## 4.0 QUALITY CONTROL PROCEDURES

For all parameters, the data has been visually checked, looking for extremely and unusual low/high values and/or periods with constant values. Nocturnal shortwave radiation data has been checked for non-zero values; wind speed and direction for sensor freezing; precipitation data has been checked for delayed measurement due to the melting of solid precipitation (in that case, the amount is usually measured around 10 local time of the morning of the following day). Snow depth values have been checked to delete hourly/daily fluctuations of the measured snow (in absence of real snow fall) due to the dependence of the sensor signal on air density; in fact, though the sensor is temperature compensated, more or less regular fluctuations (no greater than ± 1-2 cm) are still recognisable.
Cross-checking among the variation of different measured parameters (ground heat flux, snow cover, etc.) was also performed to assure the consistency among the variations of different variables under the same conditions. The consistency of downward and upward shortwave radiation was also verified calculating the albedo (at high sun elevations).
The quality control flags follow the CEOP data flag definition document.

## 5.0 GAP FILLING PROCEDURES

No gap filling procedure was applied.

## 6.0 DATA REMARKS

6.1 PI's assessment of the data

6.1.1 Instruments problems

None.

6.1.2 Quality issues

Due to sensor freezing, in some cases wind speed and direction were recorded as 0 and 360, respectively, and, thus, considered bad. Due to slow melting of solid precipitation in the not-heated rain gauge, precipitation is sometimes recorded with delay. These values were considered dubious. There is a general tendency of the sensor to over-estimate relative humidity and to reach saturation conditions. Dew deposition could be observed on the radiation sensor. Snow depth measured values have fluctuations related to air density variations.

6.2 Missing data periods

None.

## 7.0 REFERENCE REQUIREMENTS

Original data was collected and is provided within the framework of the Ev-K2-CNR/NAST Joint Scientific and Technological Research Project, funded by Italian Ministries and National Research Council through the Ev-K2-CNR Committee.

## 8.0 REFERENCES

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