Standard Operating Procedures

Weather Station

This document describes the **Standard Operating Procedures (SOPs)** that must be applied to all weather station contributing measurements to the ACTRIS Cloud Remote Sensing Data Centre.

Every National Facility shall have a typical weather station including five measurements

1. TA : Air temperature
2. RH : Relative Humidity
3. PR : Precipitation Rate
4. WS : Wind Speed and direction

I. Site requirements

1	Operation area : environment surrounding the instrument	• Surface: stable, solid and easily accessible installation area. • Open view within a cone of specified elevation angle from zenith to prevent obstacles such as buildings or trees. The objective is to have representative meteorological measurements around cloud-radar and disdrometers. • The prevailing wind direction is also important to find the optimal location of the disdrometer.
2	Specific points of attention	It should be a tipping bucket rain gauge or a weighing precipitation gauge. Heater has to be installed inside the rain gauge. The rain gauge has to be installed at the same level as the cloud radar / disdrometer. Accuracy of 0.1 or 0.2mm for precipitation rate. Temperature and relative humidity sensors have to be installed inside a specific multi-plate shelter at the same level as the cloud radar / disdrometer. Wind speed and wind direction should be representative of the dynamics around the cloud remote sensing instrument and disdrometer. Open field

		of view is very important and a set-up at several meters above the ground will be better. Dynamic sensors should be installed at 10m agl. The instrumental set-up concerning weather-station, disdrometer and cloud remote sensing instruments should be done in a very limited area, maximum some tens/hundreds of meters between each sensor. • Disdrometer and rain gauge have to be very close: maximum 10-20m • For the other meteorological variables (wind, temperature and humidity): the objective is to have a representative value around the cloud remote sensing site, some hundreds of meters can be accepted. • Altitude difference between all the variables except for wind measurement should be smaller than 5m.
3	Reliability of internet and power	400W for electrical power and internet access for the datalogger (PC+software)
4	Comply with local Safety and Security Rules	

II. Operation modes

1	Stability	Keep the instrument always on power.
2	Scanning modes	-
3	Ensure collection of data	Data collection is ensured by a datalogger connected to a battery
4	Ensure collection metadata and HK data	Metadata and housekeeping data collection is ensured by the datalogger
5	Continuity	24/7
6	Ensure accurate system clock and location	Use UTC time zone (no changing with Summer Time), use ntp or GPS reference
7	Ancillary measurements to be performed	-
8	Recommendations to maximize good working order of the instrument	Open view to have representative measurement of weather measurement

III. Monitoring of system parameters

1	Instrument status dashboard(s) and (automatic) alert systems (applied on data and housekeeping data)	Objective : Quasi NRT HKD : heater OFF/ON ? Geophysical data : min/max air temperature, relative humidity, atmospheric pressure, wind speed and precipitation rate System / data logger : free disk space
2	Housekeeping data threshold and	-

	available variability	
3	Web sites to access QLs	Time series of air temperature, relative humidity, atmospheric pressure, wind speed and precipitation rate
4	Visual inspection of instrument (e.g. remotely controlled camera)	A physical check of the rain gauge is mandatory every week to ensure that the system is clean (especially for the rain-gauge).

IV. Data types and database connection

1	Data type	Air temperature, relative humidity, atmospheric pressure, wind speed and precipitation rate HouseKeeping data and/or status
2	Data format	Ascii file with data **and** header is OK, also the data file as Netcdf file with data and metadata is accepted. But no binary data files.
3	Temporal resolution of the data	1min to 10min
4	Temporal resolution of the metadata	1min to 10min
5	Range resolution of the data	-
6	Maximum range	-
7	Raw data and metadata flow (including housekeeping data) implementation to the data center	-

V. Calibration

1	Retrieval of Calibration Parameters	Total amount of precipitation compared to a well-known value with a fixed and standard precipitation rate
2	Characterization of measurement uncertainties	Yes. For each tipping bucket and weighing system
3	Calibration schedule (automatic and hands-on)	Calibration every 6 or 12 months for the rain gauge sensor made by Met-Office.
4	Detecting systematic errors during instrument operation	

VI. Maintenance schedule

1	Preventive maintenance	Cleaning the tipping bucket rain gauge or the weighing precipitation gauge every week. Cleaning the wind-speed sensor twice a year to ensure a good measurement of the flow.
2	Likely component replacements	
3	Likely software issues, software upgrades	Version numbering is crucial.

VII. Documentation

1	Synthesis of technical actions (e.g. on-line log book)	-
2	Procedure and technical documents	-
3	Web form	
4	Training guides	
5	Recording of maintenance actions	

Table 1. Minimum and optimum requirement for meteorological variables

Variables	Minimum requirement	Optimum requirement
Time resolution	*10min*	*1min*
Air temperature	*Average value*	*Minimum value*
Relative humidity	*Average value*	*Maximum value*
Wind speed	*Average value*	*Maximum value* *Average value*
Wind direction	*Average value*	*Average value*
Precipitation rate	*Sample value*	*Sample value*