Information offered by NuclierData

1. Data source

All NuclierData variables are measured at the radiometric and meteorological station located on the roof of the Polytechnic School of the University of Girona (41 962° N, 2.829° E, 115 m). You can find information about the station, the instrumentation and the maintenance routines here.

Both the measuring station and the database is managed by the Environmental Physics Group (Department of Physics) from the University of Girona. Several research projects (NUCLIER, NUCLIEREX, NUCLIERSOL) have provided funding for the expansion, improvement and maintenance of the station.

2. Measured variables offered for download in several aggregation times

NuclierData system allows downloading the following variables measured at the station:

	Units	Measurement interval (s)	Aggregation time in *datalogger* (min)	Aggregation operation in *datalogger*
Global horizontal irradiance	W m^{-2}	1	1	Average
Diffuse horizontal irradiance	W m^{-2}	1	1	Average
Direct (beam) irradiance	W m^{-2}	1	1	Average
Infrared irradiance	W m^{-2}	1	1	Average
Erythemal UV irradiance	W m^{-2} (*)	1	1	Average
Atmospheric pressure	hPa	1	5	Average
Precipitation	mm		5	Accumulation
Air temperature	°C	1	5	Average
Relative humidity	%	1	5	Average
Wind speed	m s^{-1}	1	5	Average (**)
Wind direction	° (N=0, E=90)	1	5	Vector (***)

(*) Weighted according the erythemal action spectrum
(**) Mean velocitat (as scalar)
(***) Direction of the mean wind vector

3. Offered aggregation levels

NuclierData system allows downloading data at several levels of aggregation: hourly, daily, monthly, and annual. Next table shows the specifications for each case.

	AGGREGATION LEVEL →	HOURLY	DAILY	MONTHLY	ANNUAL
	Aggregation operation or value shown	Units	Units	Units	Units
Global horizontal irradiance	Accumulated	kJ m^{-2}	MJ m^{-2}	MJ m^{-2}	GJ m^{-2}
Diffuse horizontal irradiance	Accumulated	kJ m^{-2}	MJ m^{-2}	MJ m^{-2}	GJ m^{-2}
Direct (beam) irradiance	Accumulated	kJ m^{-2}	MJ m^{-2}	MJ m^{-2}	GJ m^{-2}
Infrared irradiance	Accumulated	kJ m^{-2}	MJ m^{-2}	MJ m^{-2}	GJ m^{-2}
Erythemal UV Dose	Accumulated	SED (*)	SED (*)	SED (*)	SED (*)
Atmospheric pressure	Mean	hPa	hPa	hPa	hPa
Atmospheric pressure	Minimum	hPa	hPa	hPa	hPa
Atmospheric pressure	Maximum	hPa	hPa	hPa	hPa
Precipitation	Accumulated	mm	mm	mm	mm
Precipitation	Maximum intensity	mm/h	mm/h	mm/h	mm/h
Air temperature	Mean	°C	°C	°C	°C
Air temperature	Minimum	°C	°C	°C	°C
Air temperature	Maximum	°C	°C	°C	°C
Relative humidity	Mean	%	%	%	%
Relative humidity	Minimum	%	%	%	%
Wind speed	Mean (**)	m s^{-1}	m s^{-1}	m s^{-1}	m s^{-1}
Wind speed	Maximum	m s^{-1}	m s^{-1}	m s^{-1}	m s^{-1}
Wind direction	Mean vector (***)	° (N=0, E=90)	Not computed	Not computed	Not computed

(*) SED: *Standard Erythemal Dose*, 1 SED = 100 J m^{-2}
(**) Mean velocitat (as scalar)
(***) Direction of the mean wind vector

The original data at 1 or 5 minutes resolution are available by contacting the station managers (nuclierdata@udg.edu) with an explicit and detailed request.

There are other observations and measurements that may be available by contacting the station managers:
- Photosynthetic photons flux density (PPFD)
- Backscattering profiles and estimated of the cloud base height from ceilometer (Vaisala CL31)
- Multichannel radiometer measurements (MFR7) and estimates of aerosol optical depth.
- Whole sky images taken by a hemispheric camera (SONA, images here)
- Sunshine duration (from a Campbell-Stokes type heliograph)

4. Comments about the aggregation process

When starting an aggregation process, original values are filtered and corrected following the criteria shown below. If we are not able to apply a correction, values that do not agree with the criteria are labeled as NULL, that is, they are considered missing values.

	Original time resolution (min)	Minimum acceptable value	Maximum acceptable value	Applied corrections, if possible
Global horizontal irradiance	1	-10 W m^{-2}	1400 W m^{-2}	If value<0 → value=0
Diffuse horizontal irradiance	1	-10 W m^{-2}	1400 W m^{-2}	If value <0 → value =0
Direct (beam) irradiance (**)	1	-10 W m^{-2}	1370 W m^{-2}	If value <0 → value =0
Infrared irradiance	1	180 W m^{-2}	480 W m^{-2}	
Erythemal UV Dose (**)	1	-0.1 UVI units (*)	14 UVI units (*)	If value <0 → value =0
Atmospheric pressure	5	950 hPa	1030 hPa	
Precipitation	5	0 mm	30 mm	
Air temperature	5	-15 °C	50 °C	
Relative humidity	5	0 %	110 %	If value >100 → value =100
Wind speed	5	0 m s^{-1}	40 m s^{-1}	
Wind direction	5	0°	360°	

(*) The Ultraviolet radiation Index (UVI) is computed as 40×UVE, where UVE is the erythemal irradiance in W m^{-2}.
(**) Instruments measuring beam irradiance and UV irradiance contain also a temperature sensor. If the measurement of temperature is missing, the corresponding beam and UV measurements are labeled NULL.

Aggregations for hourly, daily, monthly and annual values are always performed directly upon the original values at 1 or 5 minutes resolution (depending on the variable). For any level of aggregation, a requirement has been implemented that no more than 2% of the original values are missing, erroneous, or discarded (NULL). This approach results in the following specific requirement:

- Hourly from 1 minute resolution: one value can be missing as maximum (1 minute 60 represents less than 2%).
- Hourly from 5 minute resolution: no single value can be missing.
- Daily: missing data cannot represent more than 0.02 × 24 = 0.48 hours.
- Monthly (assuming months with 30 days): missing data cannot represent more than 24 × 30 × 0.02 = 14.4 hours.
- Annual (assuming a year with 365 days): missing data cannot represent more than 7.3 days.

When for a specific variable the system does not produce a value at a certain level of aggregation, in general it will still be possible to obtain values of that period for lower levels of aggregation. For example, even if the annual value of 2006 is not produced for a variable, it is possible that several monthly(and hourly and daily) values can be produced for that year.

5. Contents of the downloaded file

The downloaded file is in .csv format (plain text with fields separated by commas) in UTF-8 code. The first line is the header, indicating the contents of fields: timestamp and variables included. The names of the fields, although abbreviated, are informative enough, so they allow an easy identification of contents.

For hourly aggregations, the *hour* field contains the time when the aggregate period begins: for example, if *hour* is 17, the aggregated period runs from 17 to 18 h. Time is always UTC (Universal Time Coordinated).

For some variables it is possible to obtain maximum and/or minimum values measured in the selected aggregation period. In the downloaded file, these values come along with the timestamp indicating when these maximum/minimum values have been reached, with a precision 5 minutes. At the heading, these fields are indicated as *tmst* (timestamp).