



High-rate ISFS Data for METCRAXII

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These data contain surface meteorology measurements of the [Integrated Surface Flux System \(ISFS\)](#) during the second Meteor Crater Experiment (METCRAXII), at the Barringer Meteor Crater, Arizona, during October of 2013.

For general information about the operations of the ISFS during METCRAXII see <https://www.eol.ucar.edu/content/isfs-metcraxii>.

The ISFS high-rate datasets contain values of variables measured by the NCAR ISFS. These values have been resampled using a simple nearest-in-time method to an evenly spaced time grid. Sensors which operated at 1 sample/sec or less have been resampled to a 1 Hz time grid. Higher rate sensors, such as 3-D sonic anemometers have been resampled to a 20 Hz time grid.

See the tables at <https://www.eol.ucar.edu/content/isfs-metcraxii> for information on the sensors that were deployed.

The data are stored in NetCDF files. Information on the NetCDF file format and software is available at <http://www.unidata.ucar.edu/software/netcdf/>. Information specific to ISFS NetCDF files is available at <https://www.eol.ucar.edu/content/isfs-netcdf-files>.

High-rate Datasets and Download URLs

Two high-rate datasets are available.

- `netcdf_hr_qc_geo_tiltcor`, <http://data.eol.ucar.edu/codiac/dss/id=386.007>: All wind vectors have been rotated to geographic coordinates (+U is wind to the east, +V is wind to the north), and 3D wind vectors are corrected for tilt of the anemometer relative to a plane of mean flow (see [#SonicTiltCorrection](#)).
- `netcdf_hr_qc_geo_notiltcor`, <http://data.eol.ucar.edu/codiac/dss/id=386.008>: Same variables as in `netcdf_hr_qc_geo_tiltcor`, but the 3D winds have not been corrected for sonic tilt.

Quality Control, Corrections

The QC procedure consists removing the high rate data (i.e. replacing it with the missing data value) during periods where it is determined that the data does not meet QC criteria. This is done before the data are re-sampled to the 1 Hz and 20 Hz grids.

See [Notes On Quality Control](#) for details. Here is a quick summary:

The [online field logbook](#) logbook has detailed information about sensor issues that were noted in the field.

- `u`, `v`, `w`, `tc` from the CSAT3 sonic anemometers have been removed when `diagbits`, from the the CSAT3 diagnostic bits, is non-zero.
- `P.nne.flr`, `P.sw.flr`, `P.w.flr` data were removed during periods of sensor problems, as determined by anomalous data.
- `T`, `RH` values removed when the aspiration fan current, `Ifan`, of the ventilated hygrothermometer was out of normal range and during periods of other sensor problems.
- Radiometer `Rpile` and `Rsw` values removed when `Wetness` indicates the presense of liquid water, when notes in the field log indicated the optics were dirty, when the radiometers were being cleaned, and for periods of known wiring problems.

The following corrections have been applied to both datasets

- All horizontal wind components, `U` and `V` from 2D anemometers, and `u` and `v` from fast 3D anemometers, have been rotated to geographic coordinates, where +`U` is wind to the east, +`V` is wind to the north. These rotations are based on compass measurements of the anemometer orientations.

NetCDF File Names

Each NetCDF file contains four hours of data. The file names are of the form "`metcraxii_tc_YYYYMMDD_HH.nc`", for the tilt-corrected data and "`metcraxii_ntc_YYYYMMDD_HH.nc`" for the non-tilt-corrected data, where `YYYYMMDD_HH` is the starting year, month and day and hour in UTC.

Time Representation

The `base_time` variable contains one value, the time of the start of the file, as a number of POSIX (non-leap) seconds since 1970 Jan 1, 00:00 UTC.

Values for each time-varying measurement will be found in the NetCDF files, as a variable with a **time** dimension. The time dimension will be 14400 for a complete file, the number of seconds in four hours.

Before being written to the NetCDF files, the raw, asynchronous samples are re-sampled to an evenly spaced time sequence, using a simple method of matching the raw sample nearest-in-time to the evenly-spaced times. No interpolation or averaging is done.

Variables of three time resolutions are stored in the files. State parameters such as temperature and humidity were sampled at 1/sec. These variables will have a time dimension of 14400, the number of samples in four hours.

Radiation and soil measurements were sampled at 0.2 Hz. These data were resampled to the 1/sec time grid, and so generally 3 or 4 out of 5 values every second will be the missing value. When resampling a lower resolution time series to a higher resolution grid, the resampling procedure will frequently repeat values. As a result there often be 2 repeated values and then 3 missing radiation and soil values over 5 seconds.

Data from sonic anemometers and fast hygrometers were sampled at approximately 20/sec. These variables will have an additional **sample** dimension of 20 in addition to the **time** dimension.

The **time** variable contains the time to be associated with each 1 Hz sample, in units of seconds since **base_time**. Each time value is the middle of the second.

For variables with a sample dimension of 20, the timetags for the 20 samples of the second are evenly spaced around the corresponding **time**. The time-tag for a sample from a variable with **time** index **i**, sample index **j**, is:

$$t_{i,j} = \text{base_time} + \text{time}_i - 0.5 + (1/20) \times (1/2 + j)$$

i is the time index

j is the sample index, ranging from 0 to 19 (**sample** dimension minus one)

Dimensions

The NetCDF dimensions in each file are:

Dimension name	size	description
time	14400	number of seconds in 4 hours
sample20	20	additional dimension for 20 Hz variables
site	5	index for the five ISFS sites at METCRAXII: flr, rim, base, near, far

Short Name Attributes

Each measured variable will have a **short_name** NetCDF attribute. The field before the first period in the **short_name** is a generic variable name, such as **T** for temperature, **Rsw** for short wave radiation, or **u** for the U component of the wind.

Heights

The height in meters above ground of the measurement, if appropriate, will be indicated in a second field after a period in the **short_name**, for example **RH.30m.rim**.

Tower Sites

The last period-separated field in the **short_name** attribute is the site name, "flr" (crater floor), "rim", "base" (next ISFS base trailer), "near" and "far".

NetCDF Variable Names

The actual NetCDF variable names will have underscores, '_', in place of periods and single quotes. Therefore a variable with a **short_name** attribute **U.3m.near** will have a NetCDF variable name of **U_3m_near**.

Units and Long Names

Variables have a NetCDF attribute specifying the units of the measurement. Many variables have a **long_name** attribute giving more information on the measurement.

Missing Data

The missing data value is 10^{37} . A missing value indicates either that the sensor was not reporting at the given time or it was determined that the data value did not meet QC criteria.

Sonic Tilt Correction

The 3D sonic anemometers were installed as level as was possible, but not perfectly "bubble" level.

The **netcdf_hr_qc_geo_tiltcor** dataset contains 3D wind vectors and second moments which have been rotated to a coordinate system where the mean **W** component is zero, as described in </content/sonic-tilt-corrections>.

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