

Meteorology and Micrometeorology Data Submission Guidelines

One of the fundamental requirements of being a participant in the AmeriFlux network is to submit data within one year of data collection to the central AmeriFlux data repository located at the Carbon Dioxide Information Analysis Center (CDIAC). Investigators are expected to provide a core suite of flux and micrometeorological measurements and estimates reported on 30-min (preferred) or 1 hr reporting intervals referenced to the beginning of the interval.

Data are submitted in a comma-separated ASCII file. The file type can be CSV, ASC, or TXT. There are two internal formats: the preferred format documented here and the Level 2 (L2) core variable standard format described in the L2 readme file on the CDIAC ftp server (ftp://cdiac.ornl.gov//ameriflux/data/Level2/standardized_files/with_gaps/L2_Readme.doc).

The preferred format is more complete to accommodate a broader suite of measurements. Sites with multiple instruments at different tower heights or sites deploying multiple sets of instruments for redundant measurements should use this format. The differences between the preferred format and the L2 core variable standard format are summarized at the end of this document.

Meteorological and micrometeorological data must be submitted as non gap-filled records. AmeriFlux investigators are strongly encouraged to also submit gap-filled meteorological data. When submitting gap-filled data please provide a flagging column indicating whether the data point is filled or not (0=original measurement, 1=filled). In cooperation with and thanks to the ICOS data activities, Level 4 gap-filled files are produced and available from the CDIAC archive (<ftp://cdiac.ornl.gov/ameriflux/data/Level4>).

Separate files are submitted for non gap-filled and gap-filled data. The data columns in the gap-filled file must include all required variables, but otherwise may be a subset of the non gap-filled data columns. The same column headings are used for the same variables in each file.

The following provides required AmeriFlux data reporting elements, variable names, and reporting units. Please adhere to these guidelines.

Content and Format of Data Submission File Header

Each file contains a header followed by data rows. The header includes information identifying the site, investigator, and submission date as well as rows identifying contents and units of the data rows. A missing data value is indicated by a value of -9999.

Data must be submitted in standard units. The units for each variable are documented in the table below.

<u>Line</u>	<u>Row Text</u>	<u>Contents</u>
1	Sitename:	Site name. The site name should be consistent with the one on the

- AmeriFlux web site. Note that the site name cannot contain any commas.
- 2 Email: E-mail contact for questions. The e-mail contact need not be the principal investigator.
 - 3 Created: File creation date
 - 4 Variable name column headings
 - 5 Variable units

Content and Format of Data Submission File Data Records

Data row column headings are of the form:

<Variable name><repeat>_<offset>_<offset>_<modifier>

where:

- Variable name is one of the variable names described below. The most important variable names are contained in the table below. Note that variable names may include the character “_”.
- Repeat is an integer which indicates data obtained from additional instruments. If there is one and only one instrument, the repeat is not used. The second instrument is associated with repeat = 2.
- _<offset>_<offset> gives the tower elevation in m or soil depth in cm of the measurement. If the site reports only one measurement of each variable, the offset is not used as the offset can be determined by the site ancillary data.
- _<modifier> is one of the additional attributes names documented at the above web page.

Examples include CO2, PAR2_OUT, TA_20_5, and TBole_Pine, and GAP_CO2_10_5.

<u>Variable Name</u>	<u>Units</u>	<u>Description</u>
YEAR		Calendar year, A.D.
DOY		Julian Day; integer.
HRMIN		Local standard time expressed in a three or four-digit HHMM format (e.g., 2:30 AM = 230; 2:30 PM = 1430).
DTIME		Decimal day and local time of day; each half-hour equals 0.02083 (e.g., 12.74988).
UST	m/s	Friction velocity, calculated as the square root of kinematic momentum flux.
TA	deg C	Air temperature.
WD	deg	Wind direction, expressed in degrees clockwise from the North.
WS	m/s	Wind speed measured above the canopy.

NEE	$\mu\text{mol}/\text{m}^2/\text{s}$	Net ecosystem exchange, including subcanopy CO ₂ storage. Subcanopy storage includes the entire column from the ground to the height of the eddy covariance system and for some sites advection losses too.
FC	$\mu\text{mol}/\text{m}^2/\text{s}$	CO ₂ flux or the rate of vertical transfer of CO ₂ , not corrected for storage or advection, as calculated from measurements above the canopy. Positive values denote upward fluxes and negative values downward fluxes.
SFC	$\mu\text{mol}/\text{m}^2/\text{s}$	CO ₂ storage in the canopy air layer. The canopy air layer includes the column from the ground to the height of the eddy covariance system.
H	W/m ²	Sensible heat flux or the rate of vertical transfer of heat, not corrected for storage, measured above the canopy.
SH	W/m ²	Sensible heat storage in the canopy air space and biomass. Heat storage in the soil above the soil heat plate is the storage term for FG.
LE	W/m ²	Latent heat flux, not corrected for storage, measured above the canopy.
SLE	W/m ²	Latent heat storage in the canopy air layer.
FG	W/m ²	Soil heat flux.
TS	deg C	Soil temperature. Multiple soil temperature measurements/profiles are encouraged and welcome.
PREC	mm	Rainfall or wintertime precipitation.
RH	%	Relative humidity of air.
PRESS	kPA	Barometric pressure
CO ₂	$\mu\text{mol}/\text{mol}$	CO ₂ concentration above the canopy
VPD	kPA	Vapor pressure deficit, as the difference between the saturation water vapor pressure and the measured water vapor pressure.
SWC	m ³ /m ³	Soil water content, based on time-domain measurement methods sensitive to dielectric permittivity. Multiple soil water content determinations/profiles are encouraged and welcome.
Rn	W/m ²	Net radiation. Positive values denote upwards.
PAR	$\mu\text{mol}/\text{m}^2/\text{s}$	Incoming photosynthetically active radiation (i.e., radiation in the 0.4 to 0.7 micrometer waveband), measured above the canopy.

PARdif	$\mu\text{mol}/\text{m}^2/\text{s}$	Incoming diffuse photosynthetically active radiation, measured above the canopy.
PARout	$\mu\text{mol}/\text{m}^2/\text{s}$	Reflected photosynthetically active radiation.
Rg	W/m^2	Incoming global solar radiation including both direct radiation and diffuse radiation, measured above the canopy
Rgdif	W/m^2	Incoming diffuse global solar radiation including reflected and scattered radiation from all portions of the sky, measured above the canopy.
RgOut	W/m^2	Outgoing global solar radiation, measured above the canopy.
Rgl	W/m^2	Incoming longwave radiation (i.e., radiation in the 4 to 100 micrometer waveband), measured above the canopy
RglOut	W/m^2	Outgoing longwave radiation, measured above the canopy.
FH2O	$\text{mmol}/\text{m}^2/\text{s}$	Water vapor flux above the canopy
H2O	mmol/mol	Water vapor concentration above the canopy.
RE	$\mu\text{mol}/\text{m}^2/\text{s}$	Total ecosystem respiration.
GPP	$\mu\text{mol}/\text{m}^2/\text{s}$	Gross primary production, including total ecosystem respiration (Re) and net ecosystem exchange (NEE).
APAR	$\mu\text{mol}/\text{m}^2/\text{s}$	Absorbed photosynthetically active radiation.

Relationship with L2 Core Variable Standard Files

One of the most important data products produced from the submitted data is the L2 core variable standard files available from the CDIAC ftp site http://cdiac.ornl.gov/ftp/ameriflux/data/Level2/standardized_files/. The L2 core variable standard data file format is documented in the L2_Readme.doc on that ftp site.

The standard files use a different, “Common Ancillary” header. The standard files also use a simpler column heading naming convention. These are documented below.

Content and Format of Common Ancillary Header

<u>Line</u>	<u>Row Text</u>	<u>Contents</u>
1	Site name:	Site name. The site name should be consistent with the one on <TBD web page>.
2	Location: Latitude: <nn> Longitude: <nn> Elevation	Location including latitude, longitude and elevation. Latitude and longitude are

	(masl): <nn>	expressed in decimal degrees, N & E hemispheres have positive values, S & W hemispheres have negative values. Elevation is in meters above sea level.
3	Principal investigator:	Principal investigator name.
4	Ecosystem type:	Ecosystem type according to IGBP classifications.
5	File creation date:	File creation date. All dates are of the form DDMMYYYY.
6-10		Data fair use policy.
11-13		File creation documentation
14		CDIAC e-mail contact for questions
15		Variable name column headings
16		Variable units
17		Percentage of data available. For gap-filled data, this will always be 100.

Content and Format of L2 Core Variable Standard File Data Records

The differences between the L2 core variable standard file variable column headings and the preferred data submission column headings are that the L2 core variable headings:

- do not encode the offset. Those offsets include TS1_DEPTH, TS2_DEPTH, and CO2_HEIGHT.
- include TS1_DEPTH and TS2_DEPTH. These columns give the offset in cm of the associated TS1 and TS2 measurements.
- Include CO2_TOP and CO2_HEIGHT. If more than one concentration is reported by the site investigator the measurement closest to the surface is presented above as CO2 and the measurement at the CO2_HEIGHT offset from a location above the canopy is reported as CO2_top. In general, CO2_HEIGHT is the highest sampling point.

Missing values or values set to missing by CDIAC during their QA/QC checks are denoted by -9999.

To submit data simply contact Tom Boden or Bai Yang using the information furnished below. Data may be submitted in a variety of ways including sending electronic mail with file attachments, mailing data to CDIAC on transfer media (e.g., CD-ROM, DLT), or transmitting data to the CDIAC server directly using the File Transfer Protocol (FTP).

Tom Boden
Carbon Dioxide Information Analysis Center (CDIAC)
Environmental Sciences Division
Building 4500N
Oak Ridge National Laboratory
Oak Ridge, Tennessee 37831-6290
U.S.A.

e-mail: bodenta@ornl.gov
Telephone: 865-241-4842
Fax: 865-574-2232