Data Processing Levels

This document defines data processing levels used by the AmeriFlux and European Fluxes networks. These levels are defined across two dimensions: **spatio-temporal representativeness** (using **numeric** levels), and **processing and quality information** (using **alphabetic** levels). Table 1 shows a summary of the levels, with details are listed below.

Table 1. Data Processing Levels for the AmeriFlux and European Fluxes networks.

Levels	A	B	C
0	High frequency and micromet data at original spatial and temporal resolutions, with quality flags available but not applied	Quality filtered Level 0A data	*Reserved for future use*
1	All data at original spatial resolution (sensor-level) but aggregated to uniform temporal resolution, with quality flags available but not applied	Quality filtered sensor-level data using quality flags from Level 1A data and gapfilled using only *fully empirical approaches*	Quality filtered sensor-level data using quality flags from Level 1A data and gapfilled using *process based approaches*; also adds sensor-level data products derived from models
2	All data aggregated to uniform spatial (footprint-level data) and temporal resolutions, derived from Level 0B or Level 1 data, with quality flags available but not applied	Quality filtered footprint-level data using quality flags from Level 2A data and gap-filled using *only fully empirical approaches*	Quality filtered footprint-level data using quality flags from Level 2A data and gap-filled using *process based approaches*; also adds footprint-level data products derived from models

The **spatio-temporal representativeness** is defined with eddy covariance fluxes and micrometeorological measurements in mind. Fluxes are representative of an area (footprint) around the measurements point with a radius of the order of tens to hundreds of meters at a certain time interval. The levels define if a specific data variable can be considered representative of the footprint or not, with corresponding time scales. The portions of the data processing levels defined by spatio-temporal representativeness are:

0. Data representative of individual sensor surroundings without any temporal aggregation; data should not be considered as representative of the footprint or ecosystem.
1. Data still representative of individual sensor surroundings (similar to Level 0), but can be aggregated at different temporal resolutions.
2. Data representative of tower footprint measured by one or more sensors. Data at this level can be aggregated at different temporal resolutions (similar to Level 1).
3. Spatially gridded data (*not discussed in this document*).

The **processing and quality information** helps identify if the data have been filtered for quality, and if gapfilling or other processing have been applied. In addition, it also identifies if a product is based on models that include any process-level knowledge. The portions of the data processing levels defined by processing and quality information are:

A. Actual measurements, plus quality flags when available (but data not filtered)
B. Quality flags applied (data filtered) and gapfilled with empirical methods (without process level knowledge)
C. Data that includes results from models based on process-level knowledge (including gapfilling)

The combination of these two dimensions defines the data processing levels, fully described below (summarized in Table 1).

- **Level 0A.** High frequency and micrometeorological data at original spatial and temporal resolutions – quality flags available but not applied.
- **Level 0B.** Quality filtered data derived from Level 0A data.
- **Level 0C.** [RESERVED FOR FUTURE USE]

- **Level 1A.** All data at original spatial resolution (sensor-level) but aggregated to uniform temporal resolution. Data derived from Level 0B with quality flags available but not applied.
- **Level 1B.** Quality filtered sensor-level data using quality flags from Level 1A. Data can also be gap-filled, but using only *fully empirical approaches*.
- **Level 1C.** Quality filtered sensor-level data using quality flags from Level 1A data. Data can be gapfilled using *process based approaches*. Additional sensor-level data products derived from models are also available.

- **Level 2A.** All data aggregated to uniform spatial (footprint-level data) and temporal resolutions, derived from Level 0B or Level 1 data, with quality flags available but not applied.
- **Level 2B.** Quality filtered footprint-level data using quality flags from Level 2A data and gap-filled using *only fully empirical approaches*.
- **Level 2C.** Quality filtered footprint-level data using quality flags from Level 2A data and gap-filled using *process based approaches*; also adds footprint-level data products derived from models.