QA/QC and uncertainty budget of NEON's eddy-covariance flux data

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Background

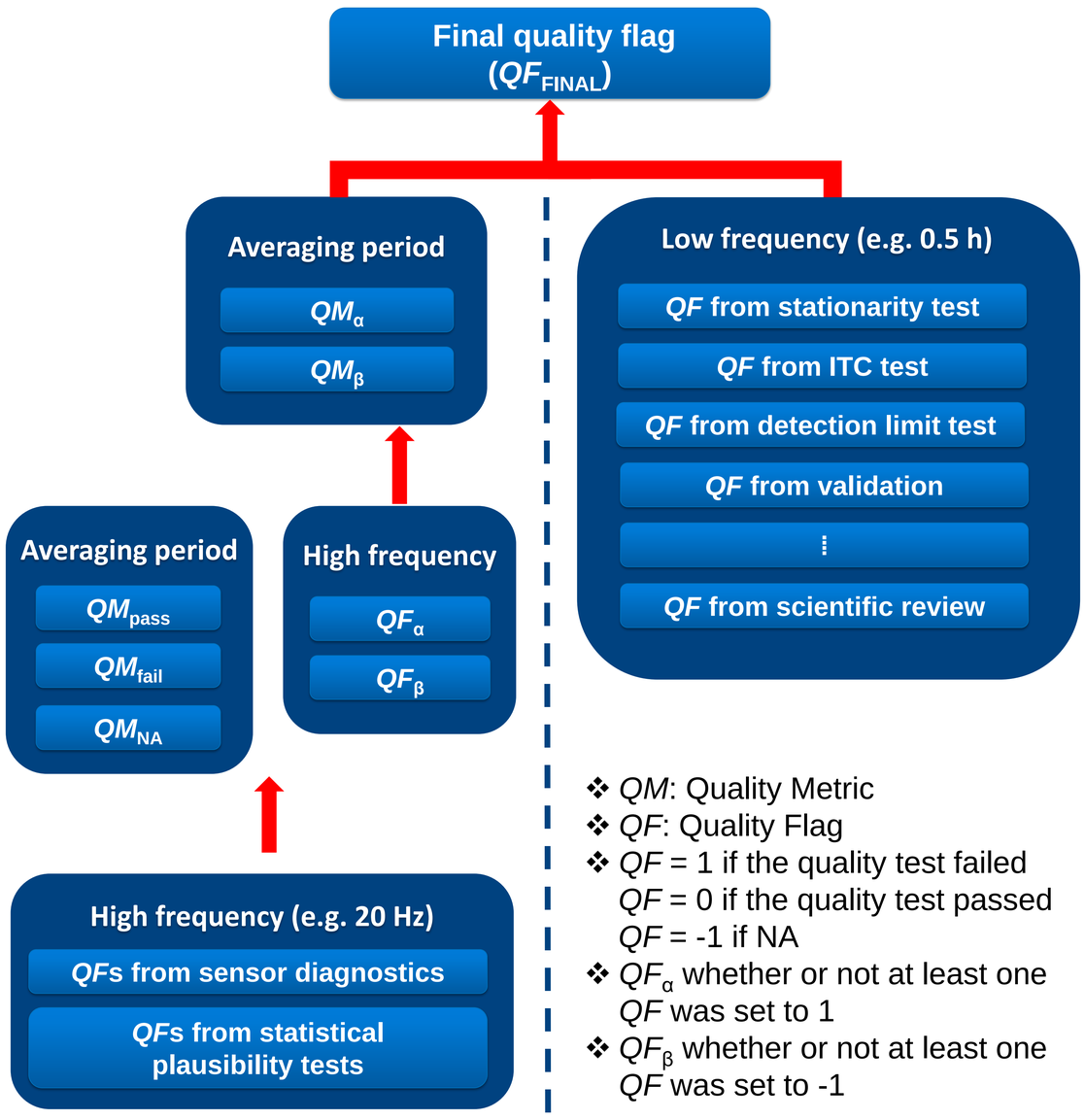
Eddy-covariance (EC) fluxes are filled with theoretical assumptions and require many additional quality assurance and quality control (QA/QC) tests in conjunction with quantification of uncertainty. Therefore, NEON's EC flux data products are subjected to a thorough data quality and uncertainty assessment that lead to both, quality flags and quantitative uncertainty estimates.

Here, we present NEON's flux QA/QC and uncertainty quantification framework. In this framework, a wide range of qualitative and quantitative algorithmic processing routines are applied to flux data products including:

a. tests related to sensor diagnostics;
b. statistical plausibility tests, e.g. range, persistence, step;
c. EC-specific tests based on the degree of fulfillment of one or several methodological assumptions, e.g. detection limit, homogeneity and stationarity, development of turbulence tests;
d. uncertainty calculations, e.g. sensor calibration and assembly performance, IRGA field validation, turbulent sampling errors, location bias, energy imbalance.

QA/QC framework

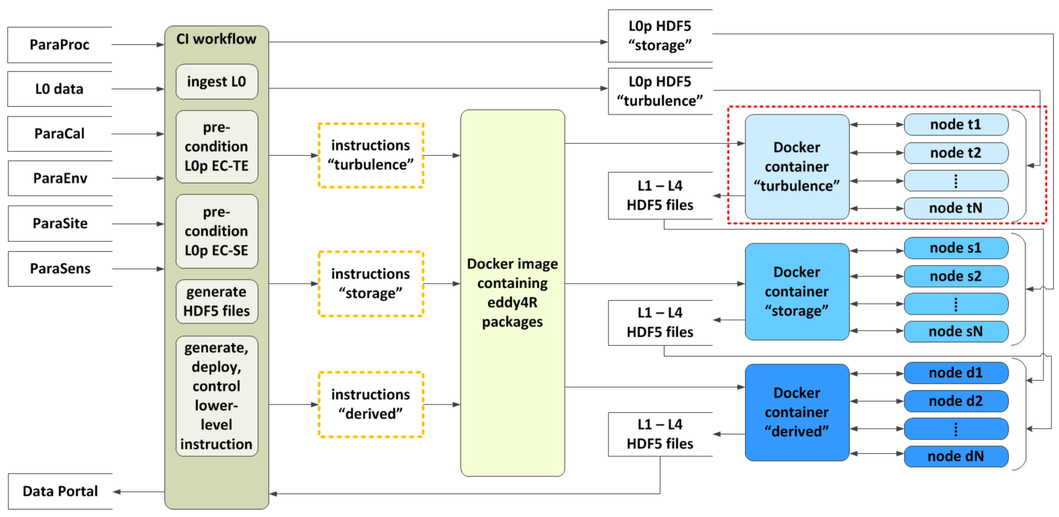
A final quality flag is produced individually for each flux data product, which represents a determination of the validity for further data analysis. The sensor health and statistical plausibility tests are first used to calculate QM_{α}, and QM_{β} over the averaging period. Then, the results of EC-specific tests are taken into account to determine whether the data product is flagged as valid (QF_{FINAL} = 0) or invalid (QF_{FINAL} = 1). If the scientific review flag is set high during science operation management (SOM) review then QF_{FINAL} will be set high.



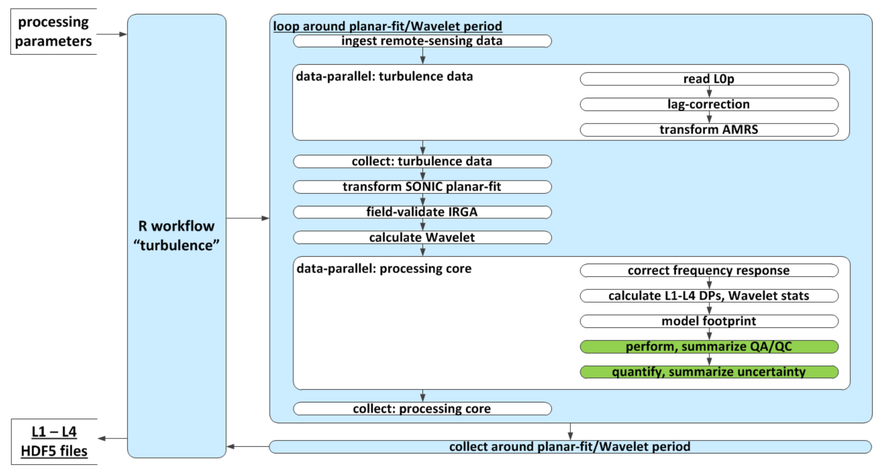
❖ *QM*: Quality Metric
❖ *QF*: Quality Flag
❖ *QF* = 1 if the quality test failed
QF = 0 if the quality test passed
QF = -1 if NA
❖ QF_{α} whether or not at least one *QF* was set to 1
❖ QF_{β} whether or not at least one *QF* was set to -1

Eddy-covariance flux data flow

Flow of information among processing environment



Turbulence R workflow

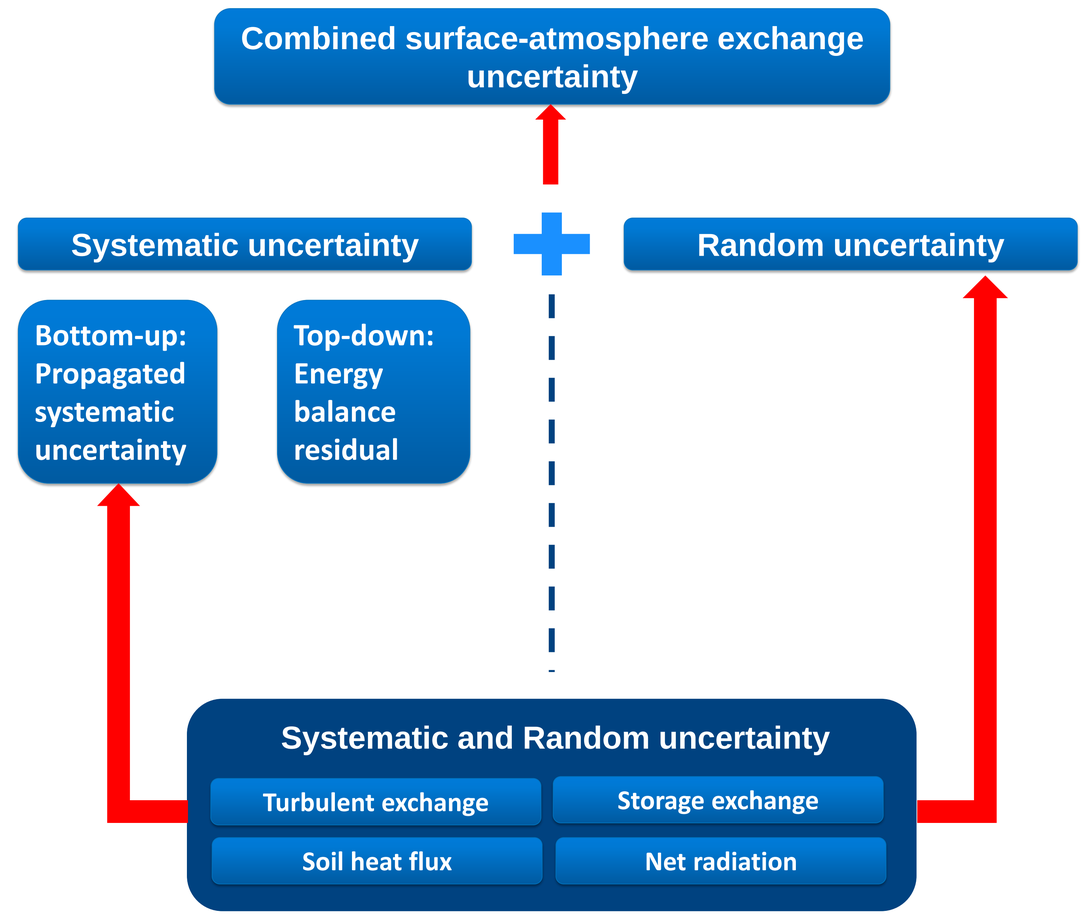


QA/QC and uncertainty budget functions will be available in the R package, eddy4R.

Uncertainty quantification framework

The combined uncertainty is determine using a two-pronged approach:

a. bottom-up approach
b. top-down approach



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