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On the need for uncertainty assessment of long-term eddy-covariance measurements

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Eddy-covariance measurements are routinely performed worldwide on a long-term basis, in order to observe ecosystem exchange of trace gases, water and energy. The data obtained are needed to validate or constrain process-based models and for evaluating ecosystem budgets. There is a strong demand for consistent and comprehensive quality flagging and uncertainty quantification to assure comparability of datasets from different sites. We review established quality assessment procedures and suggest a newly composed strategy comprising tests on high-frequency raw data, tests on statistics, fluxes and corrections. Additionally, we quantify different types of errors. This strategy will be applied within the recently launched TERENO network of ecosystem observatories. Five test datasets from TERENO and CarboEurope-IP were subjected to the specific quality assessment scheme. These datasets include two different sonic types, open- and closed-path instruments, tall and low vegetation, flat and complex terrain. We show the robustness and applicability of the scheme to data acquired with the different measurement set-ups. Coherences between established flagging schemes and newly added error determination are demonstrated. This uncertainty assessment for each flux estimate represents an indispensable value for modeling as well as for budgeting fluxes.