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Representing systematic and random errors of eddy covariance measurements in suitable likelihood models for robust model selection

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The importance of evapotranspiration (ET) fluxes for the terrestrial water cycle is demonstrated by an overwhelming body of literature. Unfortunately, errors in their measurement contribute significantly to (model) uncertainties in quantifying and understanding ecohydrological systems. Measurements of surface-atmosphere fluxes of water at the ecosystem scale, the eddy covariance method can be considered a powerful technique and considered an important tool to validate ET models. Spatially averaged fluxes of several hundred square meters may be obtained. While the eddy-covariance technique has become a routine method to estimate the turbulent energy fluxes at the soil-atmosphere boundary, it remains not error free. Some of the inherent errors are quantifiable and may be partitioned into systematic and stochastic errors. For model-data comparison, the nature of the measurement error needs to be known to derive knowledge about model adequacy. To this end, we compare several assumptions found in the literature to describe the statistical properties of the error with newly derived descriptions, in this study. We are able to show, how sensitive the assumptions about the error are on the model selection process. We demonstrate this by comparing daily agro-ecosystem ET fluxes simulated with the detailed agro-hydrological model Expert-N to data gathered using the eddy-covariance technique.