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# Model accuracy impact through rescaled observations in hydrological data assimilation studies

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Relative magnitudes of signal and noise in soil moisture datasets (e.g. satellite-, model-, station-based) feature significant variability. Optimality of the analysis when assimilating observations into the model depends on the degree that the differences between the signal variances of model and observations are minimized. Rescaling techniques that aim to reduce such differences in general only focus on matching certain statistics of the model and the observations while the impact of their relative accuracy over the optimality of the analysis remains unexplored. In this study the impacts of the relative accuracies of seasonality and anomaly components of modeled and observation-based soil moisture time series on optimality of assimilation analysis is investigated. Experiments using well-controlled synthetic and real datasets are performed. Experiments are performed by rescaling observations to model with varying aggressiveness: i) rescaling the entire observation time-series as one-piece or each month separately; ii) rescaling observation seasonality and anomaly components separately; iii) inserting model seasonality directly into observations while anomaly components are only rescaled. A simple Antecedent Precipitation Index (API) model is selected in both synthetic and real dataset experiments. Observations are assimilated into the API model using Kalman filter. Real dataset experiments use the Land Parameter Retrieval Model (LPRM) product based on the Advanced Microwave Scanning Radiometer on the Aqua platform (AMSR-E) observations over four USDA-ARS watersheds, while ground-based observations collected over these watersheds are used for validation. Results show that it is favorable to rescale observations more aggressively to a model when the model is more accurate (higher signal to noise ratio than the observations), while rescaling the observations strongly to the model degrades the analysis if the observations are more skillful.