



Evaluation Of Assumptions In Soil Moisture Triple Collocation Analysis

M. Tugrul Yilmaz (1) and Wade Crow (2)

(1) Middle East Technical University, Ankara, Turkey (tuyilmaz@metu.edu.tr), (2) Hydrology and Remote Sensing Laboratory, United States Department of Agriculture, Beltsville, Maryland, USA (wade.crow@ars.usda.gov)

Triple collocation analysis (TCA) enables estimation of error variances for three or more products that retrieve or estimate the same geophysical variable using mutually-independent methods. Several statistical assumptions regarding the statistical nature of errors (e.g., mutual independence and orthogonality with respect to the truth) are required for TCA estimates to be unbiased. Even though soil moisture studies commonly acknowledge that these assumptions are required for an un-biased TCA, no study has specifically investigated the degree to which errors in existing soil moisture datasets conform to these assumptions. Here we evaluate these assumptions both analytically and numerically over four extensively-instrumented watershed sites using soil moisture products derived from active microwave remote sensing, passive microwave remote sensing, and a land surface model. Results demonstrate that non-orthogonal and error-cross-covariance terms represent a significant fraction of the total variance of these products. However, the overall impact of error cross-correlation on TCA is found to be significantly larger than the impact of non-orthogonal errors. Due to the impact of cross-correlated errors, TCA error estimates generally underestimate the true random error of soil moisture products.