



## **Investigation of the impact of the nonlinear relations among soil moisture products over data fusion process**

Mahdi Hesami Afshar, Burak Bulut, and M. Tugrul Yilmaz

Civil Engineering Department, Middle East Technical University, Ankara, Turkey (mehdi.hafshar@gmail.com)

Soil moisture is one of the terrestrial essential climate variables that has critical role in the water, energy, and carbon cycles. There are different ways available for the retrieval of this essential variable (e.g., remote sensing, hydrological models, insitu measurements, and etc.). However, the time series of these retrievals often contain systematic differences, which need to be removed via different rescaling approaches before these data sets could be used in data fusion type studies.

In this study, the added utility of nonlinear rescaling methods relative to linear methods in the framework of data fusion has been explored. Nonlinear rescaling methods implemented in this study include: multivariate adaptive regression splines (MARS), Support vector machines (SVM), and artificial neural network (ANN), while the linear methods include linear regression, variance-matching, and triple collocation. Land Parameter Retrieval Model (LPRM) and NOAH soil moisture datasets are rescaled into the space of in-situ measurements obtained over four United States Department of Agriculture (USDA) Agricultural Research Service (ARS) watersheds and later merged using a simple linear weighting method.

Validation of the fused products using linear and nonlinear methods show that on average, fusing of nonlinearly rescaled LPRM and NOAH soil moisture products yields 3 percent correlation (i.e. against the in situ data) improvement against nonlinearly rescaled NOAH soil moisture product, while this improvement is more than 5 percent when the fused product is compared against the linearly rescaled NOAH product.