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Modelling the uncertainty in the surface soil moisture retrieved from ASAR data using Copula

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In recent times the surface soil moisture (SSM) is being used to improve the performance of the Land Surface Models (LSMs) through data assimilation. Assimilation approaches require information of the uncertainty of the SSM apart from the mean estimate. Very few attempts have been made to model the uncertainty in the retrieved SSM from the satellite data. Moreover, the commonly used approaches of estimating uncertainty assume a definite relationship between SSM and backscatter coefficient. Since the backscatter coefficient is sensitive to parameters such as soil roughness, bio mass, soil type etc apart from SSM. Hence the assumption of unique relationship may not be realistic. Copula provides a way to overcome the problem of assuming an unique relationship because it does not require any assumption about the structural dependence between SSM and backscatter coefficient. In addition copula provides a way for flexible representation of the multivariate distribution.

In the present study, Copula is used to retrieve SSM and its uncertainty using the ASAR (ENVISAT) data at AMBHAS site (www.ambhas.com). Twelve images of ENVISAT having a time span of two years and multi-incidence angle have been used in this study. The backscattering coefficient from different incidence angles is normalized to one incidence angle, which is used in the present work. The field measurements of SSM are taken in 21 plots having contrasting land use and land cover settings. Five types of copulas are compared in this study, namely, t-copula, Clayton, Frank, Gumbel, and Gaussian. The comparison is done based on the goodness of fit tested using the two dimensional Kolmogorov-Smirnov test.