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Estimation of soil parameters using microwave remote sensing observations

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Land surface models, which describe the energy and mass exchanges between land and atmosphere, are one of the key components in an Earth system model (ESM). Due to its character of high heterogeneity, land surface is also the most difficult part to be modeled in an ESM.
Due to its capability to provide spatial observations in various resolutions in regional, continental and global scales, remote sensing data is severing as a very valuable source of information for the modeling of land-atmosphere interactions.During the last of couple decades, remote sensing data were used mainly to define the initial status of land surface models, to classify the land cover and land use type, and to correct the estimation of state variables in a data assimilation system. One relatively unexplored issue consists of the estimation of land surface parameters, such as, for example, soil texture, soil porosity, through remote sensing. This is due to the lack of a relationship which connecting remote sensing data with land surface parameters.
The objective of this paper is to develop a systemic method to retrieve a number of land surface parameters through a combination of microwave remote sensing, radiative transfer modeling, land surface modeling and multi-objective optimizing. The microwave brightness temperature observations are used as the calibration references. The land surface model and radiative transfer model are used to determine the relationship between land surface parameters and the brightness temperature. The method is validated through a field experiment, in which a ground-based microwave radiometer is used to provide brightness temperature observations in a controllable footprint. Grand truth of soil parameters is also measured through intensive in situ samplings. The comparison of optimized parameters with the in situ observed ones indicates that our method has high potential to calibrate land surface parameters.