Geophysical Research Abstracts
Vol. 14, EGU2012-2595, 2012
EGU General Assembly 2012

Surface soil moisture over Sahel derived from ENVISAT RA-2 radar altimetry backscattering coefficients

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In this study, we analyse the potential of the radar altimeter onboard ENVISAT for estimating surface soil moisture in the semi-arid Gourma region in Northern Mali. To this end, the relationships between observed backscattering coefficients derived from 4 retracking algorithms, namely Ocean, Ice-1, Ice-2 and Sea-Ice, and ground data, including soil type, topography, vegetation and soil moisture are investigated. The considered period is 2002-2010. Results show a strong linear relationship between the backscattering coefficients and surface soil moisture measured at six different stations along the satellite track. The best results are obtained with the Ice-1 and Ice-2 algorithms. In these cases, correlation coefficients are higher than 0.8 with RMSE smaller than 2%. Vegetation effects are found to be small due both to the nadir-looking configuration of the radar altimeter and to the small vegetation cover. Finally, the relationship between soil moisture and normalized backscattering coefficient is used to retrieve soil moisture from the altimeter data that is compared to soil moisture estimations obtained from the METeorological Operational (METOP) Advanced SCATterometer (ASCAT). These results highlight the high capabilities of Ku-band altimeters to provide an accurate estimation of surface soil moisture in semiarid regions.