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Soil moisture estimation in cereal fields using multipolarized SAR data

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The retrieval of soil moisture from remote sensing data is an extremely active research topic with applications on a wide range of disciplines. Microwave observations represent the most viable approach due to the influence of soils' dielectric constant (and thus soil moisture) on both the emission and backscatter of waves in this region of the spectrum. Passive observations provide higher temporal resolutions, whereas active (SAR) observations have a higher spatial detail. Even if operational moisture products, based on passive data, exist, retrieval algorithms using active observations still face several problems. Surface roughness and vegetation cover are probably the disturbing factors most affecting the accuracy of soil moisture retrievals. In this communication the influence of vegetation cover is investigated and a retrieval technique based on multipolarized C band SAR observations is proposed.
With this aim a dedicated field campaign was carried out in La Tejería watershed (north of Spain) from January to August 2010. Eight RADARSAT-2 Fine-Quadpol scenes were acquired in order to investigate the role of vegetation cover on the retrieval of soil moisture, as well as the sensitivity of different polarimetric parameters to vegetation cover condition. Coinciding with image acquisitions soil moisture, plant density and crop height measurements were acquired in eight control fields (cultivated with barley and wheat crops). The sensitivity of backscatter coefficients (in HH, HV and VV polarizations) and backscatter ratios (p=HH/VV and q=HV/VV) to soil moisture and crop condition were evaluated and the semi-empirical Water Cloud Model was fitted to the observations.
The results obtained showed that the contribution of the cereal vegetation cover was minimal in HH and HV polarizations, whereas the VV channel appeared to be significantly attenuated by the cereal cover, so its value decreased as the crops grew. As a result, the ratios p and q showed a very good correlation with vegetation condition and resulted to be almost insensitive to soil moisture variations. These ratios were next used to parameterize cereal vegetation cover on a retrieval scheme based on the Water Cloud Model. Results were best on VV polarization where the correlation coefficients obtained were above 0.7. The approach proposed is very promising from an operational point of view since it corrects the influence of vegetation cover in the retrieval without requiring external information to describe it. Besides, the low variability of the empirical coefficients obtained for different fields, suggests that differences in surface roughness at this stage do not significantly affect soil moisture retrievals.