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Soil salinity estimation using RADARSAT 2 polarimetric data in arid and sub-arid regions: Morocco and Tunisia cases.

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Soil salinity is a serious environmental hazard that affects nearly 7% of the earth's surface. In Morocco and Tunisia, soil salinity affects 5% and 8% of their total area respectively. Affected areas are exposed to an overuse of renewable water resources and a chronic decline of groundwater levels. Therefore, problems of soil salinization are severe. Salinization causes negative effects on the ground; it affects agricultural production, infrastructure, water resources and biodiversity. Experimental methods for monitoring soil salinity by direct measurements in situ are very demanding of time and resources, and also very limited in terms of spatial coverage.
Several studies have described the usefulness of remote sensing for mapping salinity. In fact, radar remote sensing can be an interesting tool for mapping and monitoring soil salinization by its synoptic coverage and the sensitivity of the radar signal to soil parameters at the first five centimeters of surface. The radar remote sensing could be more interesting than optical data as the soil salinity depends on the moisture variability.
This study develops the potential of RADARSAT-2 polarimetric SAR data for soil salinity estimation in Tadla plain (central Morocco) and Mahdia region (Central Tunisia). These two test sites are different in their soil compositions as well as in their surface occupations. This was done in the object to compare the behavior of the radar backscattering with respect to the soil salinity variation in different environment. RADARSAT-2 data were acquired in full polarization at a rate of three acquisitions in FQ9 angular mode over Tadla plain and three acquisitions in FQ7 angular mode over Mahdia region. Based on field measurement data of electrical conductivity collected in three field campaigns over three dates simultaneously with acquisition periods of SAR satellite images, and polarimetric parameters, a two model calibration techniques are used to develop a soil salinity estimation model. Firstly, the model is calibrated locally in a window of size 7x7 pixels; the second calibration technique is made using territory segmentation based on elaborated map salinity. This approach provides a more accurate estimation than the first model calibration approach; this is due to the uncertainty caused by radar image noise which decreases if we based on large estimation units. The sensitivity of a polarimetric parameter to the soil salinity was evaluated for 20 coherent and incoherent polarimetric parameters.