Geophysical Research Abstracts
Vol. 21, EGU2019-5577, 2019
EGU General Assembly 2019

Soil moisture retrieval over wheat fields using the backscattering coefficient and the interferometric coherence derived from Sentinel-1

Nadia Ouaadi (1,2), Lionel Jarlan (2), Jamal Ezzahar (3), Mehrez Zribi (2), Saïd Khabba (1), Elhoussaine Bouras (4,2), and Pierre-Louis Frison (5)

(1) Cadi Ayyad University , Faculty of Sciences Semlalia, Department of Physics, LMME, Marrakech, Morocco , (2) University of Toulouse,CESBIO, IRD/CNRS/UPS/CNES, Toulouse, France, (3) Cadi Ayyad University, ENSA, MTI, Safi, Morocco, (4) Cadi Ayyad University , Faculty of Sciences and technologies, Department of applied Physics, LP2M2E, Marrakech, Morocco , (5) University of Paris-Est, IGN, LaSTIG//MATIS, Champs sur Marne, Paris, France.

surface soil moisture is a key parameter for irrigation management, water stress and crop monitoring. The importance of this parameter is exceptionally important in the semi-arid regions where the water resources are often very limited. On the other hand, the utilization of radar data present unique advantages as it provide data independent of illumination and weather conditions. Within this context, the purpose of this work is the estimation of surface soil moisture, over wheat fields, using an approach based on the use of C-band Sentinel-1 radar data only. Field measurement are collected during 2016-2017 and 2017-2018 growing seasons over two fields of winter wheat with drip irrigation located in the Haouz plain in the center of Morocco. In a first part, the satellite time series are physically interpreted with the support of the experimental data, field knowledge and sentinel-2 acquisitions. Two polarizations (VV and VH) and three angles of incidence (34.5°, 35.2° and 45.6°) are investigated in this study. Furthermore, two different information extracted from Sentinel-1 products are used: the backscattering coefficient and the interferometric coherence. According to the results of time series analysis, the interferometric coherence is sensitive to the development of wheat, while the backscatter coefficient is widely linked to changes in surface soil moisture. In order to better understand the backscattering mechanism of wheat canopies, the second part of this work is dedicated to the modeling of the different contributions from the wheat field to the total backscatter using the Water Cloud Model coupled with the Oh et al, 1992. model for soil backscattering. The comparison between the modeled backscattering coefficients and those extracted from Sentinel-1, yielded a root mean square error (RMSE) values ranging between 1.36 dB and 1.75 dB for VV and between 1.63 dB and 2.09 dB for VH. The third part of this study concerns the surface soil moisture retrieval. Strong exponential relationship have been established between the interferometric coherence and the dry biomass for the whole growing season (correlation coefficient R=0.84 and RMSE=0.1 kg/m^2). The dry biomass estimated using this relationship is then used beside of the backscattering coefficient, in an inversion procedure employing the calibrated WCM to retrieve the surface soil moisture. The proposed inversion approach compared favorably to other classical empirical and semi-physical inversion methods. Indeed, it is able to retrieve the surface soil moisture for VV, with a correlation coefficient R, RMSE and bias of 0.72, 0.06 m3/m3 and 0.01 m3/m3, respectively. For the VH polarization, the obtained R, RMSE and bias are about 0.41, 0.09 m3/m3 and 0.05 m3/m3. To summarize, it can be concluded that the proposed approach, which is applicable from the sowing until the harvest using the Sentinel-1 data only, yielded very promising results in retrieving surface soil moisture over the winter wheat crop in semi-arid regions.