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► To cite this version:

Emile Ndikumana, Dinh Ho Tong Minh, Nicolas Baghdadi, Dominique Courault, Laure Hossard.
Rice height and biomass estimations using multitemporal SAR Sentinel-1: Camargue case study.
SPIE Remote Sensing, Society of Photographic Instrumentation Engineers (SPIE). Cardiff, GBR.,
Sep 2018, Berlin, Germany. 1 p., 10.1117/12.2325174 . hal-02785362

HAL Id: hal-02785362

<https://hal.inrae.fr/hal-02785362>

Submitted on 4 Jun 2020

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Rice height and biomass estimations using multitemporal SAR Sentinel-1: Camargue case study

Paper 10783-31

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The development and improvement methods to follow agricultural growth is a timely challenge, especially for radar images. This is due to the speckle noise nature of radar, leading to a less intensive use of radar rather than optical images. Recently, the European Space Agency Sentinel-1 constellation is a satellite system providing the global coverage of Synthetic Aperture Radar (SAR) with a 6-days revisit period at a high spatial resolution about 20 m. These data are valuable aids in providing the spatial information of agricultural crops. The aim of this paper is to analyze the potentialities of using Sentinel-1 radar images for rice biomass and height retrieval. The study is carried out on a multi-temporal Sentinel-1 dataset acquired from May 2017 to September 2017 over the Camargue region in the South-Eastern France. Ground measurements were made in the same period to collect biomass and crop heights over 11 rice fields. The images were processed in order to produce an intensity radar data stack in C band including a dual polarization VV and VH, resulting finally in 50 images for the studied period. Correlation analysis were made according to a multivariable regression which exploited not only the dual polarization information but also the day of sowing of rice practices for the stable inversion. We found that the SAR Sentinel-1 is strongly correlated to the rice height and biomass in the order of magnitude $R^2 > 0.9$ and the root mean square error was less than 15% for height and 16% for biomass. Such results confirm that the high qualified radar Sentinel-1 could be well exploited for rice biomass and height retrieval and could be used for operational tasks.