Use of ALOS-PALSAR data for the monitoring of Sahelian semi-arid areas

Semi-arid areas are eco-climatic zones of transition that are of primary concern in the current context of global warming. In addition they are subject to high anthropic pressure. Since the launch of ERS-1 in 1991, and with the follow-on ensured by other radar sensors (ERS-2, ASAR, METOP-ASAT), an archive of 18 years of radar acquisitions is now available. It presents a significant added value for middle term trends analysis of climatic conditions. Past studies have shown that C-band data are particularly well suited for the Sahelian belt monitoring. In addition to SAR data, the scatterometers on board ERS as well as METOP satellites appear particularly well suited for semi-arid areas monitoring. Although designed for the estimation of wind speed and direction over the oceans, the high temporal frequency of their acquisitions make them especially well suited for seasonal variations monitoring of surface parameters (namely soil moisture and biomass) at regional scale. The alternation of the dry and rainy seasons is particularly well depicted in the radar signal, with a yearly amplitude closely linked to the annual rainfall and to the associated green biomass development. The different modes of acquisition of ASAR or RADARSAT sensors, allowing spatial resolution from 20 m to 1 km, allow a better understanding of the response observed at the 25 km spatial resolution associated to scatterometer data. The combination of a vegetation model with a radiative transfer model has allowed to analyze the different contribution of the radar signal. The vegetation model allow to simulate the temporal evolution of soil moisture and the development of the annual grasslands, with the help of meteorological data. Consequently, it is possible to have a description of the scene at a daily step. Combined to a radiative transfer model, modeling the interaction of an electromagnetic wave with the scatterers of the observed scene, the temporal evolution of the radar signal observed from satellites can be simulated. Results show that at C-band, both vegetation and soil contributions are the same within the radar signal.

The 4 study sites are located through a 400 km North-South transect, in the Gourma region, Mali, where extensive in situ measurements offer a unique validation data set.

The ALOS-PALSAR data allows to analyze the contribution of L band for monitoring these Sahelian areas. 23 PALSAR data have been acquired between January 2007 and April 2009. It appears that the radar response is constant during the dry season, from one year to another. On the other hand, variations can be observed between the different acquisitions realized during the rainy season. The contribution of vegetation and soil moisture are analyzed at different polarization. Preliminary results show that soil contribution plays a major role in the L band response. Furthermore, the potential of polarimetric L-band data for bonds detection is assessed. Bonds monitoring is of prime interest for a better understanding of land surface processes in such a semi-arid environment.

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