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Monitoring flooded areas in floodplains of Paraná basin using microwave REMOTE SENSING

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Remote sensing techniques represent a valid tool to monitor the dynamics and extension of flooding effects. The advantages they offer are related to their capability to generate maps over extended areas, which are difficult to be obtained by in situ measurements, especially in the case of large basins. In particular, microwave remote sensing proved to be a valid tool for flooding monitoring. The cloud penetration of microwaves is particularly important to observe floods, which are often associated to cloud cover. Moreover, microwaves have a strong sensitivity to the soil wetness. Active microwave instruments have the advantage of a good spatial resolution, which is necessary for inhomogeneous areas. However passive instruments have a short revisit time and present a better sensitivity to flooding. In spite of their coarse resolution, passive microwave techniques proved to be effective in the monitoring of large basins.

This paper shows results of microwave observations of a strong flooding event, which occurred in 2007 in the Parana river. In particular, in the period from February to April, 2007 significant increases in the water level were observed. Basically, we considered the signatures collected by the passive AMSR-E radiometer, operating at six frequency bands: 6.925 GHz (C), 10.65 GHz (X), 18.7 GHz (Ku), 23.8 GHz, 36.5 GHz (Ka), and 89.0 GHz. The IFOV (related to spatial resolution) is equal to 43 x 75 km at 6.925 GHz, is reduced to 29 x 51 km at 10.65 GHz, and to 8 X 14 km at Ka band. In the analysis, we have used the Polarization Index PI, which is defined as the normalized difference between brightness temperatures measured at vertical and horizontal polarizations.

First of all, we have compared maps of the flooded basin obtained at different frequencies. Higher frequencies (Ka band) delineate well the flooding in the areas close to the river, but lower frequencies (C band) are able to detect the presence of water even in agricultural areas located at high distances. Then, we have correlated variations of PI with in situ measurements of water level at four different locations along the river. A significant correlation is observed in all locations, and the best results are obtained in the Delta of the river. In the same Delta, the effects of flooding on the PI measured at different frequencies are analyzed for various kinds of land cover, and the masking effects of dense vegetation have been estimated.

Finally, we have tested the performance in the Delta of an algorithm, proposed in the literature, aimed at estimating the fraction of flooded area using Ka band signatures. The algorithm works well in areas covered by marsh, which is submerged during the flooding. Refinements aimed at extending the algorithm to a wider variability of land covers, using also the synergy with radar signatures collected by Envisat ASAR, are presented and discussed.