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Flood investigation in Parana river using active and passive microwave signatures

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Over the past decade, several flood monitoring and forecast methodologies, based on remote sensing data, have been proposed. Among them, the ones based on microwave observations are the most successful, since large flood events and intense cloud covers are often encountered simultaneously to cloud covers, which prevent observations at optical wavelengths. Furthermore, since flood events are strong dynamic processes, higher temporal resolutions are required, even if this leads to lower spatial resolutions. This limits the monitoring capability using only spaceborne SAR observations.

The objective of this paper is to estimate both the fraction of inundated area and the mean water level within the vegetated floodplain of the Parana River Delta in Argentina, during a flood event which started in November 2009 and lasted until April 2010. To this aim, data collected by both ENVISAT ASAR data and AMSR-E radiometric signatures were used. The Parana River Delta (PRD) region stretches through the final 300 Km of the Parana basin. It covers approximately 17.500 Km2, close to Buenos Aires city in Argentina. The part of the Delta where the fraction of flooded area and the mean water level as a function of time were evaluated is dominated by two marsh species: Junco and Cortadera. Within this region, we considered a rectangular box of about 200 X 150 km.

The adopted methodology is outlined below. First of all, the fraction of flooded area was estimated using ENVISAT ASAR. For each SAR pixel, we considered the variations of backscattering coefficient with respect to the image of June 10 2009, taken as a reference, and we established a threshold to decide whether the pixel was flooded or not. Moreover, the average polarization difference was computed within the selected box using AMSR-E signatures at X, Ku and Ka Band; For all frequencies, the polarization difference of non-flooded areas and water bodies were estimated on the basis of literature data and the AMSR-E signatures collected over targets close to the study area. Then, the polarization difference in the flooded delta was estimated by inverting the formulas proposed by Sippel et al. (Int. J. Remote Sens., 19, 3055–3074, 1998). Finally, by inverting a look up table based on model simulations, the values of polarization difference in the flooded delta were converted into corresponding water levels. It was found that the estimated trends of water level are similar for the three selected frequency channels. Moreover, these trends are consistent with local measurements of water level in a single location of the river.