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Hydrology and Earth System Sciences Discussions

HESSD

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Interactive Comment

Interactive comment on "Estimating flooded area and mean water level using active and passive microwaves: the example of Paraná River Delta floodplain" *by* M. Salvia et al.

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GENERAL COMMENTS This manuscript presents a methodology to estimate the flood extent and mean water level in the Parana River flood plain by using synergistically active and passive microwave remote sensing data, plus emission simulation models. The paper clearly falls within the scope of HESS, since it addresses the spatial and temporal monitoring of the water amount present in a wetland area. The manuscript is well structured and written in a clear, precise and fluent English. A suitable number of figures illustrate the analysis steps undertaken throughout the text. The paper combines the use of passive (AMSR-E) and active (Envisat ASAR) microwave data time series together with radiative transfer modeling, which is quite unusual and innovative. The presented method exploits an existing radiometric polarization difference model and a simulation model of vegetation emissivity. It also makes use of ancillary data regarding the spatial distribution and morphological features of the vegetation. All the previously developed work is properly referenced. The methodology is applied to estimate the mean water level evolution in the study site using three AMSR-E frequencies. The results for the three frequencies show good agreement.

SPECIFIC COMMENTS

Page 2896, lines 10 to 18: In the first paragraph of the Introduction section, the author states that the microwave-based flood monitoring methodologies are often used and successful. It would be appropriate, in the opinion of this reviewer, to include one or more references supporting this assertion. The reviewer misses some discussion on the accuracy achievable by the method in the water level retrievals, or further comparisons with ground truth data: were there more gauging stations during the time period analyzed? Maybe a topographic map would allow to roughly assess the relation among fraction of flooded area and changes in mean water level. The thresholding of ASAR data for the flooded fraction estimate seems a potential source of significant error: soil moisture, for example, could increase the backscattering coefficient more than 1.5 dB. Furthermore, an increase in soil moisture could affect large areas and therefore introduce considerable error in the flooded fraction estimates.

- In the first paragraph of the Introduction, our statement was based on papers by Choudury et al., 1989, Sippel et al., 1994, Sippel et al., 1998, Hamilton et al. 2002, already cited. We will state this explicitely, as recommended by the reviewer. We can cite also C. Prigent, W.B. Rossow, and E. Matthews, “Global maps of microwave land surface emissivities: Potential for land surface characterization,” Radio Science, 33: 745-751, 1998.

- Three new water level stations among the watershed were added for further comparison (Figures 1 and 2; both figures are available at the end of this document). The water levels were grouped in order to compare gauges in locations with similar emergency levels. As it can be seen, the water level trend is similar to the one of Rosario in all the other stations. Moreover, maximum levels are reached for the similar dates in all the stations. This implies that this flooding event is not a local one, but is a large event that compromises all the upper Delta. This is also confirmed by the maps of flooded fraction derived using SAR, that show large flooded areas in the upper Delta.

- Several flooded fraction maps were developed and the sensitivity of thresholding is now discussed. The trends of flood fraction are shown in Figure 3, while the corresponding trends of water level are shown in Figure 4 (both figures are available at the end of this document). As expected, the selection of a different threshold leads to different flooded fractions, and different estimated water levels. We believe this is consistent, since setting a higher threshold is simply a change of the rule to define a pixel as flooded, and these results correspond well to this (Figure 4).

- About soil status, it will be stressed in the paper that since this is a wetland area, soil is normally covered with marsh vegetation (there are no bare soils) and normally wet. Nevertheless, we have specifically studied the effects of an asymmetry in the threshold rules, which is related to an eventual bias in the estimation of flooded fraction due to soil moisture changes. Soil moisture can only produce an increase in sigma-0. Therefore, a thresholding technique that defines as “no change” the range (- 1.0 dB / 2.0 dB) should reduce this bias. However, the trend for this threshold is close to the one with -1.5 dB / 1.5 dB, originally used in the paper (see Figure 3). This agrees with the assumption that the observed changes in sigma-0 are not related to changes in soil moisture. In fact, flooding can produce both an increase and a decrease of sigma-0, while soil moisture can produce only an increase. - About conventional techniques used, it is important to remark that this is a very flat area, characterized by small slopes. Therefore, available DEMs are not reliable.

TECHNICAL CORRECTIONS Page 2900, line 3: "Del Plata" estuary should be "De La Plata" estuary (I think...). Page 2902, line 24: "Envisat ASAR precision image products in Wide Swath image mode" should be "Envisat ASAR medium resolution image products in Wide Swath image mode". Page 2909, line 11: "Table 2" should be "Table 3".

- These corrections will be included in the text.

Please also note the supplement to this comment:
http://www.hydrol-earth-syst-sci-discuss.net/8/C2158/2011/hessd-8-C2158-2011-supplement.pdf

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 2895, 2011.