

## ***Interactive comment on “Towards the response of water balance to sugarcane expansion in the Rio Grande Basin, Brazil” by F. F. Pereira et al.***

### **Anonymous Referee #1**

Received and published: 26 June 2013

The paper deals with a relevant and updated issue, i.e., land-use changes (sugarcane expansion in Brazil) and its possible hydrological effects in a large basin. The authors used a considerable data set and a hydrological model that seems suitable for the objectives of this research. The text has been, in general, clearly written, except for the item 4.3, where the presentation of results, which would suitably fit a table, is excessively long. It would be desirable to have less result description and more result discussion. The methodology is compatible with the objectives and the references are related to the theme and updated. Due to the merits of the paper, we understand that it can potentially be accepted for publication, but not in its present form.

The main problem of the paper regards the interpretation of the computational results, and, before solving this question, we understand that it should not be published. Spe-

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cial concern is the conclusion that “simulations showed that the annual accumulated values of evapotranspiration increase up to 180% while surface runoff is reduced to 20%” (i.e., an 80% decrease in the runoff) “of the values calculated using a land scenario from 1993” (p.5564 LL.20-23, see also p.5584 L.12 and conclusions, p.5585). Still according to the simulations, a 70% runoff reduction is expected if 4.7% of the Funil area is planted with sugarcane (p.5578 L.10), whereas for the Camargos sub-basin, 100% runoff reduction is expected if only 2% of the area would be used to grow sugarcane (p.5578 L.25). These results seem implausible, but could be true. However, the authors do have at their disposal measured data from 1970 to 2010 (p.5570 L.9) and sugarcane expansion within the period has been substantial: for instance, in the A Vermelha sub-basin alone, the sugarcane area increased from 9.4% in 1993 to 30.1% in 2007 (Table 3). We would like to suggest the authors to investigate the stationarity (or not) of the hydrological series within the measurement period (1970 – 2010) to check if these changes have been observed as a natural response to sugarcane expansion. Visually, from Figures 4 and 5, no decrease trend could be identified, but there is a reference to runoff changes from 1993 to 2007 up to 1.5% (p.5576, L.26), far below the figures presented in the conclusions. Besides, the differences of runoff and evapotranspiration plotted in Figures 7 – 10 show a clear instability (see, e.g., Figure 7b, where differences range from -100% to +65% within six months, see also p.5578 L.25), which could be a computational feature that should be interpreted (maybe cumulative differences between scenarios would provide a more useful result). If, indeed, the measured hydrological behavior differs from that of the computational simulations, the authors should present and interpret this inconsistency. Another related problem is the different expected change in runoff for different time steps (daily, monthly or annual).

Two conceptual questions should also be considered. First, the authors refer to “short-, medium- and long-term impacts” (p.5564 L.2), but we have not clearly identified these temporal horizons in the paper. Maybe the authors refer to time steps, please clarify. Secondly, there are references to “land use scenarios” of 1993, 2000 and 2007 (p.5574 L.18, for instance), but we comprehend that these are not scenarios in the word’s

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original meaning, rather historical land use of the basin.

Some minor notes are presented below. p.5564 L.16 “but also on the type” instead of “but also the type” p.5567 LL.6-8. Characterize the size and the representativeness of the series, which generated the discharge values p.5569 L.2 “plenty of data, which” instead of “plenty of data which”. Check for use of commas throughout the text (see also, e.g., p.5574 L.24; p.5583 L.16) p.5571 L.7 and L.20 What do the authors mean by “mean groundwater flow” and “upward flux of water”? Please clarify p.5571 L.18 “as being the most important during calibration” instead of “as being important during calibration” p.5572 L.20-26 Why did the authors not use the data from 1970 to 1989? p.5572 L.27 “Basin was first divided” instead of “Basin was firstly divided” p.5573 L.2 “it has been used” instead of “it is been used” p.5573 L.10 Please clearly state where the gauging stations are located (if upstream or downstream from the reservoirs) and to which extent the operation of these reservoirs might affect the measured discharges p.5573 L.25 “Although baseflow recessions were. . .” instead of “Despite baseflow recessions were. . .” p.5574 L.3 “In order to validate” instead of “In order to test and validate” p.5576 L.6 “11.4% and 30.8%, respectively” instead of “11.4% and 30.8%” p.5576 L.25 What exactly does “reduction on daily runoff” mean (see also p.5577 L.3)? A reduction in the average of daily discharges? Please clarify p.5576 L.26 The authors affirm that “This reduction is directly proportional to the expansion area”. Is it really directly proportional or just monotonically increasing? The same applies to p.5583 L.22, where the authors state that “soil moisture content was inversely proportional to evapotranspiration in all sub-basins”. Do you not mean ‘monotonically decreasing’, instead? Please check both cases. p.5576 L.28 “. . . was the most affected” instead of “. . . were the most affected” p.5577 L.2 “within their area. Consequently,” instead of “within their area consequently,” p.5580 L.7 “113 hectares”: please check unit p.5582 LL.21-24 What does ‘attenuation’ in the text from “Between CR1993. . .” to “upstream sub-basins” mean? Please clarify p.5583 L.21 “A general pattern that emerges” instead of “A general pattern which emerges” p.5585 L.21 Did you mean “up to 80%” instead of “up to 8%” (although with disagree with these conclusions)? p.5586 L.2 The

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authors refer to runoff reduction of 12%, which is confusing Table 1 caption, first line: “parameters used (or assumed) in this study” instead of “parameters adopted in this study” (see also L.4) Figure 11 is not visible

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 5563, 2013.

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