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Interactive comment on **"Modeling the effects of
cold front passages on the heat fluxes and
thermal structure of a tropical hydroelectric
reservoir"** *by* M. P. Curtarelli et al.

Anonymous Referee #4

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This paper uses a three dimensional hydrodynamic model to describe the changes
in the thermal structure of a Brasilian reservoir and in the heat fluxes during a time
when five cold fronts were observed to pass. The article is, in general, clear and well
written but it has a serious deficiency: it is not clear at all what the new contributions
are. What does one learn, after reading the manuscript, about the physical behavior
of lakes that has not been published before? The authors, trying to justify the novelty
of the work, state that 'Although the effects of cold fronts have been reported for North
American water bodies, few studies have addressed this issue in South American lakes
and reservoirs'. In a recently posted revision, the authors even give several references

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for earlier work conducted in North- and South American lakes/reservoirs. But, to my understanding what needs to be clearly stated is an answer to this question: what is different in this lake (or in general in South-American or tropical lakes) compared to other lakes in the world? And, how this manuscript helps understanding those different behaviors between this and other lakes? Later in the text (still in the introduction) the authors indicate that 'The intensities of cold front passages over South America are generally much smaller than those over North America (Marengo et al., 1997)'. If the frequency of cold front passages (I interpret intensity in terms of frequency of atmospheric perturbations) is different in this region when compared to other lakes of the world, why is this frequency important for lake physics? Does it have to do with the particular thermal structure exhibited by the lake? Is the thermal structure always that weak, along the year? Is this a characteristic of tropical lakes, compare to temperate lakes? What is the influence of river inflows or outflows in lake stratification, if any? If the main difference between tropical and temperate- lakes were lake stratification (being generally weaker in the first) the authors should analyze the link between the frequency of cold fronts and the rate at which the thermal stability evolves. Furthermore, they should compare the passage of cold fronts to other factors contributing to the evolution of lake stratification, such as river inflows, for example. They have all the necessary tools, and also probably the results, but they need to be interpreted in depth, in a more quantitative manner. The major contribution is not from a methodological point of view, for using remote-sensing data or for accounting for the stability of the atmospheric boundary layer. I really find that the potential contribution of a paper on the description of tropical lakes and their response to cold fronts is very considerable, but the results need to be re-thought and re-interpreted in more clearly and in a quantitative manner (the authors are using sophisticated computational techniques), so that it can be published in HESS, as a fundamental contribution to our understanding of the effects of cold-fronts on tropical lake dynamics. As presented this is a modeling exercise in which they use remote-sensing techniques to retrieve cloud cover and river temperature data, rather than land-based equipment. But, unfortunately (very unfortu-

nately) very little information is derived from the model results. I really encourage the authors to make a thorough reanalysis of their results, along the lines mentioned above (see also below). Other suggestions and comments are provided below

1) p.8468, Line 8: What is the meaning of resilience? How do you quantify it?

2) p.8468, Line 16: Colder than what?

3) p.8469, Line 9: In the sentence " Although the effects of cold fronts ...". Which effects are you referring to? Do you mean in heat fluxes?

4) p.8469, Line 9: "reported in North American waters studies...". Which are these reports? Could you cite references?

5) p.8469, Line 9: "few studies...". Which studies? Could you site references?

6) p.8471, "Site description": Which is the residence time of water in the reservoir?

7) p.8473, Line 10: Did river inflows keep constant in time? How was the evolution in time of the river inflows?

8) p.8473, Line 12: How did the company measure total inflow? If it is based on water outflows and reservoir volume, precipitation is double counted (within the inflow rates and as an input to de model).

9) p.8473, "Satellite data": Did you calibrate satellite data with water samples taken in the river surface or at least with the nearest-to-surface thermistors in S1 and/or S2? Can you explain more in detail how you retrieve WST at the rivers?

10) p.8477, Line 21: What you mean with "carefully chosen"? Do you mean a grid-independence study? Please explain.

11) p.8477, Line 22: is 0.03 the value of the water albedo for shortwave or longwave radiation?

12) p.8477, Line 22: Since you are using values measured in another reservoir, did you

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test how sensitive is the model to the value of horizontal diffusivity for this reservoir?

13) p.8478, Line 14: What criteria did you use to separate the areas under the influence of the S1 and S2 meteorological datasets, respectively?

14) p.8478, Line 26: Again, how did you initialize temperature profiles? Linear interpolation from S1 to S2?

15) p.8480, Line 5: "reasonably" is an ambiguous statement.

16) p.8480, Line 10: "lower than 3%". 3% of what? Mean temperature? Maximum temperature?

17) p.8480, Line 16: Again, 1% of what?

18) p.8480, Line 17: I think "very well" is not a proper statement.

19) P.8482,"Heat budget": What is the effect of taking precipitation into account?

20) p.8483, Line 17: I cannot see upwelling events from Fig. 6i.

21) p.8483, Line 26 to p.8485, Line 2. I think these lines should be part of the "Data and methods" section.

22) p.8484, Line 4: what is the reference density 0?

23) p. 8485: Where is the discussion section? In which way have you improved knowledge with respect to studies carried out in the same study site (as for example Alcântara et al., 2010a)? How these findings compare to other South American lakes? How is the heat budget changed in comparison to other South American lakes?

24) p. 8486, "Conclusions": conclusion is largely a summary of the results of the work. It could benefit from a discussion placing the results of this work in the larger context of how it improves our understanding of the thermal response, mixing and changes in heat fluxes in South American lakes due to the effects of cold from passages.

25) p.8494, Table 2: Is the drop in air temperature ΔTa, the subtraction of daily-

averaged values?

26) p.8497, Fig. 2: it is hard to read letters from Fig. 2.

27) P.8498, Fig. 3: Could you extend the F1-F5 marks as lines so we can follow your ideas more clearly? It seems to be a trend in the air temperature towards lower values at the end of the period (Fig. 3c), maybe the effect of the cold front passages could be better observed if you subtract this trend. From Fig. 3g and 3h, we can see there are WST variations of $\sim$10 $^{\circ}$C in each of the rivers. . .Is this daily variability a common feature?

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 8467, 2013.