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Hydrology and Earth System Sciences
Discussions

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.

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Dear referee,

thanks for reviewing our manuscript. I found the comments helpful, and believe the revised manuscript will represent a significant improvement over the initial submission. The following are the comments and responses to your questions:

Major Comments:

1. The main study aim needs to be reformulated. The investigation of effects of cold front passages on the heat fluxes and thermal structure was already conducted on the

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previously paper from Alcântara et al. (2010). The main contribution of this manuscript was to evaluate the effect of cold front passages on spatial heterogeneity of thermal regimes using a 3D hydrodynamic model. The aim must be properly stated.

We agree with this suggestion. Indeed the main contribution of this manuscript was to evaluate the effect of cold front passages on spatial heterogeneity of thermal regimes using a 3D hydrodynamic model. We will reformulate the text following the suggestions given.

2. The assumption to consider Corumbá River inflow equal to the Corumbá Reservoir outflow likely underestimate the Corumbá River inflow because the influence of adjacent watershed was negligible (35 km of river reach can be important in terms of volume). This contribution can be estimated using regionalization, for instance. Also, evaporation in tropical large water surfaces is another term to consider. Please, try to take into account these effects or at least provide a discussion about this limitation on the results.

We agree with this comment. We will use flow data collected in some tributaries of Corumbá River to try better estimate the inflow value. We will also provide a short discussion about the limitations cited (inflow and evaporation) on the results section.

3. In general data from Satellite is not accurate when comparing to observed data. Please provide the accuracy of those estimations or provide a discussion about this limitation on the results. Has precipitation from satellite been used to evaluate the effects of cold front passages?

The M*D11A1 products (used to retrieve the river inflow's temperature) have been validated at stage 2 through a series of field campaigns conducted between 2000-2007, and over more locations and time periods through radiance-based validation studies (Wan et al., 2002; Wan et al., 2008; Coll et al., 2009). Accuracy is better than 1K (0.5K in most cases), as expected pre-launch.

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The TRMM products have been validated through the ground validation (GV) program, based at NASA Goddard Space Flight Center in Greenbelt, Maryland. The GV program is responsible for processing several TRMM science products for validating space-based rain estimates from the TRMM satellite. The 3B42 product reproduces satisfactorily the surface observation–based histogram of precipitation, as well as reasonably detecting large daily events. However, this product has lower skill in correctly specifying moderate and light event amounts on short time intervals, in common with other fine scale estimators (Huffman et al., 2007). In this work the precipitation data provided by TRMM 3B42 product was used as input in the hydrodynamic simulation. However the precipitation effects were not analyzed in this work. The ELCOM model considers the precipitation data only to compute the reservoir water balance (Hodges and Dallimore, 2010).

We will insert information about the remote sensing data accuracy on “Data and Methods” section and a brief discussion about its limitations on “Results and Discussion” section.

4. The methodology to evaluate cold front effects on stratification and mixing processes (e.g. Brunt–Väisälä frequency, Lake Number, Schmidt stability) should be described on "Methodology section".

We agree with this suggestion. The methodology to evaluate cold front effects on stratification and mixing processes will be described on "Methodology section".

5. The discussion needs a major redevelopment with a good literature backup. Additionally other questions must be considered such as increase of Bowen ratio during cold fronts, and the maximum loss of sensible heat flux during F4 were expected? Also, upwelling events were observed during F4 passage?

The “Results and Discussion” section will be redeveloped with a better literature backup. The increases of Bowen ratio during the cold fronts passages were expected. This occurs due to the fact that the sensible heat flux is more sensitive to the cold

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fronts passages than the latent heat flux. The sensible heat flux increase, on average, around 24% while the latent heat flux increase around 19%. Moreover, we assign the maximum sensible heat loss during the F4 passage (122 W m−2) due to the highest wind speed observed in this event (8.8 m s-1).

The upwelling events were observed both during and after the F4 passage. When F4 passage reaches the Itumbiara reservoir (on 30th May) the wind field changes its direction, from Southeastern to Southwestern, and increases its intensity, reaching 8.8 m s-1. After the F4 passage (2nd July) the wind changes its direction again, from Southwestern to Southeastern, reaching values around 7 m s-1. The two wind episodes (during and after F4) persist for more than 18 hours with wind speed higher than 3.5 m s-1. In both cases, the model results showed the occurrence of downwelling-upwelling cells traveling from the upwind to the downwind side of the reservoir.

We will try to explain in more detail these questions on “Results and Discussion” section.

Minor Comments:

1. In "Site description" section - are wind intensity averaged values?

Yes. The wind values presented to the wet season (1.6m s−1) and the dry season (3.3m s−1) are averaged values.

2. Change "The data are collected..." to "The data were collected"

We will change "The data are collected..." to "The data were collected".

3. Please inform the frequency of time series of total inflow, outflow and water level.

The total inflow, outflow and water level time series is provided with daily frequency. We will insert this information in the manuscript.

4. Change "... adapted from the work of Casulli and Cheng (1992)” to “adapted from Casulli and Cheng (1992)”

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We will change "... adapted from the work of Casulli and Cheng (1992)" to “adapted from Casulli and Cheng (1992)”

References

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