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Hydrology and Earth System Sciences Discussions

HESSD

8, C3287–C3292, 2011

Interactive Comment

Interactive comment on "Inside the hydro-physics processes at the plunge point location: an analysis by satellite and in situ data" *by* A. T. Assireu et al.

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Replies and justifications to the suggestions and criticisms of the reviewers.

Reviewer 2

We would like to thank Reviewer 2 for the important and constructive criticisms and suggestions made to our manuscript.

We offer the following replies to the reviewers questions/doubts, using 'A' for our replies to the Reviewers' questions 'Q'.

General Comments

Q- 1) The conclusions, as formulated, are not fully justified by the presented observational evidence and discussion. The authors affirm that the "Kelvin-Helmholtz instability was the main mixing mechanism" [in the wet season], but it is not clear why they are so sure. No quantitative assessment of this mechanism compared to other ones, such as wind mixing, internal waves, etc, is given in the paper (even though the data available to the authors apparently may allow such an analysis). The only argument of the author in support of their statement is a simple Richardson number based criterion (p. 1204, line 27). The latter only suggests that the KH instability is feasible, but does not mean, however, that it is the principal mixing mechanism. The other conclusion that "strong turbulence introduced by high winds and surface cooling were predominant" [during dry season] also needs a more elaborated justification.

A- We introduce some arguments reinforced the importance of Kelvin-Helmholtz instability (see below) and replace "the main" by "an important" in the Conclusion. "Manso Reservoir experiences large seasonal and short time runoff variations. As result, the inflow variations present an intermittent pattern with large inflows at the summer-autumn months (Fig. 6a). This fact suggests that the inflow exerts controls on residence time for Manso Reservoir, as verified by Rueda et al. (2006) at the Sau Reservoir. The estimated power spectra at thermocline displacement and buoyancy flux due inflow show similar variability for frequency between 0.3 and 0.6 cpd (Fig. 6b). If the peaks in the range of 0.3-0.6 cpd were indicative of interchange between thermocline oscillation and buoyancy flux, they would be coherent but out of phase, (because the signal of inflow must be propagate 23 km downstream- from upstream until thermistor chain). If moving with a propagation speed u $\sim$ 0.1 ms-1 (as estimated by model and confirmed by drifters) and a distance of 23 km, one obtains the propagation time $\sim$ 2.5 days (because the signal of inflow must be propagate 23 km downstream – from upstream until thermistor chain). Coherence spectra (Fig. 6c) indicate that motions in the range of 0.3-0.6 cpd are coherent and are 120° out of phase (Fig. 6d). This result suggests that the inflow is an important mechanism driving thermocline displacement. “If the following inequality holds true < 1, then vertical mixing is energetically possible. In order to evaluate the typical vertical velocity shear, current measured by drifters in river-reservoir transition zone was analyzed. The mean difference between current to 6m and 2m were approximately 6.0 cms-1(Fig.9b). This difference (U1-U2) applied in the above inequality indicates that the Kelvin-Helmholtz may play a strong role in the thermocline displacement during the wet season. Alongshore components of the drifter velocity (Fig. 9a) shown the anisotropy in the mean kinetic energy.”

-The another conclusion “strong turbulence introduced by high winds and surface cooling were predominant” was reformulated.

Q- 2) Not all of the data that the authors claim to have used in their analysis are adequatelyrepresented in the article. For instance, it would be very interesting to look at the velocity data from drifters released in the reservoir, but there is no figure or discussion onthis matter, and it is not even clear what these data were used for and how (perhaps, toobtain estimate for U2 in Section 3.2?). On the contrary, some of the figures look unnecessary,for example, the long-wave and short-wave radiation series (Fig. 2, bottom panel) or pH profiles.

A- Insertions/corrections were made in order to solve these questions:

“. In order to evaluate the typical vertical velocity shear, current measured by drifters in river-reservoir transition zone was analyzed. The mean difference between current to 6m and 2m were approximately 6.0 cms-1(Fig.9b). This difference (U1-U2) applied in the above inequality indicates that the Kelvin-Helmholtz may play a strong role in the thermocline displacement during the wet season. Alongshore components of the drifter velocity (Fig. 9a) shown the anisotropy in the mean kinetic energy.

– pH profile was excluded.

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Specific Comments

Q- The first word in the title should be omitted. A- Was made.

Q- Section 2.1 is entitled “Field site and measurements” – and yet no measurements are described in this particular section. A- This section was reformulated.

Q- The choice of numerical value for drag coefficient Cd in Eq. (5) and its applicability to these specific conditions should be explained. A- A phrase was inserted: “. . .and the drag coefficient (cd) was assumed equal to about 0.003 as in Arneborg et al., 2004. These authors shown that if the drag coefficient is changed by a factor of two, the speed and height change by 20-25%.

Q- Page 1200, line 17 – What is meant be “convergence zone”? Please explain. A- Convergence zone = margins constriction.

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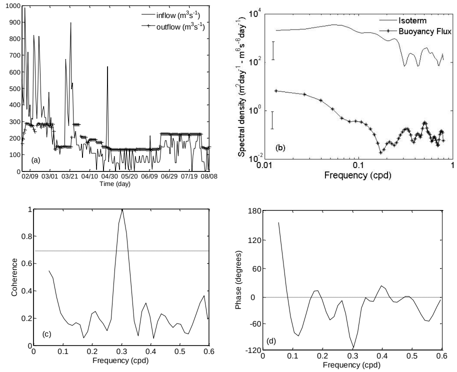

Figure 6: (a) Inflow and Outflow, (b) Power spectra of time evolution of thermocline displacements and buoyancy flux smoothed by three Hanning passes (the 95% confidence interval is indicated), (c) coherence (the 5% level for zero coherence is indicated) and (d) relative phase for thermocline and buoyancy flux.

Fig. 1.

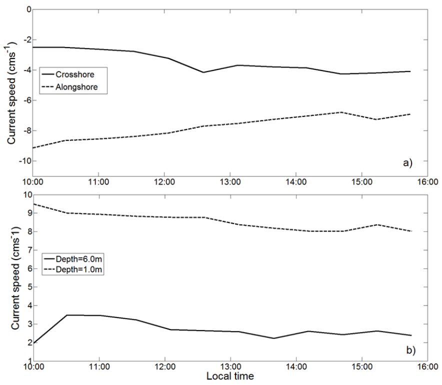

Figure 9: (a) Alongshore and cross-shore current velocity component, (b) speed to 1.0 and 6.0 m depth. "

Fig. 2.

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