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Biogeosciences Discussions

Interactive comment on "Ecological research and large scale land-atmosphere feedbacks: lesson from the Bouchet's complementary relationship" *by* E. Lugato et al.

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We agree with both reviewers that the current structure of the paper does not highlight properly hypothesis and the main take-home message. We decided to discuss here the main concerns raised by the reviewers and to address the minor concerns in a deeply revised manuscript.

Overarching hypothesis are the following:

1) a direct extrapolation of manipulation experiment results from plot scale to regions risks to be inadequate to properly describe the complexity of land-atmosphere feedback. This hypothesis is based on the simplified description of Bouchet's comple-

mentary relationship theory (CR). According to CR, in water-limited environments not affected by large-scale advection, any change induced externally on actual or potential evaporation or rainfall is constrained by a univocal solution involving the two remaining factors. When related to manipulation experiments, which are inevitably made on relatively small plots, the CR tells us that effects observed at plot scale are not able to produce the same land-atmosphere interactions which are generated at larger scale. The paper intends to validate the CR looking at the relationships between trends in rainfall and pan evaporation in a well-defined water limited region (Australia);

2) Models that simply assimilate field data from manipulation experiments without taking into account land-atmosphere feedback are inadequate to predict future climate scenarios;

Thus, the take-home message is that a new paradigm is required to bridge the gap between field experiments and modeling. The CR could be of guidance in creating such a bridge.

Referee 1

1) as said above we will clarify hypothesis and take-home message in the revised manuscript. Moreover, we will check for language inconsistencies and ambiguities.

2) This point is, in fact, not well clarified in the material and method section. In the revision, the manuscript will better explain that: i) a limited number of weather station (BoM) data have been compared with short term eddy covariance (Fluxnet) data for CR validation; ii) all weather station for Australia have been used to analyze eventual long term trends.

3) This point is somehow connected to the previous one. In the revision, we will also clarify that the data from weather stations, located closest to the three eddy covariance stations, have been used to generate the kind of data in figure 2 (as an example for one site). In that figure, monthly long term data (1976 -2009) of ETp and P were plotted to

estimate ETa by CR. Then, the resulting ETa data has been compared with measured latent heat fluxes (Fluxnet sites) for all the overlapping years between the two datasets (figure 3).

4) See our introductory comments. We are going to improve our statistics also including confidence intervals in our validation of CR (figure 3).

As far as the Bouchet's calculation is concerned, we better summarize here assumptions and procedures. These will be detailed in the revised manuscript. To overcome arbitrary assumptions on the choice of ETw, we calculated this parameter with a no linear fitting of ETp vs P at monthly interval. When the fitting is not statistically significant, we proceeded in two ways: i) when energy limited conditions occurred (months in which ETp is constant throughout all precipitation range), we impose ETa = ETp for all precipitation range; ii) we discarded months in which minimum ETp is higher than the corresponding precipitation value as asymptote calculation is problematic.

For pg 6084 comments, we acknowledge that also this part of the manuscript requires clarifications. The data of figure 5 are clearly showing that there is not a significant trend in Epan and P across 26 years. Instead, if a sub-period is arbitrarily selected (i.e. 1999-2009), significant and well- correlated trends between Epan and P can be observed. This observation is clearly consistent with CR (increase in P = decrease in Epan and viceversa) but cannot be used, as done elsewhere (Jung et al, 2010), to infer abrupt changes in the global water cycle. Not by chance previous conclusion made at this regard where mainly driven by data from Australia (Jung et al 2010).

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