

## ***Interactive comment on “Biotic pump of atmospheric moisture as driver of the hydrological cycle on land” by A. M. Makarieva and V. G. Gorshkov***

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I've been following with greatest attention and interest to the unfolding discussion on the Biotic Pump paper. If I had a few doubts about the proposed mechanism upon reading the original paper, after the extensive and deep explanations provided by the authors to respond to comments by Dr. Sherman, Dr. Dovgaluk and Dr. Barbosa and specially the authors last explanations on the evaporative force, I am now left with no more doubts. Still, it appears that other people (Dr. Hurk) keep reiterating doubts from a first reading of the original paper, of which the authors have already addressed

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extensively, giving an impression that these latecomers missed most of this debate. For that reason, it appears to me that time has come where it would be in the interest of science that comments and authors explanations given in this rich debate be absorbed into the biotic pump paper, and that the paper be considered for a publication in HESS, so that the community can move on.

But the comments by Dr. Hurk deserve consideration. On the Amazon transect, it would be good that Dr. Hurk present some climatological data besides of referencing to a student textbook. The North-South swinging of the ITCZ is the main driver for the change in interaction over the Amazon between the relatively dry cold fronts from the South and the moist equatorial masses from the Atlantic (trades). To my knowledge and from the data I have access to (NCEP reanalysis and the network of flux towers we run in the Amazon, see LBA project) there have never been wind blowing from the Amazon into the Atlantic, inverting the trades. Amazonian trees also never cease to transpire to great amounts, even during the peak of the dry season when some intrusions of cold dry air come from the SE. Dr. Hurk should read my earlier comments in this debate where I elaborate on the innate capacity of the Amazon to overcome external climate forcing. If there is a transect where the biotic pump is in best agreement, that is in the Amazon, there is no discrepancy there whatsoever.

On the second argument, I again direct Dr. Hurk to my earlier comments about numerical gimmicks and imitating capacity in GCMs, comments recently and successfully shared with the global modeling community (Nobre, 2006). A parrot can imitate human voice surprisingly well, without knowing the meaning or logic in the speech. GCM with poor physics is to climate what a parrot is to speech: it can only handle what it already knows. But even so, not perfectly. For the equatorial belt GCMs are notoriously incompetent in representing convection, let alone rainfall. Because GCMs tend to rely extensively into parameterization (the euphemism for empirical fitting), they by nature have a hard time representing processes of non-linear chaotic systems. Abrupt changes emerging from forgotten or non-considered physics will pop up without warn-

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ing, precisely because such phenomena was absent from the climatic time-series used in the "parameterization" (take for example the first occurrence ever of a hurricane in the Southern Atlantic in 2004 - Catarina, absolutely not predicted by GCMs). Again, as said in my earlier comment, GCMs cannot properly represent precipitation over South America.

About the third comment of Dr. Hurk, I understood from the patient explanations by the authors that the evaporative force is all about gas pressure deficits, arising from dynamic and spatially separated differences in mixing ratios of a condensable constituent in the gas mixture. The classic concept of diffusion in a liquid mixture with no pressure gradients is physically inappropriate for a gas mixture experiencing a non-equilibrium pressure gradient. As far as I understand, a similar issue was put forward by Dr. Barbosa, who undertook quite a detailed physical analysis of the paper and who explicitly admitted clearing of his initial doubts after the authors explanations.

#### Reference

Nobre A D, 2006, Is the Amazon forest a sitting duck for climate change? Models need yet to capture the complex mutual conditioning between vegetation and rainfall, ESSP Open Science Conference, session Future Directions: Earth System Modeling, Beijing China, 9-12 Nov

NOTE: I directed this comment to Dr. Hurk because it appeared rather odd to me the posting of comments from an anonymous "panel". Was this panel composed of experts or of students? What I understood from HESSD is that this is a space for "attributed" debate, not for anonymous postings. It is a tradition in the peer review literature that reviewers be protected by anonymity. But this can only function properly because it is in the best interest of the publication that the reviewers be highly qualified, experts in the respective field. Without this guarantee, anonymity plays a disservice to the community.

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