Review of:
“**Land cover and its transformation in the backward trajectory footprint region of the Amazon Tall Tower Observatory**”,

by Pöhlker and *twenty-seven* additional authors.

Reviewed by: David Fitzjarrald, ASRC, University at Albany, SUNY

General comments to the Editor.

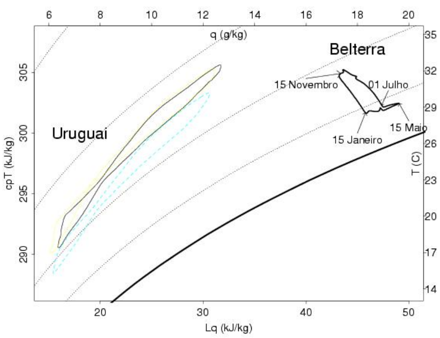
The ATTO team delivers manuscript that reads like notes from a committee white paper. Clearly a lot of work has been done by some of the authors, but I sure would have been happier had more effort gone in to dealing with the ostensible topic of the paper, the utility of the backward trajectories that lead to the ATTO.

To demonstrate the importance of their effort, the authors offer up a litany of examples of Amazon Basin land cover change and deforestation, but, sadly, too many of these are references to the situation in the SW portion of the Basin, *not* upwind of the ATTO. (One fine exception is the authors’ noting of the location and importance of the Renca Reserve, which is upwind of the ATTO, a site that may or may not be a new locus for mining, depending on politics in Brazil.)

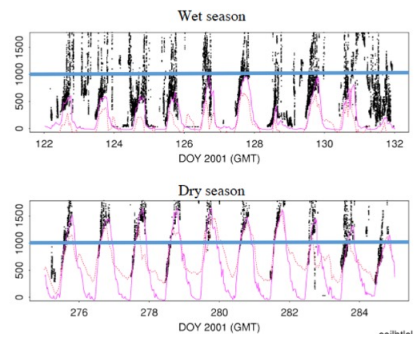
There appears to be a real disconnect between the authors’ cavalier attitude that the trajectory results can be accepted intact with little question and the amount of detail presented in identifying the surface land-cover and fire presence categories. The authors assure the reader that: “*Trajectory models have been constantly improved, while gridded meteorological data became more sophisticated….”* However, please note that there are *still* only a few radiosonde stations to furnish the reanalysis with extremely important input *upwind* of the ATTO (see map below, along with the preferred trajectories identified in this manuscript). What’s more, most of these stations are at the coast, and will not adequately represent the boundary layer inland. Granted, the wind is pretty steadily easterly, switching from NE to SE over the seasons, but the presence of large rivers means that local breeze circulations could significantly alter the trajectories in lower layers, precisely the ones that the authors want to emphasize.

Unless I missed it, there are only two mentions of the ‘boundary layer’ is in this manuscript (line 30 page 12, and line 38, page 32, where this point is repeated), in the context of discussing the global Hadley Cell and the climatology of the trade winds feeding in moisture. A few references listed below indicate that identifying the HYSPLIT trajectories in this part of the world is not news anymore. This is an off-the-shelf effort. The authors are offering the readers this paper so it can be referenced in later work, but they owe the reader some more depth of understanding of the strengths *and weaknesses* of this approach. The ‘residence time’ that matters ought to be the duration *and location* of the presence of the virtual parcel when the airmass is in ‘communication’—turbulent connection—with the surface, which I imagine to be during the presence of the midday convective boundary layer. When the authors mention HaPe Schmid’s footprint work as a starting point, they don’t carry over the idea that it is the turbulent mixing and subsequent diffusion that defines the ‘tower footprint’.

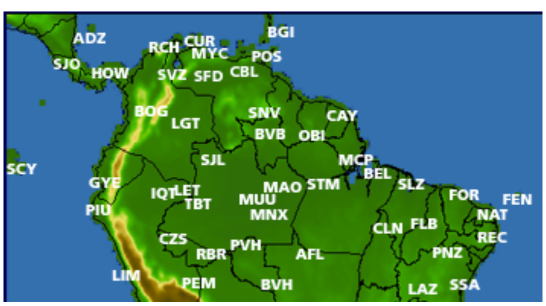
That 1000 m level (close to the ATTO highest level) is likely be in the CBL for some daylight hours during the eastern Amazon Basin dry season, but it will likely be in the cloud layer during the midday wet season CBL (see the illustrative plots below—data from the LBA km67 site near Santarém PA). That will turn out to precess over the course of the day for parcels tracked back from different arrival hours at the ATTO site, and would look like to a 'dashed line' of activity as the trajectory crosses into the continent. It shouldn't really the duration, total time the air is in motion. One should take into account the convective hours of connection upwind, and then the hours of convection at the ATTO to present to the bedazzled readers the 'hot spots' of potential upwind influence, no?



Surface seasonal changes of surface state on a *T* vs *q* phase plane.; LCL, km67. Gray lines show isolines of LCL. Mean conditions for Belterra (near Santarém) and an average of Uruguayan grassland sites



Cloud base and LCL, km67. Black points mark cloud base. Red and magenta lines are LCL at forest km67 and a nearby pasture km77 sites in LBA. Horizontal blue line at 1km altitude.



Radiosonde sites in northern South America.

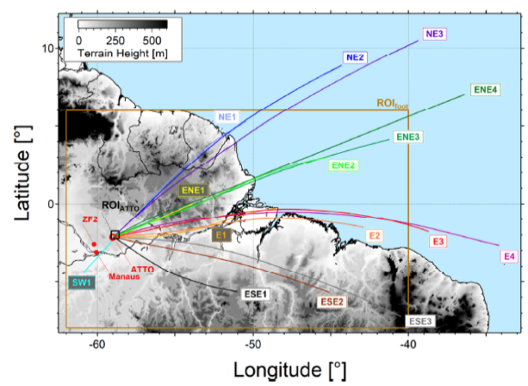


Figure 4. Map of northeast Amazon Basin with 15 clusters from systematic *k*-means back trajectory (BT)

D'Amelio, M. T. S., L. V. Gatti, J. B. Miller, and P. Tans. "Regional N 2 O fluxes in Amazonia derived from aircraft vertical profiles." *Atmospheric Chemistry and Physics* 9, no. 22 (2009): 8785-8797.

Lintner, B. R., & Neelin, J. D. (2010). Tropical South America–Atlantic sector convective margins and their relationship to low-level inflow. *Journal of Climate*, *23*(10), 2671-2685.

Nieto, R., Gallego, D., Trigo, R., Ribera, P., & Gimeno, L. (2008). Dynamic identification of moisture sources in the Orinoco basin in equatorial South America. *Hydrological sciences journal*, *53*(3), 602-617.