

Interactive comment on “Lightning activity in Brazilian thunderstorms during TROCCINOX: implications for NO_x production” by H. Huntrieser et al.

Anonymous Referee #1

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Comments on "Lightning activity in Brazilian thunderstorms: implications for NO_x production" by Huntrieser et al..

The present manuscript represents a new attempt at shedding light on the problem of determining the factors that affect lightning-NO_x productions in thunderstorms through the analysis of data collected during the TROCCINOX airborne field campaign in Brazil in 2005. The authors compare tropical and subtropical storms sampled by two airborne platforms, as well as sensed by an array of instruments on the ground, including an on-site lightning detection network. The authors attempt to characterize the production of NO_x by lightning by relating it to parameters such as peak stroke current, stroke length,

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release altitude and pressure. They find that tropical storms over Brazil may produce less lightning NO_x than subtropical tropical ones. The data analysis suggests that the number of flash strokes alone or the differences in the strokes' peak current frequency distributions are not enough to account for the observed differences. They suggest that only when other factors, such as the number of flashes with peak currents above a certain threshold and the stroke length are included in the analysis, can these differences be explained. The authors go on to elaborate that the stroke length, reportedly larger in subtropical storms due to the higher windshear that those storms are subject to, may be a critical factor. The longer strokes result in a larger production of NO_x per stroke. The authors compute, based on the estimated production of NO_x per detected lightning stroke (as measured by the in-situ lightning detection network) the per-storm and global lightning NO_x budgets. Interestingly, when computing the latter, the maximum relative error stemming from the individual relative errors of the variables involved results in a figure whose range spans well over an order of magnitude. This is a problem that confronts most lightning NO_x studies. Fortunately, the authors are keen to mention this fact in the discussion and conclusion sections.

Once the suggestions below are implemented, the manuscript is fit for publication in ACP.

Comments:

-Page 14821, line 22: In section 6 it is RINDAT's VLF components that are grouped into flashes, not LINET's. The paragraph implies that this is done for LINET's strokes. Please clarify this.

-Page 14821, lines 5-10: Could the authors please quantify the LINET's detection efficiency for both its central detection area as well as its periphery?

-On page 14837, when computing PLNO_x for the storms on 4 February, the authors only consider LINET strokes with peak currents >10kA. The author state later in the manuscript (page 14849) that these weaker strokes are responsible for producing

"only" 50% of the storms' LNOx. While the LNOx production in these storms is heavily weighted towards those strokes with high peak currents (10% of the strokes with peak currents >10kA are responsible for 50% of the storms' LNOx production), the authors are discarding a statistically significant portion of the stroke population and the non-negligible portion of the NOx that they strokes produce. This could have as a consequence a underestimation of both the tropical storms' LNOx production and the global NOx budget. A note of caution on this fact would be welcome.

On page 14485, the authors mention that those strokes from LINET data classified as uncertain are defined as CG strokes (without ruling out the possibility of them being IC strokes). Given that IC strokes, both positive and negative, amount, in the storm under study, to 57% or more of the total flashes, the above assumption may lead to significant biases in the results, all the more given that the differences in peak currents, including the polarity, between the different types of flashes are significant. Please include a sentence to mention this.

-Page 14821, line 22, Please substitute "..6a.." with "6 a"

-Page 14821, line 12 "allows for comparison.."

-Page 14821, line 23 should read: "..manually into flash.."

-Page 14821, line 22: "In Sect. 6a (sic) small set of strokes were combined manually to (sic) flash "components", which indicate that LINET locates few VLF strokes per flash component (on average 3 and up to 9).": The sentence is not clear; how does the fact that strokes were manually combined implies that LINET locates few strokes per flash?

-Page 14822, lines 5-7; What is LINET's detection efficiency in the centre area? State accuracy in same terms as RINDAT to compare the 2 networks.

-Page 14822, line 11 replace "on board" with "onboard" or "on-board"

-Page 14822, line 15 "...the duration of a measurement" is not right; What this means is that sensor can view any one area in its footprint for a period of 90 secs.

-Page 14822, line 23 "on 4 February"

-Page 14822, lines 26; RINDAT's detection efficiency appears to be quite good (80-90% for peak currents above 10ka and a location accuracy of 0.5-2km); if larger than LINET's, one could ask, why not use RINDAT as the main lightning detection network?

-Page 14823, lines 12-14; what is this assumption based on?

-Page 14824, line 9-11; I most definitely cannot discern an azimuth bias on RINDAT's stroke distribution plot....

-Page 14826, line 15 Please substitute "altitudes" with "altitude".

-Page 14827, line 27, Please substitute "main" with "prevailing".

-Page 14828, line 27, Please substitute "downstream" with "downwind".

-Page 14829, lines 24 and 27, should read "left hand side transects" and "right hand side anvil transect", respectively.

-Page 14830, line 19: Do you mean to say that the storm developed in one hour? If not, please clarify.

-Page 14834, line 24: Please substitute "further" with "farther".

-Page 14838, lines 14 and 15: Please cite references for recent LNOx production estimates.

-Page 14846, line 9: Please delete "The".

-Page 14851, line 3: Please delete "respectively"

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 14813, 2007.

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