Atmos. Chem. Phys. Discuss., 7, S8159–S8161, 2008
www.atmos-chem-phys-discuss.net/7/S8159/2008/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Lightning activity in Brazilian thunderstorms during TROCCINOX: implications for NO_X production" *by* H. Huntrieser et al.

H. Huntrieser et al.

Received and published: 7 January 2008

We thank Reviewer #2 for the helpful comments.

- However, recent experimental results from Florida have shown with rocket-triggered lightning that it is the continuing current phase of a lightning flash that is responsible for most of the NO production (Rahman et al., 2007, GRL). I have spoken with two other atmospheric electricians, and they have concurred that it is most likely the continuing current phase that is important for NO production, and that the peak current of the return stroke should not be all that important. The authors should mention in this manuscript the Rahman et al work, and perhaps downplay the discussion of peak current. The hypothesis concerning flash length as the main reason for greater NO

production per stroke in midlatitude and subtropical storms than in tropical events, and the related hypothesis that the length is related to vertical wind shear, are exciting developments for further research. As such, this paper should be published in ACP.

- The Rahman et al. paper was only briefly mentioned since the results are very new and only based on a small set of data (3 triggered flashes). However, we also believe that this result is important and added some further sentences (Page 14817, line 8): However, recently Rahman et al. (2007) presented first direct measurements of NOx generated by rocket-triggered lightning in the field. Based on the results from a small data set of three triggered flashes, they suggest that it is the longer-lasting and continuous current portions of flashes that are responsible for most of the NO production. In comparison, the production by short-term return strokes was found to be minor. However, these longer and continuous current portions of flashes are currently not measured by operating lightning detection networks as the National Lightning Detection Network (NLDN) and the very low frequency / low frequency (VLF/LF) lightning location network LINET used here. NLDN only detects the high-current return stroke of a discharge.

Further changes by the author:

- The following references were added: Pickering et al., 1998 (for reasons mentioned in answers to Reviewer #1); Schmidt et al., 2007 (for reasons mentioned in answers to Reviewer #1); Betz et al., 2007b (for reasons mentioned in answers to Reviewer #1).

- The authors found additional material supporting their hypothesis in Sect. 6 (Discussion). The following references were added to page 14850, lines 21-26: Carey et al., 2005; Ray et al., 1987; Steiger et al., 2007a-b. Furthermore, the text of this paragraph was complemented: A lateral displacement of upper level charge on the convective scale (˜10 km) because of vertical wind shear (0-6 km) was first suggested by Pierce (1955), Brook et al. (1982), Ray et al. (1987), and Hill (1988) (known as "tilted dipole mechanism"). Later, observations by Engholm et al. (1990) of MCS confirmed a tilted

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deformation of the convective charge centre by the vertical wind shear. Contrarily, Rutledge and MacGorman (1988) first suggested that the origin of charge for positive ground flashes in the trailing-stratiform region of MCSs was the rearward advection of positive charge on large aggregates of ice particles from the MCS convective charge centre (leading line) by the mesoscale storm-relative winds (now known as "charge advection mechanism"). More recently, these mechanisms have also been discussed by Gilmore and Wicker (2002), Carey et al. (2005), Carey and Buffalo (2007) and Steiger et al. (2007a,b). However, the VHF lightning observations by Carey et al. (2005) clearly indicate that the "tilted dipole mechanism" and the "charge advection mechanism" are two different mechanism on different scales (convective and mesoscale) that should be considered separately.

- Fig. 17c was missing in the ACPD version: Figure added.

- A new schematic figure (Fig. 18) was added (Sect. 6, page 14850, line 14), showing the horizontal separation of charged regions by the enhanced vertical wind shear, to support the hypothesis described in this paragraph.

- The previous Fig. 18 was now changed to Fig. 19.

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