

## ***Interactive comment on “The chemistry of daytime sprite streamers – a model study” by H. Winkler and J. Notholt***

**Anonymous Referee #2**

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**Comments on Winkler and Notholt, The chemistry of daytime sprite studies — a model study**

### **General comments:**

The authors consider an important aspect on the chemistry of sprites, namely the difference between day- and night-time sprites. Sprite streamers are initially a source of ozone, but during daytime the NO produced will undergo a catalytic ozone destruction cycle and so cause local ozone depletion, more pronouncedly so at higher (some 50 km) altitudes.

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Some authors e.g. Arnone et al. (see references in the paper) have also discussed the role of sprite-produced NO<sub>x</sub> on a global scale, but such a discussion is outside the scope of this study. As the authors point out, it is important to study transport effects under different conditions in order to fully understand the global chemical impact of sprites.

However, the impact of sprites is likely to be much more significant locally than on a global scale and therefore the findings are important and the paper is well suited for ACP.

### **Detailed comments:**

**Abstract:** It is a bit confusing; for example it is not fully clear if O increases both during day and night-time events, as seen in Fig 4.

**Section 1:** The significance of the results depends on the occurrence frequency of daytime sprites. It would really be worth investigating how to detect daytime sprites for statistical purposes. To my understanding some of the results are only indications, not one-to-one correlated with daytime sprites.

**Sections 3-4, model description:** I have made no attempts to validate the chemical reaction scheme and find up-to-date rate coefficients. How was the model developed, from scratch or based on an existing chemistry model? Furthermore, does it consider ionisation by the UV emission from excited species (N<sub>2</sub><sup>+</sup> might also be important), or is only photoionisation by solar radiation taken into account?

It also ought to be experimentally verified that daytime sprites initiate at the altitude of conventional breakdown like the night-time ones, but for now this assumption has to be made.

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Results: As the authors point out it would be important to run the present model for different conditions and also model mixing with the ambient air and transport of the produced  $\text{NO}_x$  and  $\text{O}_x$ . So this paper contains important suggestions for further work!

**Minor details:**

p. 29530 l. 11: a productions → a production

p. 29531 l. 14 concentration ... decrease → concentration ... decreases

Table 2, Fig 2, titles and captions: maybe "negative species" instead of "negative ions", since usually electrons and negative ions are distinguished from each other.

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Interactive comment on Atmos. Chem. Phys. Discuss., 13, 29521, 2013.