

Interactive comment on “Chemistry of sprite discharges through ion-neutral reactions” by Y. Hiraki et al.

Anonymous Referee #1

Received and published: 8 April 2008

This is a paper with some interesting results connected to the emerging field of sprite chemistry. There are, however, some points that, in my opinion, are key and were omitted. First, what is the latitude the authors have used to implement these calculations?. The latter is important since NO might change considerably from, for instance, polar latitudes to midlatitudes. Another important issue not clearly explained/clarified in the paper is that of the initial values of the different species concentrations they are modeling and, in particular, that of NO which the authors have assumed to be 102 cm^{-3} at an altitude of 60 km. It seems that this initial value comes from a chemical model of neutral atmosphere published by Iwagami (ref 13) in 1998. However, it is NOT clear enough is Iwagami’s model is the final and unique source of initial values for the present sprite chemistry model. I do not know Iwagami’s paper, but what I do know is that the results

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by the latest version of the Whole Atmosphere Community Climate Model (WACCM), a public domain resource, indicate that at 60 km, the nighttime NO initial value at mid-latitudes ($+38^\circ$) is around 107 cm^{-3} with a well know sharp decrease/increase of the nighttime NO concentration 30-50 Km range. All this is important because, I am not convinced that the claimed 2-3 orders of magnitude increase of the nighttime NO concentration due to sprite chemical activity has a sound physical-chemical basement. Thus, I am not completely happy about this result. The authors should clearly state how do they calculate (or estimate) or what the source of their initial values is and, very important also, what are the lalitudes where their results apply. Well, this is my main concern about this paper.

Apart from the above comments, I found that, in general, this paper is difficult to read since, in my opinion, it is not clear enough. For example, the authors claim they are using a set of ion-neutral reactions that is not shown in the manuscript. Also, for the sake of clarity, the x-axis of Figures 3 and 5 should use a log scale. There are some other small details including the use of a better English.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 2311, 2008.

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