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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Radiative effects of tropospheric ionisation" *by* K. L. Aplin

Anonymous Referee #2

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This paper presents an interesting explanation for the atmospheric IR continuum problem, but does not really defend it very well. Most arguments were qualitative and suggest a similarity in trends but do not actually deal with the absolute cross-sections and concentrations required. Also even the trend in Fig. 2 is not all that convincing.

While the paper shows some correlation between cosmic rays and apparent IR absorption, it does not provide a very feasible mechanism. Average ion concentrations are reasonably well known in the troposphere and typically vary from 10^2-10^4 ion/cm^3. Even assuming a 10 km tall volume of ions with a density of 6x10^3 ions/cm^3 (maximum suggested), the column density is still only 6x10^9 ions/cm^2. Thus even a 1% anomaly would require a huge cross section on the order of 10^{-12} cm^2, and no where in the paper is the assumption of such a large cross-section justified. Some new text was added about Carlon's measurements giving a cross section of 10^{-20} cm^2 molecule but it is unclear if this is per ion cluster or per water molecule.

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Carlon's laboratory experiments need to be discussed in more detail; it would be nice to see independent laboratory measurements of the IR absorption of $H_2O+ \cdot (H_2O)_n$ ions. Is it possible that ion induced nucleation plays a role in the IR attenuation? Page 4: if 10^{10}-10^{14} water clusters cm^2 are required to cause the observed anomaly, how can only 10^3-10^4 ion clusters/cm^3 cause the same effect? It would seem that the radiative effect of the large, singly charged water clusters would act similar to an uncharged cluster. The arguments in this paper should be strengthened.

Interactive comment on Atmos. Chem. Phys. Discuss., 3, 3205, 2003.

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Interactive Comment