

Interactive comment on “Chlorine Nitrate in the Atmosphere” by Thomas von Clarmann and Sören Johansson

C. Boone (Referee)

cboone@scisat.ca

Received and published: 3 August 2018

This article presents a comprehensive look at a molecule with an important role in atmospheric Chlorine processing. I have no major concerns, but there are a few typos and wording issues (described below)

page 2, line 25: Remote sensing of ClONO₂ from ground
> from the ground

page 2, line 27: because the ray-path avoided to cross the humid boundary layer which

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has lead to a much clearer spectral signature of ClONO₂.

> Awkward wording. Suggest “. . .because the measured light does not pass through the humid boundary layer, yielding a much clearer spectral signature from ClONO₂.”

page 2, line 31: Summaries of stratospheric chlorine chemistry and its history is given
> are given

page 3, line 2: in atmospheric sciences it is relevant as a stratospheric trace gas
> Awkward wording. Suggest “. . .in the stratosphere it is a trace gas with a significant role in chlorine-related chemistry.”

page 4: Why did Equation 3 end up on two lines? It would look better on one line.

page 6, line 1: Along with photodissociation, also these sinks depend on sunlight
> Awkward wording. Suggest “Although no photons are explicitly involved in the above reactions, these sinks have an implicit dependence on sunlight . . .”

page 7, line 12: The product Cl is involved in catalytic ozone destruction
> I believe you mean BrCl, not Cl

page 7, line 20: The variable k is used for both rate constant and the Boltzmann constant. Perhaps you should use a different label for the Boltzmann constant (k_B)

page 9, line 17: The net reaction R25 indicates a photon ($h\nu$) was involved, but no photon appears in any of the reactions involved (R21-R24)

page 9, line 23: but also allow that chlorine is transported over long distances without reaction.

> Awkward wording. Suggest “. . .but also allow chlorine to be transported over long distances without reaction.”

page 10, line 14 (R31): The net reaction R31 does not indicate any photons ($h\nu$), but the reactions indicate that there were two photons involved

page 11, line 5: which is only available in seizable amounts

> sizeable amounts

page 11, line 16: sedimentation of HNO_3 -loaden particles

> HNO_3 -laden

page 11, line 21: This in tendency counter-balances

> Awkward wording (“in tendency”). Either delete this phrase or change the wording to something like “. . .tends to counterbalance. . .”

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page 12, line 5: formation of seizable amounts

> sizeable amounts

page 13, line 1: if temperatures are below 190 K a lot of aerosol is available.

> Suggest “. . .if temperatures are below 190 K and a lot of aerosol particles are available.”

page 14, line 11: de-accelerate

> decelerate

page 15, line 4: An example of these cross sections are

> An example of these cross sections is...

page 15, lines 6-8: The recent version of the HITRAN (high resolution transmission) spectra database (Gordon et al., 2017) recommends the usage of these absorption cross sections for atmospheric research. The spectra are part of the HITRAN recommendations since the version of 2004 (Rothman et al., 2005).

> Suggest “These absorption cross sections are recommended for use in atmospheric research by the most recent version of the HITRAN (high resolution transmission) spectral database (Gordon et al., 2017) and have been the recommendation since the 2004 version of HITRAN (Rothman et al., 2005).”

page 15, line 15: In their paper these authors also summarize

> Perhaps “The paper also summarizes. . .”

page 17, line 18: Table Mountain Observatory, California Gunson and Irion (1991)

> Brackets misplaced in reference: “(Gunson and Irion, 1991)”

page 19, line 26: reported by von Clarmann et al. (1997); Wetzel et al. (2006, 2008, 2010, 2013), Many of these flights. . .

> the “;” should technically be replaced by “and”, and there is a comma at the end of the sentence instead of a period

page 20, line 15: periods of particularly sparse measurements in 2006 and 2006.

> 2006 is repeated (2005 and 2006?)

page 20, line 16: While not part in the original MIPAS ESA data product

> While not part of the. . .

page 21, line 30: A similar technique has been applied by Von Hobe et al. (2003); Stroh et al. (2011) with the HALOX instrument.

> Again the “;” should be “and”

page 21, line 30: A maximum of ClONO₂ with 1.5 ppbv at 27 km altitude before sunrise is observed, which is decreasing one hour after sunrise down to 1.3 ppbv until two

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hours after sunrise

> Suggest (if I interpret this correctly) “The maximum volume mixing ratio for ClONO₂ was 1.5 ppbv, observed at an altitude of 27 km one hour before sunrise. During the time period of one to two hours after sunrise, ClONO₂ levels decreased to 1.3 ppbv.”

page 21, line 31: They explain this decrease

> They explained this decrease. . .

page 23, line 3: Rinsland et al. (2010) found that ClONO₂ stopped to increase.

> stopped increasing

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2018-577>, 2018.

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