

Interactive comment on “RTTOV-gb v1.0 – Updates on sensors, absorption models, uncertainty, and availability” by Domenico Cimini et al.

Domenico Cimini et al.

domenico.cimini@imaa.cnr.it

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General comments:

The manuscript presents an updated version of a fast radiative transfer model (RTTOV-gb) for ground-based microwave radiometers. It discusses model uncertainties caused by absorption properties in the microwave range and shows validations of the model with observations. The paper wants to contribute to a wider use of ground-based microwave brightness temperatures to be assimilated in numerical weather prediction models which has been shown to have a promising impact to the forecast skill. The paper is written in a clear and concise way, and I suggest publishing with minor revisions.

We thank the reviewer for her/his careful reading and positive comments.

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Specific comments:

Why did you restrict yourself to the frequency range 22-150 GHz? Did you also check the 183 GHz water vapor line which would be of great use in arctic or high altitude regions with low water vapor contents?

The frequency range depends on the popularity of ground-based microwave radiometer types. In the first paper introducing RTTOV-gb (De Angelis et al., 2016 – references are reported at the end of this document), we only considered 22-60 GHz channels, addressing the majority of operational ground-based microwave radiometers (i.e. RPG HATPRO and Radiometrics MP3000). Here, we add new instruments, extending the frequency range up to 150 GHz, since such types are becoming popular in support to satellite telecommunications. We are aware of ground-based microwave radiometers operating at 183 GHz and their benefit for low water vapor content (e.g. Cimini et al., 2007; Cadeddu et al., 2007; Ricaud et al., 2010). However, only few operational units are available in the world. The extension to 183 GHz will be considered among future developments. We have added this comment to Sections 2.1 and 4. Accordingly, the latter has been renamed “Summary and future developments”.

Is there any attempt to take cloud liquid water into account for RTTOV-gb? Please comment on that in the paper since there are many regions on Earth with frequent cloud cover.

Thanks for pointing this out. As explained in the first paper (De Angelis et al., 2016), RTTOV-gb does already include cloud liquid water in the radiative transfer calculations (direct and Jacobian modules). Here, we showed clear-sky calculations only for the purpose of comparing with operational radiosonde observations, which do not provide measurements of cloud liquid water content. We have added text to clarify this point to Sections 1 and 3.

p.3, l.6-8: I assume the coefficients are instrument type specific. This would mean that you can use the same coefficients for all stations with the same instrument type in

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different climate zones. Is that correct? That was not entirely clear to me.

Yes, that's correct. The coefficient training is based on a set of diverse profiles which covers the atmospheric conditions of different climate zones. We have added text to clarify this point in Section 2.1.

p.5 and 6: Concerning the comparison of the model with observations: Did you check the calibrations of the instruments? Were there any absolute calibrations performed during the periods of study?

For the radiometer in Milan (LWP-U72-82), the most recent absolute calibration was performed 9 months earlier than the period of study. A new calibration was performed 4 months later, and did not show substantial changes in the calibration coefficients. Thus, we assume the calibration was stable during the period of study. The radiometer in Lamont (LWP-90-150) is continuously calibrated using the tip curve method, as regularly performed by ARM (Cadeddu et al., 2013). We have added text to clarify this point to Section 3.

Technical corrections:

p. 1, l.26: Therefore (typo)

Addressed. Thanks!

p.1, l.36: To my mind "model flavor" sounds a bit colloquial. Could you find a better expression?

Agreed. It has been changed with "model parameterization".

p.2, l.11: not only "national" meteorological services (e.g. ECMWF!)

Correct. It has been changed with "national and international". Thanks!

p.3, l.36: Turner et al. 2018 has not been submitted yet

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It has been now replaced with the proper reference to the published paper.

p.4, l.1: Tretyakov is misspelled

Addressed. Thanks!

References

Cadeddu et al., 2007, doi: 10.1109/MICRAD.2006.1677098

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Cimini et al., 2007, doi: 10.1109/TGRS.2007.897450

De Angelis et al., 2016, doi:10.5194/amt-10-3947-2017

Ricaud et al., 2010, doi: 10.1109/TGRS.2009.2029345

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