Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2018-1129-RC1, 2018

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Determination and significance of upper-tropospheric humidity" *by* Klaus Gierens and Kostas Eleftheratos

Anonymous Referee #2

Received and published: 11 December 2018

This paper discusses the definition of Upper Tropospheric Humidity (UTH), a quantity derived from 6.3μm observations, and which has drawn a lot of attention since the 80s. This specific study looks at the retrieval formula itself, first analytically determined by Soden & Bretherton in 1993. I understood that the scope is to refine the retrieval to reach a better homogeneity in the HIRS2-HIRS3-HIRS4 database, and more precisely for the cold temperature, where the UTH is over saturation (with respect to ice).

However, while reading the paper, I didn't clearly catch its added-value. After reading it several times, I am sorry to say that I still don't see it. In my opinion, several aspects have been eluded: from the detection of clouds within the brightness temperature measurements in the water vapour channel, to the retrieval itself and its application. I have then several remarks that will probably show that I despite I believe that such work on

Printer-friendly version

Discussion paper

the interpretation of “water vapor” channel observation is very interesting, the present work needs to be more clear on its roots, its dataset, and its objectives.

#1. The retrieval of UTH from 6.3μm observations is only possible when there is no clouds in the free troposphere. Brogniez and co-authors discussed at length that point in a 2006 study, where they show that clouds below $\sim$700hPa are almost “unseen” in that channel. Here the study focuses on the cold range of the 6.3μm temperatures. ïČř Can the authors discuss the cloud screening technique? Can’t the very low brightness temperatures mentioned (230K and below) be reasonably associated to partially cloud-covered pixels? In their 2016 work, Chung et al mention the problem of the cloud detection in the HIRS serie which is done thanks to ISCCP. ïČř Therefore, my question here is: would that be possible that the discrepancy in the cold range values would be induced by the cloud screening (and thus ISCCP cloud detection), from HIRS2 to HIRS4?

#2. When reading UTH-related papers I am always stunned that people don’t give credit where credit is due. I agree that B. Soden & co-authors developed the first analytic retrieval of UTH, but the retrieval of UTH from 6.3μm observations was first developed by J. Schmetz and O. Turpeinen in 1988 and produced operationally at EUMETSAT ever since. I deeply regret such evolution in the referencing. It is obvious that every paper cannot list all the previous work performed on a particular topic, but then when the paper goes back to the roots, then I totally believe that this has to be done. Hence, a whole part of UTH retrieval has been put aside, and more precisely on the work on METEOSAT data: following Johannes Schmetz work, you have also Brogniez et al 2009 and (maybe closer to us) Schröder et al 2014 that have redefined the weighting function by showing that the transmission-derived weighting function of SB93 was the least accurate one, that didn’t consider the radiatively-driven information, as the authors underline it. But then the part 5.3 (as well as 5.4. . .) is, in my opinion, a little bit “reheated”. . . => Can the author go through the definition proposed in Schröder’s work for instance and compare to their definition of the weighting function?

#3 Section 2, present the 1st order retrieval, as designed by SB93 and SJW96. => Eq (1) and (2) are from the Malkmus band model, adapted to strong absorbing lines, not specified. Since this section intends to re-discuss the SB93 & SJW96 works, then all the assumptions need to be written. => It is nowhere specified that the developments by SB93 and SJW96 are adapted for tropical and subtropical standard atmospheres: in these regions the temperature profile doesn't change much and that is why the 6.3μm observations can be interpreted as UTH. However, the authors have applied it to northern mid-latitudes. I would like to know how the approximations, and more specifically the linearizations, translate from the tropics to the mid-latitudes. For example, the pressure at which T0 =240K varies slightly between the tropics and the mid-latitudes. Is there an impact?

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2018-1129, 2018.