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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Thermal structure of intense convective clouds derived from GPS radio occultations" *by* R. Biondi et al.

Anonymous Referee #1

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The paper presents temperature perturbations as retrieved from GPS radio occultation in the vicinity of deep convection systems between 50S-50N to conclude that rapid undiluted ascent occurred within the convective systems. Some information regarding the time and space sampling is missing, which is important as regard with the representativeness of the sampling. For example, the location and local time of the 53 cases are not documented. This is essential as the nature of deep convection is very contrasted between land and sea, and also because deep convection has a strong diurnal cycle over land. Furthermore, it is mentioned in the introduction that "overshooting convection can penetrate the tropopause and, with different mechanisms, either hydrate or dehydrate the UT or the LS". However, in the rest of the text, overshooting convection is not any more mentioned suggesting that none profile of 53 cases shows an overshooting feature such as the double local temperature minimum described by

Danielsen (GRL 1982). This lack of feature highlights a major limitation of the study, that is, the representativeness of deep convection in the samples. Apart the previous comment, the paper deserves publication in ACP after some revisions as detailed below.

Comments

p 29094 (l 4), please quantify "the high vertical resolution and high accuracy measurements" with numbers.

p 29095 (l 21), "Several GPS RO missions are working at present, providing a high density of vertical profiles with a good time and space coverage." Please quantify what "high" and "good" mean.

p 29097 (GPS data), please indicate the horizontal resolution of the GPS atmPrf and wetPrf products, at least in the tropical UTLS, as well as an estimate of the temperature retrieval errors.

p 29098 (l 6), please give the space resolution of this ISCCP database.

p 29098 (l 18), please write that the equator crossing time for CALIPSO is about 1:30 (am and pm) local solar time.

p 29099 (l 22), "in a time window of 2 h and within the actual radius of the CC." The life of a convective plume is about 30 min, which much less than the 2-h time window. What is the actual radius of CC in terms of distance in km?

p 29100 (l 5), a map would be useful to document the location of the 53 cases (over sea or land) together with an indication of the date, at least month and local solar time (the latter should be close to either 01:30 or 13:30 1 h).

p 29100 (l 4), it is worthwhile to note the agreement between the 12.16 km cloud top altitude observed with Caliop and the 12.2 km altitude of the minimum temperature from GPS RO. Does the 210 K minimum temperature from GPS RO agree with the

cloud top temperature observed with GOES?

p 29100 (l 8), "temperature becomes warmer than the climatology". In the three profiles, temperature does not display a sharp increase above the cloud top. Instead, it steadily enhanced on a 1 km layer to reach the dry adiabatic profile above. This suggests that mixing between cloudy and clear air occurs just above cloud top. But there is no evidence of such mixing in the Caliop backscatter. Is it an artefact of the different resolutions between GPS RO and Caliop?

p 29100 (l 10), please justify the choice of the 2 February 2008 case study. Please also indicate the time of GOES observation. Is it around 09:00 UTC, that is, before the GPS RO and CALIPSO observations?

p 29101 (l 11), "smears out the detailed vertical structure near the cloud top due to the coarse vertical resolution". It may be due also to the time lag between observation and analysis, of about 2 h if the ECMWF analysis time is here 12:00 UTC (information not given in the text).

p 29101 (l 14), please justify your selection of these two further examples.

p 29101 (l 22), again as there is no indication of time, the temperature profile from the ECMWF analysis does not necessary produced a low resolution version of a detailed structure. It might be representative of the thermal structure before the occurrence of the convective event or a few hours after the mixing of the convective plume with its environment.

p 29102 (l 11), it should be indicated in the text that the temperature anomalies in Figure 7 are calculated with respect to the background climatology (as stated in the caption of Figure 7).

p 29102 (l 12), please justify your choice of 14 km altitude to discriminate the 53 cases following the depth of convection.

p 29103 (l 24), please quantify "the reasonable agreement between the GPS RO tem-

perature profiles and nearby ECMWF analysis" with bias and RMSE.

p 29104 (l 4), avoid the use of the subjective term "excellent". Rather, quantify the agreement in cloud top altitude by "of less than 1 km".

Figures 1, 2 and 3, Time is missing in the caption.

Figures 2 and 3, units are missing for total attenuated backscatter, bending angle anomaly and temperature.

Figure 9, typo on "inversione"

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 29093, 2011.