

## ***Interactive comment on “Radio occultation bending angle anomalies during tropical cyclones” by R. Biondi et al.***

**R. Biondi et al.**

ribi@space.dtu.dk

Received and published: 21 April 2011

The authors tried to explore the possible relation between radio occultation bending angle anomaly in the tropopause and tropical cyclones. The preliminary results are interesting, but I think more work can be done to make the work more convincing. I would like to suggest revision of the work before publication.

1. Did the "raw" bending angle or "optimal" one was used in the study? The latter combines climatology to smooth out "noises" and might not be good for the extreme events like tropical cyclones.

The raw (unoptimized) bending angle was used.

2. tropical cyclone intensity varies a lot and so its impact on the tropopause may

C401

depend on its intensity. The author might consider to do the analyses in terms of different TC categories, and the correlation might be more clear. I leave this for the authors to consider.

Thank you for the suggestion. We are investigating the relationship between the strength of the tropical cyclone (and convective systems in general) and the bending angle anomaly. Unfortunately for some categories of tropical cyclones (i.e. cat 4 or 5) we have just a few GPS radio occultations or we do not have any. Since this investigation is not completed, we decided to leave the paper as is on this matter.

3. Page 1377 end of the Section4: The comparison of Fig. 5 and Fig.6 is not convincing. Considering make a climatology without any of the TCs and then compare with Fig. 5 may give more clean comparison.

The TCs do not influence the climatology so much. In any 1x1 degree box shown in Fig.1 (of the paper) we can get no more than 2 profiles during TCs out of 40-100 used for the climatology. The statistics of averaged values are not affected by the presence of the TCs in the climatology computation.

4. Section 5: The single case of RAOB comparison with bending angle is not convincing. Is it possible to do the comparison using all of the cases, such as anomaly correlation between RAOB and bending angle? also, for the comparison, it may be better to avoid using the RAOB in the TC core/rainbands, which may have strong convective scale noise. For example, it may be better to ignore the RAOB within 150km of the TC centers.

Unfortunately it is quite rare to get a radiosonde acquiring data above 14 km of altitude, co-located with a radio occultation inside a tropical cyclone, so the number of comparisons is limited. The CDAAC website provides the closest radiosonde to the GPS RO within a time/space window of 6h and 400km and this is what we have used for our comparisons: a total of 246 profiles. The strong convection is usually in the eyewall and some inner rainbands. Excluding the radiosondes within 150km from the TC cen-

C402

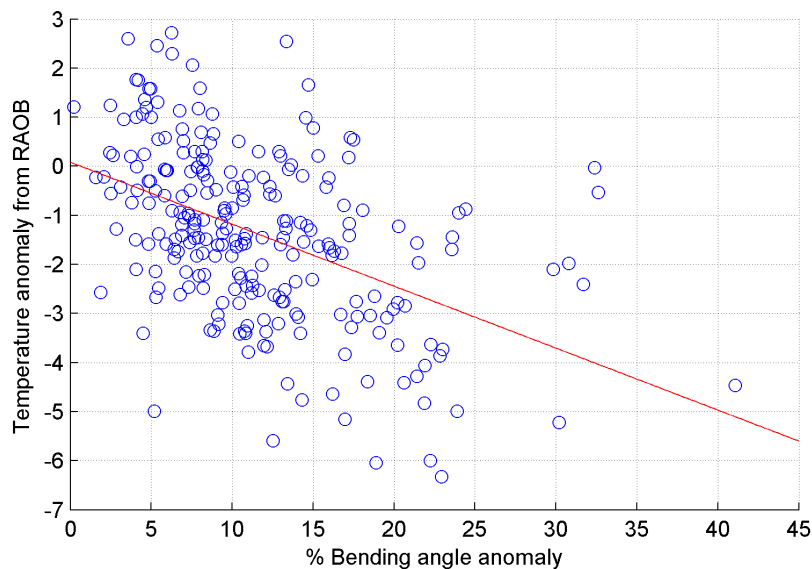
ter means to get just a few cases as comparison and probably not co-located with the convective system (which is what we are interested in). The radiosonde showed in the paper (fig.7) was about 200km faraway from the TC center. The Fig. 1 (of this reply) shows the scatterplot between the bending angle anomaly (x-axis) and the temperature anomaly from RAOB (y-axis) at the same altitude as the bending angle spike, the correlation is -0.49. Due to the time/space distance between the RO and the RAOB and due to the coarse vertical resolution of the radiosonde the maximum temperature anomaly altitude could not exactly correspond to the maximum bending angle anomaly. Obviously from this plot we can not highlight the double temperature minima mentioned in the paper, found during the TC, since those minima usually are located at different altitudes depending on the strength of the TC and on the location, but we have got a clear double minima from about 90% of the co-located RAOBs. We also have added in the section 5 the sentence "We have found 246 co-located RAOBs and the 90% of the cases show the temperature double minima in correspondence with the double spike of the bending angle."

Minor comments: Fig.3: reduce the x-axis scale rang to -5 to 15 may give better details.

Done, as in Fig. 2 of this reply

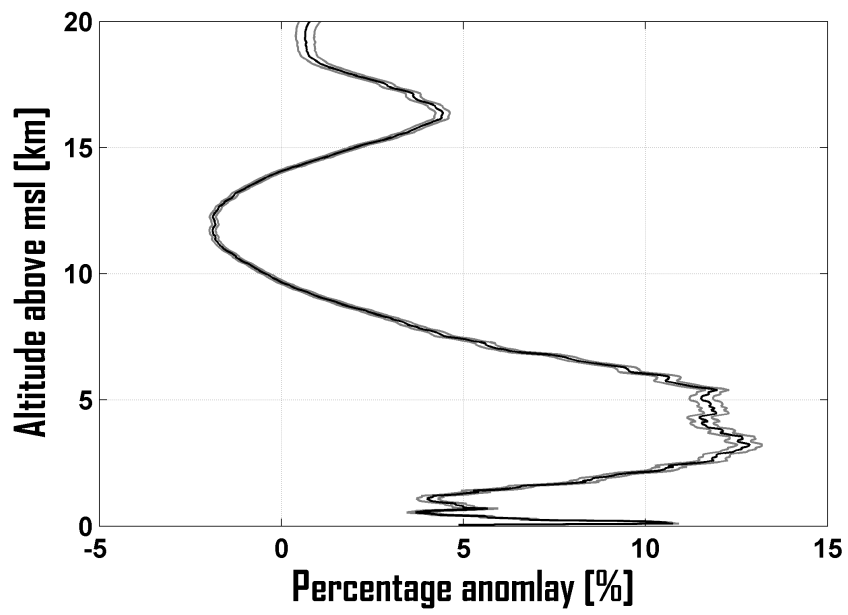
Interactive comment on Atmos. Meas. Tech. Discuss., 4, 1371, 2011.

C403



**Fig. 1.** Percentage bending angle anomaly versus the temperature anomaly from RAOB at the altitude of the lowest bending angle spike

C404



**Fig. 2.** Averaged bending angle anomaly profile for 1194 TC cases from 1995 to 2009 (black line)  $\pm$  with the standard deviation of the mean (grey lines)