

Interactive comment on “Morphology of the tropopause layer and lower stratosphere above a tropical cyclone: A case study on cyclone Davina (1999)” by F. Cairo et al.

Anonymous Referee #1

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This is a thorough study of the TTL above Cyclone Davina, observed during APE-THESEO, addressing the questions of dehydration of air in the lower stratosphere and the origin of air masses above the cyclone. The measurements are of high quality and on the whole well presented (see detailed comments below), so the paper should with minor revision be acceptable for ACP. The biggest disappointment with the paper is the lack of a firm conclusion - the authors give the impression of desperately wanting to prove their dehydration hypothesis, but the data won't co-operate. Nevertheless, this is not an argument for rejection - negative results must be recorded in the literature as well as the positive ones.

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Detailed comments.

p.18321, l.25; p.18322 l.1 vapour

p.18322, l.23 'move away from the moist adiabatic below 14 km' sounds better

p.18323, l.6 'Furthermore, during the developing stage of a tropical cyclone deep overshooting around the eye wall is very likely to occur'

p.18325 there is a good description here of the general structure of a cyclone, but it would benefit from a schematic diagram of the salient features to which the later case study could be referred.

p.18325 l.17 'the NASA DC-8 aircraft sampled Typhoon Mireille'

p.18325 l.19 'The absence of significant stratospheric mixing was also reported'

p.18325 l.23 'storms, were reported'

p.18325 l.29 'in the vicinity of'

p.18326 l.1 'work by Baray'

p.18326 l.10 'eye, probably due to intrusions of stratospheric air'

p.18326 l.13-14 'TOVS intrusions'

p.18326 l.28 'also revealed by radon measurements (Kritz et al 1993)'

p.18327 l.8 'when the tropopause is higher and colder'

p.18329 l.27 'ozonesondes'

p.18330 l.9. An absolute accuracy of 0.5 K for an aircraft flying at 200 ms⁻¹ at 50 mb is some claim. The authors should quote the appropriate reference for this claim and its pressure counterpart.

p.18322 l.14-20. The text here seems very obtuse: the sentence 'On approaching the

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cyclone, the OLEX lidar detected a thick cloud deck. The deck 8 km there.' seems to me to precede 'The weather radar on the Falcon detected a break in the eye wall, and by following this passage the aircraft was able to reach the eye' - note I changed the second sentence to say what I think it means - perhaps this isn't what you are trying to say but at least it makes some sense.

p.18333 l.2 ms-1 not m/s

p.18333. I do not see the relevance of fig.3 and suggest you drop it. It adds nothing to the paper.

p.18336 l.17. 'upward transport of ozone-poor MBL air' - what were the local MBL ozone concentrations? 15 ppbv is not impossible but quite low nonetheless.

p.18336 l.21 N2O and CFC-12 are tropospheric tracers.

p.18337 point 4. Is this what fig.3 is supposed to show? I'm sure you have the data to make this point, but it is not supported by the data shown in the paper. Also, Davina profiles are moister than the non-Davina means only below 370 K.

p.18337, l.15 'where'

p. 18338 l.14-21. The argument here is torturous. First, the mean non-Davina saturation mixing ratio and actual mixing ratio profiles are compared to make the point that the upper TTL was generally unsaturated. (Does this concur with the lidar cloud observations by the way?). Surely then the same variables should be compared for the Davina case - i.e. the saturation and actual mixing ratio. Instead, the non-Davina mixing ratio is compared to the Davina temperature (or saturation mixing ratio) and the conclusion drawn that there is potential for saturation and freeze drying. Would it not make more sense to compare the measured Davina humidity with the corresponding temperature? Anyway, the lidar provides a direct measurement of cloud so why not use that?

p.18339 l.21 'In fact the hygro-pause'

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p.18342. Conclusions. Given the inconclusive nature of this study the wording in this section must be chosen with great care, and is not always achieved here. I.6. 'The dataset is consistent with the hypothesis that tropical cyclones have the potential to dehydrate the upper TTL.....' The dataset is also consistent with the hypothesis that they do not dehydrate. This must be made clear in the conclusions.

I.9 'A plausible mechanism' is not a conclusion - this paragraph belongs in the discussion section.

I.23 'No attempt has been made' Well don't mention it then - remove this paragraph. Something for the next paper!

Figures

Fig.1 I'm afraid this figure is far too small. Even blowing it up on the computer screen, it is hard to read - in the original form the 1-point axis labels on the right-hand figure require a microscope. Also, mark on this figure the location of Reunion and the Seychelles. What is the convective cluster directly S of Sri Lanka? Is it possible to put a lat-long sale on the left-hand figure?

Fig.2 Explain the red section of the flight line in the caption (it's explained in the text but should be in the caption also).

Fig 3. As before, what is the point of this figure?

Figs 4-7. No solid red lines are visible - only red bars merging into a red splodge. This looks OK actually but the caption needs to describe what is there.

Fig.4 4th line of caption, 'from'

Fig.10 Another figure taxing to the eyesight. This needs to be increased in size also.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 18319, 2007.

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