Atmos. Chem. Phys. Discuss., 12, C1340–C1343, 2012
www.atmos-chem-phys-discuss.net/12/C1340/2012/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Strongly sheared stratocumulus convection: an observationally based large-eddy simulation study" *by* S. Wang et al.

Anonymous Referee #1

Received and published: 6 April 2012

Review "Strongly sheared stratocumulus convection: an observationally based large-eddy simulation study" by S. Wanf, X. Zheng, and Q. Jiang

General Comments:

The paper describes and analyze observational and LES data of a stratocumulus layer with strong shear. The problem is well introduced and the introduction provides a nice overview of the problem. However, the introduction immediately starts with details from a measurement campaign, which is somewhat confusing for people don't know the campaign; for example it might not be clear for every reader that the "R. H. Brown R/V" is a research vessel. Also the location of the VOCALS experiments should be

mentioned. Maybe for the introduction chapter it is better to change the nice general overview with the more specific introduction of the observations? Also the process of "de-coupling" should be briefly explained in the introduction and not only in chapter 5. A summary of the main open questions on which this paper will focus on would be nice at the end of the introduction chapter. I feel that in the introduction there are already too many details of your observations. Overall, this paper is a thorough study of the problem and I suggest publication after addressing the general and specific comments.

I have to notice that I am not a specialist in LES, so I cannot make technical comments on that part.

Specific Comments:

A few figure labels are too small, for example the labels of Fig 3 should be enlarged.

1. Maybe a few words what exactly is meant by "de-coupling" would help the readers who are not specialists in the field of CTBL

2. First reference: A. Bott instead of S. Bott

3. Page 4947, line13ff: You compare the observations in Fig 1 with the LES results in Fig 3 but with different parameters (e.g., potential temperature in Fig 1 with liquid potential temperature in Fig 3, q_v and q_t; I suggest to explain the parameters in the caption of Fig 1 - what is q_v and q_c ?)

4. P4948,l1 ff: the vertical structure of observed w'ˆ2 is hardly to interpret; I suggest to include error bars in terms of sampling statistics. Since most observation levels are close to the cloud layer it is difficult to compare with the general profile of LES. My feeling is that the error due sampling might be quite high? I suggest including a short discussion of that issue.

5. P4948; l5-13: Can you briefly explain the reason of the correlation between W'ˆ2 and the buoyancy flux? I understand that the buoyancy flux depends on the temperature inversion but a strong shear should also increase w'ˆ2 – right? I am a little bit confused

here.

6. P4949,l8: You mention that for negative w'3 we have "narrow and strong downdrafts" and for positive w'3 we have " narrower and strong updrafts" - Why is the sign of w'3 a measure of the width and the "power" of the plumes?

7. General comment to Sec 3: It is not completely clear why you have the three different scenarios of different shear in the LES while you have only observations with strong shear? In line 21 of page 4949 you summarize that the LES case with strong shear compares best with the observation – is this surprising? This is somewhat confusing to me – please clarify!

8. Sec 4. Inversion Layer: I would suggest including profiles of the mean values of \Theta_l and the mixing ratios in Fig 5 for reference since from the previous figures we cannot see the details relevant for the inversion layer. It would be interesting to see how much liquid water you still have in the inversion layer. Are the units in Fig 5 correct or is it kg/kg for the mixing ratio variances (or in other words: is the 10ˆ-6 correct)?

9. P4950,l12ff: Why do you deduce all these statements from variance profiles instead of /Theta_l and the mixing ratios themselves? In particular the statement that the inversion layer thickness increases with increasing shear, which is derived from the variance profiles confuses me.

10. What exactly do you mean with "inversion structure" on page 4950 and how can the Richardson number help to investigate this structure? What is \Theta_vl and why do you use it instead of \Theta_l for estimating Ri?

11. The Richardson number should be briefly discussed; what does a Ri > 0.25 means and so on

12. P4951,20ff: I do not understand the reason for the small jumps; honestly they are so small that I feel that they are somewhat over-interpreted. I think the whole discussion around Fig 6 needs some polishing- it is hard to follow and to distinguish between your

explanation of the LES results and physical interpretation. What are the differences of your interpretation after p4952-l1 and the discussion in Katzwinkel et al?

13. please include a reference for your Ri interpretation on p4952;l17 – on p4952;l23: the phrase "turbulence activity" is not very precise

14. you mention always the "cloud-free sublayer"; there is no figure which really shows that such a layer exists? Only in Fig 5 one can see that the variance of q_c peaks at lower levels compared to var(q_t) and var(Theta) but I think this could be illustrated in a better way

15. Fig 8; caption: "For the WS simulation (third column)" should be "for the NS simulation.." Why do you show the third column? What do the black dots mean in terms of a PDF? The interpretation is unclear.

16. P4952;l27: What do you exactly mean with "Large flow variability…" I think you should help the reader a little bit to interpret Fig 8. Furthermore, the interpretation of the joint PDF should be expanded – what can we more learn from Fig 8 compared to the previous findings?

17. P4953,l22: This sentence makes no real sense to me – can you please modify or explain what exactly do you mean? Why is the solar radiation a problem here if it is present in all three cases?

18. P4959,l6: Isn't the statement "Wind shear always exists…" a little bit to general?

19. Not sure if a table (Table 1) with one line is really needed..

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 4941, 2012.