

Interactive comment on “Genesis of Diamond Dust and Thick Cloud Episodes observed above Dome C, Antarctica” by Philippe Ricaud et al.

Anonymous Referee #2

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I find this paper to be a clear discussion of factors contributing to “warm” and “cold” clouds over Dome C. Also, it offers a good comparison of a number of measurement techniques and modelling. The result that advection patterns are a main driver of the differences between the warm and cold clouds is interesting, and I think it is suitable for ACP. The conclusions are mostly well founded. The paper is quite long, but it is very well organized and easy to read except for some small grammatical issues that I include with my following comments.

Comments

1) Line 20-23 – Re-write something like “Episodes of thick cloud and diamond dust during 15 March to 8 April 2011 and 4 to 5 March 2013 in the atmosphere above Dome C (Concordia station, Antarctica, 75°06’S, 123°21’E, 3233 m amsl) were measured

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and modelled.”

2) Line 23 – “The measurements were obtained from the following instruments: 1) . . .”

3) Line 35 – remove “by all datasets”

4) Line 76 – remove “also”

5) Lines 85-88 – “. . . experiences cloud about 30% of the time at altitudes below 3 km and less than 10% of the time above 5 km. Cloud occurrence over the western continental region is about 50% below 3 km and about 30% from the surface up to 8 km.”

6) Lines 109-110 – replace “investigating” with “on”. Remove “from” in both places. Replace period after “used” with a semi-colon.

7) Line 121 – please add a reference for the AROME model here.

8) Line 129 – remove first “the”.

9) Line 132 – remove first “the”. Remove third “the”.

10) Lines 154-155 – Please clarify the biases. E.g. “Compared with the radiosondes, the radiometer temperatures are biased 1-5 K lower at altitudes below 4 km and 5-10 K higher above 4 km.” Similarly for the “wet” bias.

11) Line 178 – remove first “the”.

12) Lines 224-226 – “AROME was used within the GEWEX Atmospheric Boundary Layer Study 4 (GABLS4) to study the meteorological evolution over the Dome C station (Bosveld et al., 2014).”

13) Lines 269-271 – Can you offer any explanation for this large difference?

14) Lines 309-311 - AROME is wetter than the radiosondes in the figure. I think your respective values here should be reversed.

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- 15) Line 316 – remove “much”
- 16) Line 322 – Change “Consistently” to “Consistent”, replace “drawn with” with “concerning” and remove the last “the”.
- 17) Line 340 – remove “much”
- 18) Line 347-348 – Change to “There was no abrupt increase of longwave downward radiation as during the warm and. . .”
- 19) Line 395 – Change to “We gain more insight into the vertical structure. . .”
- 20) Lines 423-424 – Please elaborate on why mixing of the air beneath the inversion causes the supersaturation w.r.t. ice.
- 21) Lines 433-435 – Change to “The second episode, which is much shorter than the first, relies on the same datasets presented in Section 3. The only difference is that the model analyses are only from the meteorological operational model ARPEGE that. . .”
- 22) Lines 443-444 – Please elaborate on “. . .with a explain transition propagating in the HAMSTRAD data up to 4 km altitude, probably due to the vertical resolution of the microwave measurements.” Are you saying that the transition (and please define transition) reaches 4 km because the vertical resolution is poor? You mention that the resolution is 500 m. Does that mean the transition height might be 3.6 km instead of 4 km?
- 23) Line 474-475 – “Consequently, this 12 hour period on 5 March can neither be attributed to clear sky nor to thick cloud episodes.”
- 24) Line 482-483 – Change “The ARPEGE simulation indicates an ice cloud from the surface to near 4 km on 4 March with the top altitude decreasing. . .”
- 25) Lines 494-495 - What is the temperature in this regime? You show no temperatures for episode 2, only tendencies. The reduced polarization may indicate water droplets, but it could also be due to change in the crystal ice habit. Your statement needs to be

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supported by appropriate temperatures or changed to read that there is a discrepancy in the interpretation between the reduced polarization and the temperature.

- 26) Lines 496-498 – What vertical structure are you referring to? There is considerable vertical structure in the depolarization across the time period 1000-2400 on March 5 and within the lower few hundred metres. You can't say with any certainty here that there was no precipitation of ice crystals. Even diamond dust is large enough to fall out unless there is sufficient vertical wind to maintain their suspension. Please revise.
- 27) Line 510 – Please revise to “. . .of ice crystals with a longer suspension time in the air.”
- 28) Lines 520-523 – change “were presented” on line 522 to “is discussed”. You are discussing the “impact”.
- 29) Line 564 – Replace “If we consider the” with “The”. Remove “as”.
- 30) Line 565 – Remove the first “the”.
- 31) Line 566 – Replace “, we obviously remark” with “show”.
- 32) Line 569 – Remove “indeed”.
- 33) Line 575 – Replace “slight” with “smaller”.
- 34) Line 578 – “thick-cloud episodes”
- 35) Line 580 – “. . . the diamond dust episodes occurred during. . .”
- 36) Line 584 – “Here, we attribute the tendencies of . . .”
- 37) Line 585 and 586 – Replace “into” by “among”
- 38) Section 5.3 – Please explain why this attribution was not be done for episode 1?
- 39) Line 604 – remove “a”. change “on” to “in”
- 40) Line 607 – what are “small precipitations”?

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41) Line 609-610 – Does this sentence, which refers to dehydration of the PBL and includes “precipitation”, contradict your statement at the end of section 4.4 that the diamond dust does not precipitate? See also above comments 26 and 27.

42) Lines 600-610 – You refer to microphysics as the one of the factors influencing the water vapour budget. I know you are using the model with microphysics, but it is not clear from your discussion if the influence on the water budget is truly microphysics or just the presence of cloud. Please clarify in Section 5.3.

43) Line 650 – “Since both downward and upward longwave radiation are greater than...”

44) Line 665-666 – “. . . suggesting that the cloud consisted of smaller ice crystals that may remain suspended in the air longer.”

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