

## Second Review of WCD-2020-34

**Authors:** Lesetja E. Lekoloane et al.

**Title:** "A dynamic and thermodynamic analysis of the 11 December 2017 tornado supercell in the Highveld of South Africa"

**Recommendation:** Acceptable pending minor revisions

### Overview

The second iteration of Lekoloane et al.'s manuscript is much more focused than the original submission, improving its readability and suitability. The manuscript still requires a considerable amount of mostly minor revisions and grammatical corrections, which are noted below.

I also have some major comments that I think need to be addressed. In particular, I do not feel that attribution to stated environmental ingredients is clearly demonstrated in the manuscript, though these ingredients did likely play a role in the storm's development and evolution. Also, I am not confident that modeled vorticity would be any more useful or accurate than the wind fields themselves, from which vorticity is derived. Addressing these concerns would mostly require some additions or changes to the narrative.

Following revisions, I am happy to review the paper again or allow the editor to make a final decision on the manuscript.

### Major Comments

1. The strengthening and maintenance of the supercell is not clearly attributed to the three ingredients mentioned (vertical shear, low-level warm/moist flux, and dry midlevels). These all play a role in producing a suitable environment for a supercell to develop and thrive, but it is not clear how they specifically strengthened and maintained the supercell here. The easiest way to alleviate this issue is to adjust your wording somewhat, unless you can justify your statement with more rigorous cause-and-effect testing.
2. Beginning of section 2.2.4: It is not clear to me why vorticity would be suitable here when it is derived from the components that you note cannot be reliably used. You should provide some reasoning for why you think vorticity is not subject to the same resolution concerns.

### Less Substantive Comments

1. Line 35: What "development scale" are you referring to? More detail would be useful here, as I assume many readers will be unfamiliar with this scale.
2. Line 48: I would argue that any thunderstorm that produces a tornado is a "severe" storm. I recommend rewording this sentence as, "It should be noted that some multicell thunderstorms can also produce tornadoes (including non-mesocyclonic tornadoes), and..."
3. Line 68: Omit or separate "including several animals", as these should not be included in the human injuries.
4. Line 228: "through energy supply" is vague and speculative. I would omit this.
5. Lines 240-241: What is the significance of the convergence noted here? Explain why it is worth mentioning.

6. Line 260: Specifically, the advection of dry air atop warm, moist air builds “potential” instability.
7. Line 316: “...which is an indicator that SA4.4 did not capture the mesocyclone of the VAM storm.” While this is likely true, I wonder if the magnitude is low because of the chosen pressure level (500 mb). How do 700-mb and 850-mb vertical vorticity compare? These levels may more accurately depict the midlevel or low-level mesocyclone.
8. Lines 319-321: This claim is speculative. Though it may be true, do you have any support for it?
9. Lines 385-386: Rather than referring to each component as an “underestimation”, I suggest noting the “poor resolution” of the given features due to 4.4-km grid spacing.
10. Fig. 3: The resolution of this figure is poor, making it difficult to read the surface observations and identify the noted features. If you cannot achieve higher resolution of the hand analysis, I recommend including a figure of the surface observations and trying to digitally recreate the hand analysis, or at least annotate the key features.
11. Fig. 5: These are nice plots, but I think they would be more readable in two rows and four columns.
12. Fig. 6: The surface point is clearly erroneous in the FAIR sounding. Can you remove it when plotting?
13. Fig. 7: Higher resolution images would be very helpful here.
14. Fig. 8: This is a great addition and succinctly addresses some of my prior comments. Thanks for including it!
15. Fig. 9: The surface winds here seem quite high and seem to be at odds with the prior surface map, though it is a little difficult to tell based on the resolution of Fig. 3. For example, in Fig. 3, I do not see any observations of 30 kt or higher. This could be a difference in timing (12z vs. 15z), but I also want to ensure that the data in Fig. 9 are accurate.
16. Fig. 12: These plots are actually showing divergence (since negative values are associated with convergence). Please reflect this in your titles.
17. Fig. 12: It may also be helpful to show some measure of surface temperature, theta, or theta-E to delineate cold pools.

**Minor/Grammatical Comments**

1. Line 10: “that of 1.5 km grid spacing (SA1.5) version of it” should read “the 1.5-km grid spacing version.”
2. Line 11 and throughout: “however” should be preceded by a semicolon and followed by a comma; e.g., “SA4.4 captured the supercell; however, the mid-level...”
3. Line 20: Comma needed between “society” and “including”
4. Line 24: “occurred” misspelled

5. Line 24: Change “which” to “and”
6. Line 25: Based on the preceding sentences, I would recommend starting the sentence with “There” instead of “Therefore” (i.e., “There is growing evidence...”)
7. Line 25: Moreover, change the following wording of the sentence: “...growing evidence suggesting that these extreme events...”
8. Line 26: Omit comma after “globe”
9. Line 29: Change sentence to read “...the most vulnerable communities are those in developing countries.”
10. Line 30: “depended” should be “dependent”
11. Line 30: Comma needed after “fishing”
12. Line 35: “lacking” should be “lagging”
13. Line 35: Comma needed between “stressors” and “including”
14. Line 42: Comma needed before “mostly”
15. Line 44: Change “which” to “that”
16. Line 44: Comma needed before “including”
17. Line 46: Change en dash to semicolon
18. Line 64: Change mid-level to mid levels
19. Line 64: “rotation at the ground” should be “the development of rotation at the ground”
20. Line 77: Comma needed between “understanding” and “the”
21. Line 79: Omit “models of”
22. Lines 79-80: Change “are the ones adequate” to “is necessary”
23. Line 81: Change “a model run” to “model runs” and “a grid length” to “grid lengths”
24. Line 88: Omit commas around “in this study”
25. Line 112 and throughout: Comma needed before “which”
26. Line 116: Omit comma after “Africa”
27. Line 129: “upstreams” should be “upstream”
28. Line 136: Be consistent with hyphens in noting pressure levels

29. Lines 136-137: Font size changes, and there is a hanging slash at the end of the sentence.
30. Line 145: “represents” should be “represent”
31. Line 162: Omit comma after “hPa”
32. Line 176: Change “which” to “that”
33. Line 177: Omit comma after “damage”
34. Line 201: Change “advects” to “adverted”
35. Line 203: Omit hyphen after “western”
36. Line 233: Change comma after “hail” to an “and”
37. Line 264: Remove hyphen in “low levels”
38. Line 271: Semicolon should be a comma or omitted
39. Line 276: Use “prior to” instead of your second “before” to prevent redundancy
40. Line 276: Change “near storm” to “the near-storm”
41. Line 278: Add comma after “Machadodorp”
42. Line 281: Change “twenty-four hour” to “24-hour”
43. Line 284: Include “a” between “ERA5 shows” and “large”
44. Line 295 and throughout: Add hyphen in “10-m”
45. Line 329: Omit comma before “reveals”
46. Line 330 and throughout: I’ve always heard and seen “poleward” rather than “polarward”
47. Line 339: Omit hyphen in “moist air”
48. Line 362: Omit comma after “underestimated”; could also add a comma before “possibly”
49. Line 378: Unneeded commas around “and therefore”
50. Line 380: Add a period after “et al”
51. Line 388: At least one word is missing between “was” and “which”
52. Huffman et al. reference is out of alphabetical order.