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Interactive comment on "3-D visualization of ensemble weather forecasts – Part 2: Forecasting warm conveyor belt situations for aircraft-based field campaigns" *by* M. Rautenhaus et al.

Anonymous Referee #1

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This manuscript describes the application of the Met.3D software package to planning aircraft campaigns to study warm conveyor belts. The paper is well written and for the most part clear. The paper would otherwise be ready for publication except for two crucial problems:

1. A severe Eurocentric perspective that affects the balance of the manuscript. Why this perspective is so highly skewed is unclear. Is it author bias against other countries or author ignorance of the history of their discipline?

2. Poor quality video, figures and figure captions. Much improvement is needed to explain the figures, as well as make them more readable and more understandable.

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Crucial Problems:

A. Poor citation practice

1. The paper is written as if Wernli and Davies (1997) is the earliest reference for applying the calculation of air-parcel trajectories to airstreams in extratropical cyclones. On p. 2166, line 23, the paper refers to "more recent studies" that calculate trajectories, but none are cited. On p. 2167, the paper reads, "Wernli and Davies (1997) have introduced the usage of Lagrangian particle trajectories to analyse the dynamics of extratropical cyclones." In fact, at least ten different articles were published before 1997 that "introduced" trajectories to the study of extratropical cyclones. In fact, trajectories were already being used in an operational setting within the National Weather Service by 1989 (Phillips, 1989). The rest of section 2.1 reads as if no one else other than continental Europeans have been calculating trajectories of WCBs, when in fact the work was done elsewhere first. Such statements in the paper misrepresent the actual history of meteorology and need to be corrected.

Ying-Hwa Kuo, Marina Skumanich, Philip L. Haagenson, and Julius S. Chang, 1985: The Accuracy of Trajectory Models as Revealed by the Observing System Simulation Experiments. Mon. Wea. Rev., 113, 1852–1867.

Jeffrey S. Whitaker, Louis W. Uccellini, and Keith F. Brill, 1988: A Model-Based Diagnostic Study of the Rapid Development Phase of the Presidents's Day Cyclone. Mon. Wea. Rev., 116, 2337–2365.

W. Hibbard, D. Santek, L. Uccellini, and K. Brill, 1989: Application of the 4-D McIDAS to a Model Diagnostic Study of the Presidents' Day Cyclone. Bull. Amer. Meteor. Soc., 70, 1394–1403.

Norman A. Phillips, 1989: Routine Forecast of Trajectories. Mon. Wea. Rev., 117, 1351–1354.

Richard J. Reed, Mark T. Stoelinga, and Ying-Hwa Kuo, 1992: A Model-aided Study of

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the Origin and Evolution of the Anomalously High Potential vorticity in the Inner Region of a Rapidly Deepening Marine Cyclone. Mon. Wea. Rev., 120, 893–913.

Ying-Hwa Kuo, Richard J. Reed, and Simon Low-Nam, 1992: Thermal Structure and Airflow in a Model Simulation of an Occluded Marine Cyclone. Mon. Wea. Rev., 120, 2280–2297.

Christopher A. Davis, Mark T. Stoelinga, and Ying-Hwa Kuo, 1993: The Integrated Effect of Condensation in Numerical Simulations of Extratropical Cyclogenesis. Mon. Wea. Rev., 121, 2309–2330.

Schultz, D. M., and C. F. Mass, 1993: The occlusion process in a midlatitude cyclone over land. Mon. Wea. Rev., 121, 918–940.

Mass, C. F., and D. M. Schultz, 1993: The structure and evolution of a simulated mid-latitude cyclone over land. Mon. Wea. Rev., 121, 889–917.

Kevin G. Doty and Donald J. Perkey, 1993: Sensitivity of Trajectory Calculations to the Temporal Frequency of Wind Data. Mon. Wea. Rev., 121, 387–401.

Richard J. Reed, Ying-Hwa Kuo, and Simon Low-Nam, 1994: An Adiabatic Simulation of the ERICA IOP 4 Storm: An Example of Quasi-Ideal Frontal Cyclone Development. Mon. Wea. Rev., 122, 2688–2708.

2. Another example of this Euro-centric skewed perspective comes about with the citation of references to the conveyor belt model. Although the warm conveyor belt was named by Harrold and popularized by Browning, it was Carlson (1980) who first integrated the warm conveyor belt into a holistic three-airstream model of airflow through extratropical cyclones. Citations that omit his crucial contribution include the following: p. 2163, line 12; p. 2166, lines 3-8.

3. DIAMET (Vaughan et al. 2015) also featured study of WCBs and included ensembles as part of its forecasting and part of its scientific purpose. Therefore, that study should be cited in the following locations: p. 2163, line 15; p. 2164, lines 1-6.

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Vaughan, G., and Coauthors 2015: Cloud banding and winds in intense European cyclones: Results from the DIAMET project. Bull. Amer. Meteor. Soc., doi: 10.1175/BAMS-D-13-00238.1.

4. p. 2163, line 27: 3D visualization techniques have been around much longer than implied by the authors and go well beyond “the few reports” cited by the authors. Consider the following references, which represent just a handful of the available citations. See also Robert Wilhelmson’s pioneering work on supercell thunderstorm visualization from the 1980s and 1990s, work that continues with more powerful visualization tools.

Richard Grotjahn and Robert M. Chervin, 1984: Animated Graphics in Meteorological Research and Presentations. Bull. Amer. Meteor. Soc., 65, 1201–1208.

W. Hibbard, D. Santek, L. Uccellini, and K. Brill, 1989: Application of the 4-D McIDAS to a Model Diagnostic Study of the Presidents’ Day Cyclone. Bull. Amer. Meteor. Soc., 70, 1394–1403.

James A. Schiavone and Thomas V. Papathomas, 1990: Visualizing Meteorological Data. Bull. Amer. Meteor. Soc., 71, 1012–1020.

William A. Gallus Jr, Douglas N. Yarger, Carolina Cruz-Neira, and Rex Heer, 2003: An Example of a Virtual Reality Learning Environment. Bull. Amer. Meteor. Soc., 84, 18–20.

William A. Gallus Jr., Cinzia Cervato, Carolina Cruz-Neira, Galen Faidley, and Rex Heer, 2005: Learning Storm Dynamics with a Virtual Thunderstorm. Bull. Amer. Meteor. Soc., 86, 162–163.

5. p. 2166, line 10: Pfahl et al. (2014) was not the first or even most important study to identify latent heat release in the WCB. I’m not sure a reference is needed for this statement, but if citations are going to be included, provide a more balanced citation list.

B. Figure problems

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1. Many figures are too small to read the graphics or the labels. For example, Figures 9, 10, 12, 13, 15, 16, 18.

2. The colour scheme in many of the figures is difficult to separate the volume from the background map. The colours in each are nearly the same, such as in Figure 14. (In fact, I don't even see that the colour scheme presents any yellows, oranges or reds. Why not?) These need to be fixed. This applies to the figures and the video.

3. The video is a nice addition to the manuscript, but it could be much improved. The white panels introducing the figures could be more descriptive. There could be more annotation and/or a voice-over to explain what the user is doing with the clicks and what the viewer is seeing in the animations. Often times, it wasn't clear to me what I should be seeing or what feature of the software was being displayed.

4. Figure 14: What are the branching patterns in this and other figures? It is unclear and not stated in the figure caption.

5. Interpreting Figure 8 is difficult. It is unclear what is being referred to by all the different coloured lines, and the gray and red shading of the boxes. More clarity is needed.

6. All figure captions should be complete. Many figure captions do not fully describe all the lines within the figures. As just one example of many, Figure 18 needs a description of what the purple contours represent. Fix all figure captions throughout the manuscript so that a complete description of the figure is enclosed.

7. The white lettering in some of the figures (e.g., Figure 12, left side panels) needs to be more obvious to the reader.

8. Figure 4: There is no statement about what the yellow versus green boxes represent in the caption. Also, it is unclear what the lines extending from memory manager and task scheduler represent. They connect to nothing.

9. The color scheme in Figure 7f makes interpreting the figure difficult. What is this

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feature supposed to be? It is unclear from viewing it. The caption adds no further insight: “All 51 members visualized in a single image, distinguished by colour.” What does the colour represent?

10. Figure 17: I don’t see the white contours. Can these be made more clear?

11. Figure 10, right column: This colour scheme is difficult to interpret from the base maps.

12. Figure 9d: It is difficult to interpret this figure. Ensemble member means nothing to the readers. Should the bars be ranked from highest value to lowest value, or simply be replaced by statistics of the distribution?

Major Comments:

1. Why is equivalent potential temperature (theta-e) used to identify the cold front in cross section? Because theta-e has a strong component of moisture, theta-e is notably unreliable for looking at fronts, especially in cross sections where strong moisture gradients may show false frontal zones. Regions of potential instability (theta-e decreasing with height) will indicate forward-tilting cold fronts, which are not observed in reality. Thus, frontal zones should be properly identified using potential temperature.

2. The paper has numerous abbreviations that are difficult to remember, not representative of what they stand for, and not used often enough to be worth it. Please reduce the number of acronyms within the manuscript to make it more clear for the readers. FQ-A (necessary?), ENS (should be EPS), TNF (T-NAWDEX would be easier to remember), ABL (PBL is more commonly used), etc. Perhaps the worst example of an unnecessary and unclear acronym is “R15P1”, which has the look of a specific numerical experiment. Why not just refer to the paper as “Part 1”, which is much more intuitive?

3. Resolution is not the same as grid spacing. Do not refer to “1° by 1° resolution” (e.g., Figure 6 caption; p. 2187, lines 17-18). Fix throughout the manuscript.

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Minor Comments:

1. Use standard scientific date/time format: 0000 UTC 15 October. No colons, no “on”, no “IT15/00Z”, etc. Fix throughout the manuscript, the video, the figures, and the figure captions.

2. p. 2163, Line 20: “despite” is incorrect in this context. One way to fix the sentence would be to rewrite the sentence to start with “Although”.

3. The video has several misspellings such as prosition, asses.

4. p. 2163, line 11: Semicolon should be a colon. Check for accuracy in punctuation throughout the rest of the manuscript.

Interactive comment on Geosci. Model Dev. Discuss., 8, 2161, 2015.