Review of gmd-2020-303 by Hristo G. Chipilski

Title: TempestExtremes v2.1: A Community Framework for Feature Detection, Tracking and Analysis in Large Datasets
Authors: Paul A. Ullrich, Colin M. Zarzycki, Elizabeth E. McClenny, Marielle C. Pinheiro, Alyssa M. Stansfield, and Kevin A. Reed

Suggested decision: Accept with Minor Revisions

General comments
TempestExtremes (TE) is a framework for the identification and tracking of features in Earth system datasets. The underlying paradigm behind TE relies on the construction of abstract functions (kernels) that can be called directly from the command line and controlled via a highly configurable set of user parameters. In this work, the authors extend the original version of TE by carefully documenting all newly added kernels. Using several examples based on societally important meteorological features, they also demonstrate how one can configure TE for specific Earth system applications by sequentially combining relevant algorithm kernels. The robustness of the enhanced TE package is evident in its successful application to different geophysical features and the agreement of the obtained results with past studies. Because the upgraded version of TE generalizes previous tracking methods, the presented work constitutes an important contribution to the Earth system community as a whole. In view of this scientific merit and the high clarity of presentation, I strongly recommend the publication of the manuscript in GMD after the authors address my fairly minor comments below.

Specific comments

L31: If the authors wish to expand their list of areal feature tracking algorithms, they could give reference examples pertaining to convectively-generated outflow boundaries, such is in my 2018 model-based work (Chipilski et al. 2018) or precursor observation-based techniques, such as those of Uyeda and Zrnić (1986), Smith et al. (1989) and Delanoy and Troxel (1993). The complete references to these papers are as follows:

Chipilski, H. G., X. Wang, and D. B. Parsons, 2018: Object-based algorithm for the identification and tracking of convective outflow boundaries in numerical models. *Mon. Wea. Rev.*, **146**, 4179–4200, https://doi.org/10.1175/MWR-D-18-0116.1.

Delanoy, R. L., and S. W. Troxel, 1993: Machine Intelligent Gust Front Detection. *Lincoln Lab. J.*, **6**, 187–212.

Smith, S., A. Witt, M. D. Eilts, L. G. Hermes, D. Klingle-Wilson, S. Olson, and J. P. Stanford, 1989: Gust Front Detection Algorithm for the Terminal Doppler Weather Radar Part I: Current Status. *Proc. 3rd Intl. Conf. on the Aviation Weather System*, Anaheim, CA, 31.

Uyeda, H., and D. S. Zrnić, 1986: Automatic Detection of Gust Fronts. *J. Atmos. Ocean. Technol.*, **3**, 36–50, https://doi.org/10.1175/1520-0426(1986)003<0036:ADOGF>2.0.CO;2.

L44: Please define the abbreviation CF in CF-compliant.

L53: My advice is that you to not restrict to climate datasets only as TE can be applied with equal success to other types of Earth system datasets, e.g. outputs from Numerical Weather Prediction (NWP) models.

L62: "*except from DetectNodes and StichNodes*" – remove this as these kernels are described in Section 2.1.

L75: Here the authors mention that "*filtering of existing quantities*" is one of the capabilities present in NodeFileEditor. However, it is not immediately clear how the filtering in NodeFileEditor differs from the filtering operations in NodeFileFilter, so please add a brief clarification on this point.

L123-124 (discussion relevant to Figure 1): Could you please clarify in the text whether the ID of a merged object is equal to the smallest ID from the set of merging objects? In your example from Figure 1, objects 1 and 2 from time level 2 merge to a new object with an ID=1 at time level 3, i.e. 1=min{1,2}. Is this always the case?

L226-L227: Please elaborate on the meaning of "*This further provides an example of the ability of TE to evaluate functional relationships at run-time*" as it is not clear from the context what these functional relationships are and how you have defined them.

Figure 2: On L262-263, you state there is a high correlation between the algorithm-derived TC climatology and the observed TC tracks provided by IBTrACS. Is it possible to add the IBTrACS data as a subpanel in Figure 2 so that your readers confirm this conclusion? Ideally, I would like to see an algorithm-observation comparison similar to that shown in Figure 3.

L295: Briefly explain your choice of "*159 bins of width 0.125 degrees*" by either using a reference from the existing literature or a physically-based reasoning.

L393-L395: "*strong advection of warm, moist, equatorward air*" – avoid quantifying the strength of advection unless you decide to overlay the near-surface winds in Figure 5. Similarly, it is not possible to conclude "*that the heaviest ETC precipitation is associated with the warm conveyer belt*" in the absence of wind information.

L425: Here you could reword your subsection as "*Step 2: Create AR mask with NodeFileFilter*" in order to establish a better connection with the following "*Step 3: Apply AR mark to VIWVN*".

Figure 7: Replace "*northward*" with "*poleward*" to reflect that IVT refers to either the Northern or Southern Hemispheres.

Technical corrections

L143: Remove "*a*" in "*followed by a several examples*".

L144: "*subsequent employ*" should be changed to "*subsequent utilization*".

L146-L148: Remove the sentence starting with "*In each of these composite algorithms …*" as you already mention this information earlier in your paragraph.

L209: Remove "*is*" in "… *our ERA5 data is comes* …".

L229: Avoid repeating "*output*"; e.g., you could replace the second "*output*" with "*written*".

L265: Please add the publication year to your Zarzycki et al. reference.

L545: It might be better to use "*integrating*" in lieu of "*developing*".