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Comment

Interactive comment on “Detection, tracking and event localization of interesting features in 4-D atmospheric data” by S. Limbach et al.

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Thank you very much for your helpful and constructive comments. We revised the article based on your suggestions. In the following, we answers to all your comments.

Major Comments:

(1) I think the introduction to the paper should include more discussion of the motivation for the algorithm. The authors list 3 points as to how the algorithm differs from existing region-growing based feature detection, but there is little discussion about why this is beneficial. What advantages does the algorithm have over those already existing? Why is a new 4D algorithm necessary? What

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science questions can this new algorithm be used to answer (that other algorithms are unable to answer)?

We rephrased the whole introduction starting from 3016/5. The part on the motivation behind the algorithm was expanded. We set the algorithm in context with many existing approaches. We clarified the new aspects of our algorithm with a focus on the grid-point based estimations of event locations. We emphasize on the usefulness of the identification of the events and point to possible applications. Another aspect we mention is the increased efficiency by simplification of some tasks other methods perform, and which are not necessary for the features we want to identify and track. We also mention the usage of efficient data structures which we describe and discuss in more detail now in Section 3.

(2) The algorithm is described very formally using mathematical set notation. Whilst this is all correct, I wonder if it sometimes makes the description more complicated than is necessary. Some of the ideas described are quite simple concepts to describe in words and I think the formal mathematical definitions may make the paper less accessible to some readers. This is partly personal preference and some readers may appreciate the mathematical description. However, if the authors decide to keep this, I think they should also give a description of the algorithm in words, probably before the algorithm is described formally. The authors have partly done this anyway since there are descriptive passages between the formal definitions, but I think it would be beneficial to have a description of the entire algorithm before it is described mathematically. I think this will make the paper and algorithm more accessible to some readers and will also make the mathematical description easier to follow.

Some of the mathematical notation introduced in Section 2 simplifies the discussion of the details of the implementation in Section 3. Nevertheless, this is a valid point. So we revised both sections and removed the definitions of the events, making the section

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easier to read and understand.

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(3) This paper is structured with the description of the algorithm followed by an example of its application to explore the climatology of upper-tropospheric jet streams. I think the description of the algorithm should also include examples to illustrate. The authors sometimes do provide examples, such as in the input data section where jet streams and wind data are used to illustrate. It would be useful to have such examples throughout the description of the method. This would be particularly useful to illustrate the local selection, global selection and homogeneity criteria. The example of jets given at the end of the paper does not require any homogeneity or global selection criteria, so it would be useful to include some examples of these in the description of the algorithm. Since the purpose of the new algorithm is to use it to analyse atmospheric data sets, I think it is important to make sure the practical applications of the algorithm are clear.

We added examples from our application for the local and global selection criterion to Section 2.3. We decided to add a global selection criterion on the lifetime of segments to the jet stream climatology. It excludes segments with a lifespan below 24h. The homogeneity criterion indeed is not useful for our application. However, it is an additional (optional) feature of the algorithm and is therefore briefly described.

(4) The authors should thoroughly check through the manuscript for grammatical errors as this could be improved considerably.

We will carefully check the whole text before submitting the revised version of our paper.

Minor Comments:

(1) Page 3015, line 3: Please rephrase the sentence beginning “These algorithms
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allow, for instance, to produce so-called: : :” as it is grammatically incorrect.

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We changed the sentence to: “These algorithms make it possible, for instance, to produce synoptic climatologies...”

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(2) Page 3016, line 2: Please change “was” to “were”.

ok

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(3) Page 3016, line 5: Please insert “current” before study for clarification.

done

(4) Page 3016, line 16-17: Please explain somewhere how the algorithm is more efficient to previous algorithms.

We added more detailed information on the implementation and used data structures to the Introduction and to Sec. 3. A newly added Sec. 3.4 compares our feature selection and tracking method using one pass over the data with other methods.

(5) Page 3016, line 19-21: Please clarify this point, it is not clear to me what is meant.

This sentence was removed as part of the revision of the introduction. The point was, that we detect not only a single feature, but the set of all disjoint features of the data set. This is a difference to region growing methods that start at a single seed point and identify one single feature. However, compared to other feature extraction methods, this is nothing special, so we completely removed this point.

(6) Page 3032, line 2-3: “multiple major, separate jet stream phenomena” please rephrase, I’m unclear what this means.

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We rephrased this sentence. It now reads: “As a direct consequence of the way we perform our feature tracking (see Sect. 3.2), major jet streams which are separated at first, but merge at some later point in time, are associated with the same 4-D segment.”

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(7) Figure 2: Please state in the caption what the different colours in the 3D features are.

The color is indeed not important for this figure. We have revised the figure with uniform color.

Interactive comment on Geosci. Model Dev. Discuss., 4, 3013, 2011.

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