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Interactive comment on "Atmospheric convergence zones stemming from large-scale mixing" *by* Gabriel M. P. Perez et al.

Anonymous Referee #2

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Discussion paper

Review of Atmospheric convergence zones stemming from large-scale mixing

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March 18, 2021

General

The authors identify and investigate convergence zones in terms of Lagrangian Coherent Structures. Mathematically, Fine-Time Lyapunov Exponent is used for the classification. By evaluating climatologies the results of the authors are consistent with previous investigations of the Intertropical convergence zone, the South Atlantik Convergence Zone and the South American Low-Level Jet. Furthermore, on smaller, regional scale, the authors show that rainfall and moisture flux anomalies are associated with LCS events.

The novel approach of the authors for the study of Convergence zone is interesting and motivate for further applications as it is suggested in the end of the conclusions.

Your approach might also be interesting for interdisciplinary working scientists from Meteorology, Mathematics, Informatics or Physics, who are all in the community in-

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vestigating algorithms and applications for coherent structures. Therefore, it would be helpful to explain, where the meteorological abbreviations stand for, e.g. TCWV (figure 5 and text) is not defined. Please make sure to define every abbreviation you use. Moreover, I recommend to include in the title the words "coherent structure" to have a wider readership. I appreciate the citations of the very classical works!

I recommend to publish this work in Weather Climate Dynamics after correcting some minor issues listed below.

Minor comments:

- p.2 line 45ff. Could you explain a litte bit more in detail how do you define coherence/coherent structures in terms of FTLE
- Further approaches do not count elongated structures as coherent sets, why does this work here?
- Are there further approaches to identify coherent structures of meteorological phenomena besides FTLE?
- fig 4: are the departure positions or the gradients of the departure positions are shown? Which unit does they have? Are they components of x0? The figure should be placed near the description in the text.
- TCWF is not defined (e.g. fig 5)
- figures and explanation of the figures are often placed far away in the paper, please check. E.g. fig. 5 on page 9, but explained on page 12, fig 4 is explained much later

- figure 5: How are the LCS calculated? Nice example, please explain more in detail on this example referring to the used formulas.
- Page 5: Would suggest to not end the subsection with a formula and place the formula before the sentence 'Physically, V is the average flow by which the total column (...)'
- Page 8: Since V_{ρ_v} is vertically integrated, I guess $V_{\rho_v} = V_{\rho_v}(x, y)$ such that $\mathbf{x_0}$ and $\mathbf{x_1}$ are in $\mathbb{R}^2$?
- Page 8: you integrate trajectories (2)-(3), but how do you identify the trajectory?
- Page 8, line 126 ff: why is the rate sigma exponential and not logarithmic (the sentence before that formula let us assume that σ is the exponential rate)?
- Page 8: why is $\lambda_{max(C)}$ at the same time an Eigen value (line 129 p.8)and a norm (line 134 p.8)?
- page 8: $\Delta t = 2$ days as time resolution. Did you use this time resolution for all results showing in the paper?
- page 10, l.160 please refer to (1)
- how does the method handle sources and sinks?
- page 13: you show the frequency of occurrence in $\%$, what is the absolute number of events (approximately)?
- p.13. beginning of 6.2 could you add 1 sentence what is the motivation of this comparison?
- figure 8 larger? The VIMF is hardly recognizable, but very interesting results.

- p.17 l. 303-304 (. . .) are consistent with pervious climatologies (. . .) please add sources
- p.17 l. 311-312 please add sources

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