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Nonlinear Processes in Geophysics
Discussions
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Interactive comment on "Trajectory encounter volume as a diagnostic of mixing potential in fluid flows: connection to diffusivity" *by* Irina I. Rypina et al.

Anonymous Referee #1

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This article presents a Lagrangian technique to estimate or measure the diffussion from the "volume encounter" magnitude defined by the authors as the volume of fluid that passes close to a reference fluid parcel over some time interval. The authors derive the analitical connection between this magnitude and the diffusion coefficient for 1d and 2d problems. Then, using the equations derived for the 2d problem, they apply it to ocean data from altimetry to reproduce and obtain maps of diffusivity for eddies on the Gulf Stream region.

This technique may have a strong potential to stimate in a smart way the diffusivity from Lagrangian trajectories data. However, the paper needs major revisions before

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Discussion paper

continuing the reviewing process,

1. The article is heavy deducing equations but short in results. The resuls section should be increased. A quantitative comparison of the diffusivity obtained through this method could be compared with other previous methods or results.

2. There are no cites to other problems related with the close encounters. The authors should cite preceding work where this concept was used to introduce the reader.

3. The article should be reestructured. In my opinion the article has many subdivisions which don't make easy to follow it. Once the "context" is given at the first paragraph, there is an informal definition of the volume encounter V (paragraph 2). Then, on the third paragraph the authors introduce the problem, then the methodology used. Then, again on the section (1.1) the authors introduce formal definitions, then describe in detail the problem again on the section (1.2). I suggest the authors, the description of the problem should be done at once, then present the hipothesis and finally the methodology that are going to be used to address the problem.

4. The notation should be improved to make it clear. There are undefined symbols. Some examples: -. Line 64. There is no definition for x. -. x_k is the trajectory k and x are the points which start at position xâĆĂ and time tâĆĂ and they have been integrated for a time T? The definition of the trajectories should be improved to make it clear. -. Line 103: "take steps of fixed length L". If it is an step the authors should be coherent with the notation an use δL -. Line 118: "over a time inteval t". "t" is not an interval. Maybe you mean t \in[tâĆĂ,T]

5. It would be helpfull the use of schematic images to show what is an encounter volume, with the corresponding notation. As an example, in Haller (2016) there are many schematic figures to introduce the reader on the concept and the notation.

6. The citation of the different Lagrangian methods is quite awkard. The citations are used just to mention properties of the Lagrangian problem itself. They should motivate

better the use of these citations.

7. There are severals sentences related to the choices or the scales of the problem that should be rewriten or at least support it with some reference.

8. In line 69 is written “The encounter volume depends on the starting time, integration time, the number of trajectories and the encounter radious. The dependences on the first three parameters are typical for all Lagrangian methods.” Does the authors’ method offer some advantage or diference higher than the mentioned? Methods as FTLE or FSLE depends on those three properites but other properties are derived from the particles trajectories. The LAVD also uses the vorticity along the trajectory. The authors should clarify better what is the advange or the difference than its method has over those ones.

9. line 74. “The integration time should be long enough for trajectories to sample the features of interest well, but short enough compared to their lifetime.” What happens if the time required to “sample of feature” is similar to lifetime? The second part of this sentence should be deleted or clarified. This is very arbitrary and depend so much of the phenomena in question.

10. “The grid spacing should be smaller compared to the sizes of the features of interest, and the encounter radios should be smaller than about half of the size of the smallest features of interest.” The idea behind this is to ensure that your technique will capture the smallest scales on the flow given mainly by the flow resolution. On this paragraph there are some assumptions that should be make it clear.

11. The image quality is really poor and the details cannot be appreciated.

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