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Interactive Comment

Interactive comment on "The multifractal structure of satellite sea surface temperature maps can be used to obtain global maps of streamlines" *by* A. Turiel et al.

Anonymous Referee #1

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The paper presents a method based on multifractal analysis, by which the direction of the ocean surface mesoscale velocities can be determined from microwave SST images. The skill of this technique is assessed by comparing the velocity direction obtained in this way with the direction of geostrophic velocities obtained from altimetry data.

The approach proposed is quite interesting since it suggests a way of using SST images for obtaining information of a velocity field and for validating altimetry.

My main concern however is that a large part of these results (especially the retrieving of streamline directions from microwave SST that is highlighted in the title, Abstract and in the Introduction) has been already described in previous papers. Some figures are even exactly the same as figures that have already appeared in other journals. The remaining original part is short and qualitative.

Hence in my opinion the paper is not ready for publication. It should be improved by (i) stating clearly and unambiguously what is the original contribution and (ii) performing a more quantitative and conclusive analysis. The title and abstract also should reflect the original part. This would require major changes to the text and to the structure of the paper.

Below I list some more detailed remarks and suggestions (see in particular point 4 and 6).

Detailed comments

1. Given the fact that several concepts presented in the paper are not standard for the oceanographic community I do find useful to present again some concepts already published, but this material should be clearly separated from the original results of the manuscript, should not be highlighted in the title or abstract and should not form the largest part of the manuscript. In particular, in the abstract and introduction the authors claim that they show for the first time how to retrieve circulation patterns on a daily basis from microwave SST images and multifractal formalism. This is misleading (wrong), this part of the work has been published already in Turiel 2008a. In particular, Figures 2 and 3 in Turiel et al. (2008a) are exactly the same as the two panels Fig. 1 of this manuscript; Fig. 8 in Turiel et al. (2008a) is very similar to some panels of Fig. 2 of this manuscript (the difference being arrows instead of SSH isolines and one month of difference). The multifractal formalism applied specifically to SST images has been presented in Turiel et al. 2005b; 2008a and Isern-Fontanet et al. 2007.

The original result presented in this paper is, as far as I can tell, the definition of some quantities that should characterize the skill of the method. This original part forms however a small fraction of the paper (section 4) and in my opinion is very qualitative.

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2. The discussion about the advective and material derivatives is in principle interesting but to me inconclusive. The difference between the two derivatives is the time derivative. If the time derivative is noisy the material derivative will be larger than the advective one, just because it has an extra term.

Moreover, if we take the ratio between the mean advective derivative and the mean material derivative for singularity exponents and SST, we find a lower value for SST. This seems to suggest that SST contours are a better indication of streamlines that singularity exponents.

3. The divergence speeds and the qualitative interpretation the authors propose, is not at all clear, at least to me. The isoline of a tracer does not separate from the streamlines, it intersects them.

4. Since the aim is to see whether the singularity exponents indicates the velocity direction better than SST gradient, why not measuring directly this angular relation? This could be done very simply, as A(theta)/(|v| |grad(theta)|). This quantity should be computed for both SST and singularity exponents. If (and where) it is smaller for singularity exponents, it will show unambiguously that the exponents are better than SST contours for detecting streamline directions. This result would be clear and interesting for a large community. The regional variability of this angular relation may also shed some light on why and where singularity exponents work.

5. The maps shown in Fig. 3 are very difficult/impossible to read, especially for the singularity exponents. What are the patterns for the singularity exponents? A zoomed image should be used.

6. I am confused by the fact that microwave images have a lower resolution than altimetry. The singularity exponents can gain a bit in resolution, but should not be able to add small mesoscale eddies. If they do, please show a figure with a mesoscale or filament detected by microwave and not by altimetry. I expect the agreement between sea surface height and exponents to hold for large scale structures (like the western

boundary currents shown in Fig. 2), less for other regions. In fact, looking carefully in the exponents of Fig. 2 (N Atlantic) I don't see any ring structure that should correspond to eddies if I look below 35S while I expect to see eddies in an altimetry image of this region. A zoom 20x20 deg. and far from a boundary current should be done, for better understanding the agreement between singularity exponents and streamlines.

7. SURCOUF: the description that is given of SURCOUF is incomplete, and does not allow to see the difference of the SURCOUF product in respect to standard multimission AVISO products (the presence of Ekman currents, I think). Why is this dataset “new generationn”? The focus on the altimetry period with higher accuracy is good but has probably a marginal effect on the validation, since anyway SST images are of much lower resolution. If the authors want to highlight the use of a product with Ekman currents or the choice of the period with a maximum of altimetry satellites they should show that these ingredients have an important impact on their result. This can be easily done by recomputing one of the diagnostics with a standard altimetry product.

8. Finally, I do not agree that "We have no synoptic maps of ocean currents". Altimetry data like AVISO products has been used successfully for many synoptic studies of oceanic mesoscale dynamics, also outside the special years chosen by the authors.

Interactive comment on Ocean Sci. Discuss., 6, 129, 2009.