Ocean Sci. Discuss., 11, C1135–C1137, 2014
www.ocean-sci-discuss.net/11/C1135/2014/

Ocean Science
Discussions
Open Access

Interactive comment on "Technical Note: Watershed strategy for oceanic mesoscale eddy splitting" *by* Q. Y. Li and L. Sun

Anonymous Referee #2

Received and published: 8 December 2014

The authors describe a new method to identify mononuclear eddies from AVISO maps of sea level anomaly (SLA). The method is based on the concept of watershed identification. On a SLA map, each eddy is assumed to represent a single watershed. The watersheds are identified using the "path of steepest descent" method. According to the authors, this strategy represents a fast and efficient way to identify eddies without incurring in the problem of multinuclear identification (e.g. two distinct eddies wrongly detected as a single one by the automated method).

Such problem does indeed affects existing eddy detection methods, and I do believe that the method proposed by the authors has the potential to provide a possible solution. However, I think the proposed method is currently poorly presented by the authors. This makes it hard to evaluate the robustness of the results and the reliability

of the method for practical applications. In particular, in my opinion, the study as described in the present version of the manuscript has three main flaws. These will have to be addressed before considering the manuscript for publication:

1 - The study presents a method to detect mesoscale eddies; however, the authors never provide a geophysical definition for such structures. They try to provide one in section 2.2; however, to me, that is rather a functional definition on which the detection method is then based on. All the other studies cited in the manuscript (e.g. Chelton, 2011; Chaigneau, 2008; Nencioli, 2010) first clearly identify what geophysically they consider an eddy (e.g. a coherent structure characterized by water rotating around a common center), and then develop their algorithm accordingly (minimum of OW parameter; spiraling streamlines; rotating velocity vectors around a velocity minimum).

Without providing such definition it is hard to understand why this method would provide improved results in terms of eddy shapes and intensity than, for instance, the method by Chaigneau et sal., 2011 (pag. 1721, lines 6-13). More importantly, without such definition it is hard to understand why (for example) the area marked by 2 in Figure 4 should be considered all part of the same eddy. Based on the geophysical definition adopted in previous studies it should not: the area clearly crosses multiple isolines, thus encompassing water masses not rotating around the common center in 2. The same is valid for the area 3.

It is important to notice that the study by Haller and Beron-Vera (2013) also cited multiple times in the manuscript, adopts an even more conservative definition: an eddy is not only a rotating structure, but also a structure that retains all its initial mass as it propagates (that's the reason why they are compared to black holes). The eddies identified in figure 4, do not correspond to this definition either.

My impression is that the method could be used to identify the areas around single local minima. Then within those areas, one of the existing methods could be used to identify the portion corresponding to a mesoscale eddy.

2 - At the same time, I am not convinced that the method could work on realistic SLA fields, where local maxima and local minima of SLA coexist. (Note that the examples only show applications to SLA field characterized by negative values). In hydrology, watersheds identify the boundaries between different drainage basins. By definition, they correspond to mountain ridges. Therefore, for the way the method is currently presented, my suspect is that in the presence of local maxima of SLA the boundary of a cyclonic eddy would be identified across such maxima. As such, it is hard to understand how the method would be capable to identify anticyclones, as well. A more realistic example with a SLA field including both cyclones and anticyclones at the same time should be provided.

3 - Finally, it is really hard to understand sections 3.2 and 3.3, which describe how the method works. I think that paragraphs with proper sentences (instead of the two bullet-lists provided) should be used to describe the algorithm. Please reduce the use of code notation (e.g. i = i+1; if i > n) to the minimum necessary.

Also, the first sentence of section 3.2 says: "For any multinuclear eddy, the following...". Would that multinuclear eddy be detected by your method? If so, how? Or, should another method be applied before applying your method? If so, you should clearly state that your method of detection would not be completely independent/original but it would simply complement one of the existing detection methods.

Similarly, point 1 (still on page 1724): "Label the extrema as cyclonic...". How are those extrema identified? No detail is provided.

The above comments will require substantial modifications of the technical report in terms of both structure and content. In its current state I cannot recommend the manuscript to be accepted for publication.

Interactive comment on Ocean Sci. Discuss., 11, 1719, 2014.