

## ***Interactive comment on “Mesoscale eddies and submesoscale structures of Persian Gulf Water off the Omani coast in Spring 2011” by P. L’Hégaret et al.***

### **Anonymous Referee #2**

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#### General comments

The authors discuss the properties of mesoscale eddies and sub-mesoscale structures that are created by the outflow of dense saline water from the Persian Gulf based on in-situ measurements. The material, exclusively based on field observations, can be of interest to the scientific community.

Overall it is rather difficult to follow the text. While the authors name some structures in the text as C1 or A2, for instance, these identifiers are not shown in the actual figures, only in the captions. I suggest that each individual structure referred to in the text should carry some consistent identifier that is also displayed in graphs.

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According to the introduction, one of the objectives of the paper is to describe the structure of sub-mesoscale fragments and to explore their recurrence. I don't see that the authors achieve this objective. For instance, statistical methods could have been used to derive typical length scales etc.

Overall I believe that the material presented is publishable in Ocean Science, but the manuscript requires substantial revision.

#### Specific comments (major points)

1. Introduction. What is the significance of these structures in the broader context such as the oxygen budget or carbon fluxes in the northern Indian Ocean? Why is it important to study them?

2. Okubo-Weiss quantity. What is the main difference between deformation- and vorticity-dominated structures? The authors show give specific reasons as to why this parameter is used in the work. The authors derive this quantity from instant measurements. Do such snapshots tell us anything about the hysteresis of structures over seasons?

3. Spiciness. The authors need to provide a reference for their spiciness formula. Isn't spiciness defined as the potential temperature  $\theta$  and salinity  $S$  of sea water at a given isopycnal surface (e.g., Veronis, 1972; Munk, 1981; Flament, 2002; Huang, 2011). I don't see the causal link between this definition and how spiciness is used in this work. Please explain and add references.

4. Give specific reasons for the use of two-dimensional Ertel potential vorticity.

5. What are ADCP currents used for in this work? I understand that most of dynamic properties are derived from the (corrected) TS climatology. Please clarify.

6. In Section 5.2. the authors state: "Since a strong shear and strain is necessary to break the PGW outflow and to form lens and filaments, it is logical to observe fewer submesoscale PGW structures during the summer monsoon". Yes, this seems to be

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logical, but you still need to have conclusive evidence in support of this hypothesis. Without any evidence, this section should be removed.

7. Figure 9: Can the authors please explain why the geostrophic flow field looks so different from the ADCP flow field? Is there a mistake? Perhaps the geostrophic flow field was plotted upside-down?

7. Figure 14: Can the authors explain the fundamental difference between the geostrophic and ADCP flow fields? Is there something wrong here?

Specific comments (minor points)

1. In the abstract, the authors state: "As well, recirculation of the PGW is observed, thus having the presence of salty nearby patches with two densities". What is meant by two densities? Please clarify.

2. What is an isospice? Provide a definition. Has this been used before?

3. Figure 8: The terms salty & fresh injections are not used anywhere else in the text. So, why are they used in the legend?

Technical comments

1. In the abstract that authors state: "The different mechanisms leading to its formation and presence are assessed here." "Assessed" is probably not to correct word here. "Examined" is probably a better word choice, although the authors only provide some suggestions in the end.

2. In the introduction the authors state: "Second, to concentrate on the submesoscale fragments detached from or by the mesoscale eddies, and then on the nature, structure, recurrence and possible role of such fragments". This sentence is confusing and incomplete. Role in what? Perhaps this sentence should read: "Second, we focus on submesoscale fragments detached from or embedded in mesoscale eddies to describe their typical structure and recurrence."

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3. In the results section the authors write: "This will be evidenced now with the Physindien experiment data". "Will" and "now" don't make sense in the same sentence. Better: This feature is now also documented with observational data from the PhysIndien survey.

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Interactive comment on Ocean Sci. Discuss., 12, 2743, 2015.

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