

## ***Interactive comment on “Multi-sensor in situ observations to resolve the sub-mesoscale in the stratified Gulf of Finland, Baltic Sea” by U. Lips et al.***

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Received and published: 4 March 2016

Comments:

### 1. Scientific significance:

The paper touch upon a very important issue, namely the effect sub-mesoscale processes have on vertical mixing and thereby supply of nutrients to the euphotic layer impacting primary production and thereby the whole ecosystem. Most numerical models do not have sufficient spatial resolution to handle these processes, and it is a big challenge to find a good way to parameterize these processes in larger scale models. Assessment of the importance of sub-mesoscale processes is not new, however

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the compilation of different in situ data to give a 3(4)D view of the processes is to my knowledge quite unique.

## 2. Scientific quality:

The scientific approach and applied methods are valid. However, my main concern about the paper is how the data are discussed and analysed, the readability. Many time series (wind, hydrography and Chla from different sources) are discussed separately by describing many individual events, and the reader is “drowning” in many event descriptions, having a hard time to connect the links between wind events, up-down-welling, sub-mesoscale features and Chla/prim.prod.

One of the key findings is the typical -2 slope in the horizontal wave number spectra, however it is only in the final discussion they describe what this physically/practically means, namely that sub-mesoscale processes are more energetic than suggested by the quasi-geostrophic theory of turbulence in the ocean interior (maybe obvious to specialists in turbulence). In this respect I would also like to see some quantitative “thoughts” on how much it changes the actual vertical mixing/vertical transports and how we maybe can use this to improve the parameterization in numerical models.

Several places there the direct effect of wind mixing is mentioned. This is more related to the cubed wind speed (than the wind speed), and I suggest including simple time series of cubed wind speed (based on the highest possible resolved data and thereafter averaged to a suitable (daily?) time-resolution).

## 3. Presentation quality and specific comments

As mentioned above, I would suggest to delete the detailed and lengthy descriptions of the individual data series, and rather focus on fully descriptions of the individual events. This could mean rearranging some of the figures. Some specific comments:

a. Most figures have too tiny text on the axis. Especially I had a very hard time with this on the important Fig.3. This must be changed.

- b. Suggest to change “sub-mesoscale” to “sub-mesoscale features” in the title.
- c. When first mentioning the spectral slope (-2 versus -3) in the introduction they should say what this actually/physically means (see comment above on this).
- d. Suggest adding some names on countries and the Baltic (No American would know where this is on earth).
- e. The data from the ferry is assumed to have 160m resolution. I guess this is assuming the ferry always have the same constant speed, independent of weather etc. If this is not the case, how would it affect the results?
- f. Related to Figure 2 I would also would like to see time series of cubed wind speed and take this into the discussions/descriptions
- g. Fig. 3: In addition to not being able to read the axis text and numbers, it took me a long time to understand the figure. I think some better description on how the data are combined in the different cubes would help.
- h. It is mentioned that the spectral slope are up to -3.7, but it is unclear where this is found. (Max values in the table is -2.6)
- i. In Fig 6 it is not described which line is what
- j. In 3.5 you should also mention that convergence/divergence may rapidly change the concentration of Chla

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Interactive comment on Ocean Sci. Discuss., doi:10.5194/os-2016-5, 2016.

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