

**Interactive comments on the paper “Mesoscale and submesoscale dynamics of marginal ice zone from sequential SAR observations” submitted by Igor E. Kozlov et al, 2020.**

**Overall quality:**

The paper brings to the attention an interesting ability to examine the mesoscale to submesoscale dynamics in the marginal ice zone using the MCC method on a number of Sentinel-1 A/B SAR acquisitions at short revisit times.

Hitherto the MCC has been frequently applied to optical- and altimeter-based satellite data for studies of mesoscale dynamics in coastal regions. In this paper, the novelty relates to the use of the MCC method to a series of Sentinel-1 SAR image acquisitions in the marginal ice zone, demonstrating promising results.

The paper is fairly well structured and written, with the inclusion of very good figures.

**Scientific issues:**

The paper title should preferably be modified to read: Mesoscale and submesoscale dynamics in the marginal ice zone from sequential SAR observations.

The abstract is perhaps too brief. The importance for model validation should be mentioned in consistence with the Discussion and conclusion section.

The submesoscale dynamics are also recognized to have intense, narrow bands of vertical motion. The authors need to address this issue in regard to the application of the MCC method whereby only the estimation of horizontal motion is discussed. For instance, could patterns evolve as influenced by the vertical motion, rather than the horizontal motion. The marginal ice zone is periodically also known to have bands of strong wind induced upwelling that would also influence the subsequent dynamics.

Moreover, the data are collected in September. This is related to the time of year of minimum sea ice extent and concentration. The summer sea ice melt is also nearing an end. Does this set up a shallow mixed layer regime in the MIZ that favors the presence of these mesoscale to submesoscale structures? If so, is there a seasonal variability to these SAR image expressions? It could be good to have this commented and/or addressed.

When Sentinel-1 is mentioned for the first time be more precise; e.g. Sentinel-1 is the European Radar Observatory for the Copernicus joint initiative of the European Commission (EC) and the European Space Agency (ESA).

**Technical/editorial corrections:**

Line 7: Abstract: .....retrieval in the .....

Line 8: remove.....made.....

Line 9: replace....obtaining ...with ....estimation of....

Line 11: ....strong sea ice concentration and vorticity...

Line 14: ....polar ocean has rapidly grown during....

Line 16: ...major source of uncertainties in the....

Line 22: ....remove.....cyclonic....  
Line 23:.....ice edge melt rate of....  
Line 29:.....large vertical velocities that can entrain....  
Line 51: Be consistent in the use of naming convention. Sentinel-1, rather than S-1, is my preference. The former is used in all Figure captions, while it is a mix in the text (although line 51 say...hereafter S-1....  
Line 62: .....remove.....from.....  
Line 63/64: daily basis over region of particular interest, such as the European Arctic Ocean (Fig. 1.a) with 43 S-1 A/B acquisitions available....  
Line 66: ...by overlapping SAR scenes.  
Line 67: ..SAR data , O(100m), ensure a unique....  
Line 68: To demonstrate the potential we analyze....  
Line 69:.....the warm Atlantic Water (AW).....  
Line 76: ....SAR images has several steps:....  
Line 94: and display a large number.....  
Line 101: ...with model results reported by.....  
Line 103: .....for surface current estimation using the MCC method.  
Line 113:.....evolves into the large anticyclonic...  
Line 128/129: This sentence should be improved. Avoid expressions like.....its movement direction.....  
Line 146/147: ....for eddies A ( $\xi \approx 0.07$  f) and C ( $\xi \approx 0.3$  f) yields a larger Rossby number than for....  
Line 163: ...use same unit for EKE in text and Figure Maybe also color scale in the figure could be extended to identify values of  $0.3 \text{ m}^2/\text{s}^2$ .  
Line 164:.....EKE values were attributed to the complex...  
Line 173: ....of anticyclonic flows that are very effective.....  
Line 174: ... use..... relative vorticity .....instead of .....vertical vorticity.....  
Line 184: .....data to resolve small-scale processes of the complex....  
Line 186: .....features may importantly enhance the vertical.....  
Line 187: ice and influence sea ice melt, upper ocean stratification,...

#### Figure captions:

Line 254: ....showing the coverage of Sentinel-1 A/B SAR image acquisitions...  
Line 261 (Figure 2): ....Sentinel-1 A/B images acquired on ...  
Line 262: .....the SAR image and b) map of the horizontal velocity (speed in color)  
Line 266: relative vorticity normalized by the Coriolis