The Cryosphere

Discussions

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Interactive comment on "Brief Communication: Mesoscale and submesoscale dynamics of marginal ice zone from sequential SAR observations" *by* Igor E. Kozlov et al.

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The manuscript reports on the use of consecutive (separated by 48 minutes) SAR images of the sea ice distribution in the marginal ice zone of Fram Strait. A method is described to extract the ice velocity at a resolution of hundreds of meters or several cm/s. In the described low ice concentration regions, the ice velocities likely correspond to the ocean velocities underneath. The authors demonstrate that this method can be used to obtain mesoscale and submesoscale oceanic dynamics at unprecedented resolution. This is of high interest both for sea ice physics and physical oceanography as the dynamics of the MIZ depends on both and can only be understood by considering

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both. The brief communication is well-written and succinct. I have no major issues with the manuscript, but would like the authors to clarify a few things. That should be straightforward to do. The minor points below should likewise be easy to address. Therefore I recommend minor revision.

Main points:

1. The manuscript impressively demonstrates how well the method works in this one example. However, it would be good to know how usable this method is in general. It would be great if the authors could provide the answers to the following questions in an additional paragraph.

How much effort is it to obtain the velocity vectors for an individual image pair? If it is a lot of work: Can you share the software code such that researchers can run it for their own individual time/location of interest? If it is not much work: Can you make this method operational and provide to others the velocity vectors at all times/locations where appropriate image pairs from Sentinel 1A/B exist?

When can this method be used? What is the range of sea ice concentrations where it applies? Are there differences between seasons in the detail/precision/ease with which the method can be used? E.g. maybe in July (melt season) there is less texture on the sea ice that the satellite could pick up than in September (start of refreezing). Are there influences of weather on the method (e.g. clouds, fog)?

2. The example presented here is from September 2017 in the marginal ice zone in Fram Strait. My high resolution shipboard in-situ study of a submesoscale filament (von Appen et al GRL 2018) was from July 2017, i.e. 3 months earlier. Is there a reason you chose the later time? A direct comparison between the in-situ and the remote sensed data could benefit both methods and reveal more information on the ocean than to consider them separately. I'm not suggesting to change the example presented here, but it might be nice to follow up by also using the method on the July 2017 example, hence also the motivation for the questions under point 1. above.

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3. The grammar in the manuscript needs careful editing. Especially articles (a/the) are often missing. I point out a few (but by no means all) of these instances below. I'm not sure whether this should be done now or will take place anyways after acceptance by the journal's copy editors.

Minor points:

l1 title consider "dynamics in the marginal"

l7 "New possibilities for . . . over the marginal . . . are demonstrated"

l8 "within 70-85°N or 70-85°S"

l14 "oceans has been rapidly"

l23 Can that melt rate also be expressed as m/day in the vertical?

l39 Can you give a number what "relatively low concentrations" means (see main point 1 above)?

l45 "independent of"

l51 "has recently become"

l88 "the velocity detection threshold in this case would be 0.03 m s-1" I think it is not just the threshold, but also the precision of your method. I.e. you can only determine the velocity to be 0.03m/s, 0.06m/s, 0.09m/s, and so on. Or am I misunderstanding this?

l93 Did you mean 1150km^2? Otherwise the area would only be 2km long (multiplied by 60km width).

l105 "meaning" How does the second statement (reflects underlying circulation) follow from the first statement (3-5m/s)? Maybe you should state that the winds were very weak or something like that.

l126 ". . . von Appen et al (2018) where velocities of +-0.5m/s were observed with a

vessel mounted acoustic Doppler current profiler."

l130 "in opposite directions"

l148 "one sees very"

l162 "0.02 mˆ2 sˆ-2", i.e. same units as on l149

l165 "instability, of"

l173 "flows which are very effective at producing"

Fig1b Mark box for Fig1c

Fig1c Mark box for Fig2. Otherwise Fig2 would not be georeferenced.

Fig2 Mark box for Fig3. Also consider adding a vector showing the wind direction and a scale vector for 1m/s ocean velocity.

Fig3 Consider to also show strain in a subplot. Also add the "A, C1, F1" letters and the F1 arrows to all subplots to make a comparison easier.