Review comments to 'Impact of tidal dynamics on diel vertical migration of zooplankton in Hudson Bay' by Petrusevich et al.

In this work the authors use ADCP backscatter and velocity data from a mooring in western Hudson Bay to infer diel vertical migration patterns. They present some interesting data, however, the results presentation and interpretation require more in depth work to make this work publishable.

General comments:

1. How do you make sure that the backscatter that the ADCP sees is actually zooplankton? The ADCP will 'see' anything from suspended sediment, bubbles, krill, fish, plankton etc. The presence of increased amounts of backscatter within the water column together with location in the water column and timing can give suggestions as to what is causing the backscatter: e.g. storminess leads to an increase in bubbles, or the day vs night timing gives an indication that you are seeing vertical movement of biological matter. BUT, how can you infer that you are seeing zooplankton moving rather than fish that migrate vertically from your data? Your sediment traps are fairly small and could easily miss swimming species.

2. What particle size classes does your ADCP 'see'? How does this tie in with your definition of zooplankton?

3. The analysis and description of the results needs to go into more depth. At the moment it is mostly descriptive and does not go into enough detail describing the very interesting dataset. Additionally, part the results are presented in the discussion. This needs to be tidied up.

4. This is a paper supposedly on DVM, however, in the results DVM patterns aren't really described at all, nor is the tidal modulation.

5. The authors also need to be careful to separate out the supposed swimming behaviour of the zooplankton, i.e. DVM, from the tidally induced movement of particles (also backscattering) in the water column.

6. The authors need to take more care in backing up their claims with either features that can be seen in the their data or else from relevant pieces of work in the literature.

Specific comments:

Introduction: How do you define zooplankton here? What size classes or types of plankton are included or not included?

Line 20-22: Better off before the question at the end of the paragraph

Lines 24-26: There are other diel migration patterns as well. See e.g. introduction to Cisewski et al, 2010

Line 30: Would it worth looking at Antarctic literature as well?

Line 60: There are multiple sets of references and an extra 1.

Line 94: Given that you talk about stratification in the introduction and there are some interesting vertical signals in your plankton distributions analysing stratification could lead to some interesting additional conclusions. In plots 3 a and b there is some indication that plankton distribution could be linked to MLD.

Line 101 -109: How representative are the samples from your sediment trap at capturing actual distributions of zooplankton in the water column? I guess you are assuming that organisms 'fall' into the trap and cannot avoid it by swimming back out of the funnel?

Lines 110 to 116: They are also limited because you cannot tell what is causing the backscatter! How do you determine that your backscatter is zooplankton and not other biological matter or sediment…?

Line 116: Full stop missing and 'by multiplying 1.115' → by multiplying with a factor of 1.115. I assume this is to correct for density differences between water and ice? If yes, say so.

Line 135-140: How do you know that the >500um makes up the greatest amount of backscatter? Why do you choose a >500um mesh? Mesoplankton is normally defined as 200um to 2mm in size…. What is the ratio between smaller species and larger species?

Line 145: Do you have evidence for the reasons the ice varied? If yes, detail it, if not, I would speculate here.

Figure 2: I find the y-axis very unintuitive – I feel it would be best to flip it upside down with 0 m at the bottom and 1.5 m at the top

Section 4.1: Section lists 'wind data' however it is not mentioned in this section.

Figure 4. The green-yellow colorscale makes it really hard to see anything. I suggest changing it a blue white red colorscale.

Lines 156: Maximum backscatter is consistent with many things. It only becomes consistent with DVM once you compare it to the midnight timeseries.

Section 4.2: Could you back your descriptive results up with some numbers? Calculate the difference in backscatter between day and night in the different layers – is there a statistical difference?

Lines 156-157: Evidence of MLD?

Line 165: are → is, actograms → actogram

Line 165-166: Describe the resemblance in shape – when in the day-night cycle do you see increased backscatter? Mention dawn and dusk enhancements/absences which could be indicative of swimming behaviour

Figure 3. I would add a time series of sea ice cover here for ease of comparison.

Also Figure 3. In the 80 m and 60m band there is increased backscatter at dawn and dusk regardless of ice cover.

Also Figure 3. Do positive vertical velocities resemble an upward movement of particles?

Lines 180 and after: I would make it clear somewhere here that your vertical velocities encompass both moving of water particles but also other particles in the water column and are thus a mixture of

both. Really importantly, the velocities are a mixture of passive (tidally-driven) and actively moving particles (e.g. zooplankton or possibly fish).

Lines 181-183:

> You say they have the same shape, but what does that actually mean? What signals do you see in the velocities? E.g. in the top layers you see negative vertical velocities in the 20 m layer at dusk and positive ones at dawn. However, assuming that positive vertical velocities resemble an upward movement of particles, this means that there is a net downward migration at dusk – this would be counterintuitive to the DVM you are describing, at least for this layer.
>
> Can you back any of your claims with numerics? Yes, you can see a pattern but is it statistically significant? E.g. calculate mean backscatter in daylight hours vs night hours

Lines 185-187: This description belongs in the methodology.

Lines 187-190: So what is the diurnal variation? What is the pattern you see? How does this match up with your results in Figure 2? There you seem to find the strongest signals in the deeper layers?

Lines 191 to 192: It is not clear to me what you have done here. Are you looking at semi-diurnal horizontal tidal currents? Or are you looking at horizontal tidal currents from the ADCP which are semi-diurnally dominated? How have you post-processed your current data? Have you removed any tidal signals? What bandwidth are you using? It looks like it is greater than the semi-diurnal frequency?

Line 200-204: This belongs in the methodology. What do these parameters mean for your data?

Line 200-201: I don't see a semi-diurnal signal in the currents – this is a spring-neap signal

Lines 194-195: Yes, horizontal tidal currents tend to be at least an order of magnitude larger than vertical ones.

Section 4: It is not quite clear to me what the point of this exercise is? You show that you have stronger horizontal and vertical currents during spring tides and the opposite for neap tides. This is commonly known. So where does the link to DVM come in? Where do you show the tidal modulation your title promises? And you have removed the 12 hr signal that would give you the DVM? In Hudson Bay, the tides vary throughout the year due to changes in ice cover and stratification – how do you separate these effects from DVM?

Figure 5. Describe the results from panel 5d in the text. How do you calculate your correlation coefficient? What time window is used? How did you obtain your backscatter time series? You obtain both significant positive and negative correlations, why are the negative ones not shaded pink?

Line 214: Provided you know you are looking at zooplankton – see general point 1

Line 217: How do you know it's 5 mm – what is the size range on either size? What uncertainty exists here? What about objects larger than 5 mm? Or sediment?

Line 224: You are assuming that your trap is reflective of what's in the water column. Did you check this or can you prove this is correct any other way?

Line 262-237: This needs to be backed up with an appropriate description of your results

Lines 258 – 280: This is not discussion but description of results – move to results section

Lines 294-300: This belongs in the results

Line 301: Where do you show the water column is stratified?

Line 301-304: You get changes in vertical velocity without interactions with topography? You don't show there are interactions with topography here. Also, the paper you reference here is for South Hudson Bay…

Line 305-307: This can also be caused by the presence or lack of sea ice (see. e.g. Kleptsova and Pietrzak, 2018, Ocean Modelling); also reference needed

Line 312-313: You don't show that there is reduced DVM during spring tide

Line 332-333: You do not show this anywhere.

Line 336-337: Again, you speculate this, there is no evidence for this presented.