

The Cryosphere Discuss., referee comment RC1
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Comment on tc-2020-324

Anonymous Referee #1

Referee comment on "Multiscale Variations in Arctic Sea Ice Motion, Links to Atmospheric and Oceanic Conditions" by Dongyang Fu et al., The Cryosphere Discuss.,
<https://doi.org/10.5194/tc-2020-324-RC1>, 2021

Fu et al 2021

Overall: The authors utilize EOF analysis to deduce patterns of ice drift and their correlation to atmospheric and oceanic influence. The analysis methods are sound, but I have questions about some results and their interpretation (please see below). I recommend that the paper may still be eligible for publication if these issues are adequately addressed.

Line # Comment

3 Arctic sea ice motion of sea ice

6 the three major Arctic sea ice drift patterns

7 the three main sea ice drift patterns – there are others – why are these the main ones?

20-23 A little too basic for anyone reading this

33-35 Repetitive: significantly affects the thickness distribution of sea ice

40 Eliminate "The"

40 Earlier there were 3 drift patterns cited – now there are 4?

67-68 We know that sea ice movement affects ocean currents. Is the converse also true?

74 (Tschudi and C., 2019) - bad reference. Should be:

Tschudi, M., W. N. Meier, J. S. Stewart, C. Fowler, and J. Maslanik. 2019. Polar Pathfinder Daily 25 km EASE-Grid Sea Ice Motion Vectors, Version 4. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. doi:
<https://doi.org/10.5067/INAWUWO7QH7B>.

148 Summer sea ice extent is much lower than winter, so in the summer there is substantially less ice to track, resulting in no drift speeds for large portions of the Arctic, where there is no ice cover.

174 Also quite important that there is less ice in the summer (see above)

300 How do you know causality here? In other words, as you've stated, ocean currents can affect sea ice motion by drag, but ocean current speed and direction can also be impacted by the movement of the sea ice. Which is driving which? We know that large-scale oceanic currents, like those in the thermohaline circulation, are driven by sea ice melting/freezing. You probably also mentioned this, but again, I think it's difficult to say how much the ocean is influencing the sea ice motion vs the sea ice motion influencing the ocean. It may be better to conclude that the RELATIONSHIP between sea ice motion and ocean movement is strong in certain areas and periods, rather than the INFLUENCE of the ocean environment of sea ice movement.

352 We have found the opposite: summer sea ice tends to drift faster than winter, since it is thinner, has lower concentration, and is more easily influenced by winds.

