Overview
By utilizing three satellite data products, the authors are trying to explore the relationship between the sea ice, clouds, and radiation in the Arctic. Though the results are within expected, studies like this work are important to gain a better/deeper understanding of the highly coupled Arctic system, especially from the observational perspective. I think this paper can be published on ACP after addressing the comments listed below.

Major comments

1. About the relationship table (Fig 3.), I have a couple of questions. (a)In CERES data, we see a negative SIC- ice cloud relation is all seasons, yet a positive relationship in terms of the average. I notice the authors mentioned this a bit in the text, I wonder how reliable are these numbers? (b) Mixed-phase clouds have a stronger negative relation with SIC than liquid clouds, especially when looking at non-summer seasonal correlation. Can the authors explain why? (c) related to (c), for DARDAR, the average correlation for liquid clouds is greater than mixed-phase clouds (-0.81 versus -0.67), while seasonal correlation is the opposite. Why? Any possibility this is due to the limited data [4 years only]? If so, the authors should be more cautious when interpreting the correlation numbers here and explain why.
2. By looking at the maps in Fig5, the strongest correlation happens in Autumn (SON), not winter (DJF), which is opposite to these numbers indicated in Fig3. This is especially true for the PHACT data. Please reconcile.
3. Why is the ice cloud much more over the ocean than over sea ice in Fig.7? Is this due to the deeper convection and higher possibility of the cirrus clouds or low- and mid-level ice clouds driven by small local convection? On the other hand, we see little difference (open water - sea ice) in terms of the liquid and mixed-phase clouds, both of which are low-lying clouds and seem independent from the surface type (open ocean vs sea ice). These seem not consistent with the author's interpretation in the text (also see minor #3).
4. In addition to the maps in Fig 8, I am thinking it would be very helpful to show a time series of LW_up, LW_dn, SW_up, SW_dn, and LW_CRE and SW_CRE at the surface, such as during 2007 - 2020 when sea ice is observed to decline. This would not only provide detailed process-level understanding, rather than the mean, but also offer insights for the future Arctic change.

Minor comments

1. L10: In the abstract, it would be better to briefly mention why SIC decreases + liquid cloud increase result in an enhanced surface cooling at the surface.

2. L145: Are the results sensitive to the SIC threshold to classify open-water (SIC < 0.4) and sea-ice (SIC > 0.6) grid boxes?
3. L150: For DARDAR, ice cloud cover increase over sea ice is not subtle; instead, it is significant (>10% for DJF below 5 km) and largely dominate the total cloud cover change.

4. Fig.2: liquid clouds have the largest seasonality; I wonder if the community knows the reason for this. Also, the pure liquid cloud cover is larger than mixed-phase cloud cover; is this consistent with other observational studies? Can you explain why this is the case?