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Interactive comment on "2020 Larsen C Ice Shelf surface melt is a 40-year record high" *by* Suzanne Bevan et al.

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This paper examines the factors that led to record levels of surface melt over the Larsen Ice Shelf in the late summer of 2020. The authors first establish that melt in this region during the 2019/20 summer was indeed exceptional by constructing a 40-year time-series of a melt index based on both passive and active microwave remote sensing. Having set the 2019/20 summer in this longer-term context, they go on to search for atmospheric drivers of the extreme melt. They conclude that the extreme warmth seen in the region during early 2020 was a result of an interaction between the teleconnection pattern associated with the Indian Ocean Dipole (IOD) and a rapid change in the phase of the Southern Hemisphere Annular Mode (SAM), the latter possibly being associated with a rare Southern Hemisphere Sudden Stratospheric Warming (SSW). The paper is

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Discussion paper

well-written and includes clear and well-designed figures. The methodology is clearly described and is appropriate to the problems being studied. The authors' conclusions are fully supported by the results that they present. My recommendation is that the paper is suitable for publication in TC following attention to the specific points that I raise below and further minor comments that I have made on the annotated manuscript.

Specific comments 1. In their study of atmospheric drivers, the authors focus on teleconnections with the IOD and their interaction with the SAM. It is well-known that teleconnections associated with ENSO in the tropical Pacific also affect the Antarctic Peninsula region through the Pacific-South American (PSA) teleconnection pattern. In early 2020 ENSO was in a rather weak warm phase which is generally associated with high pressure to the west of the Antarctic Peninsula. However, there is no clear indication of a PSA wavetrain in figure A2 and it looks as if the IOD is dominating on this occasion, which justifies the authors' focus. It would, however, be helpful to discuss the (lack of an) ENSO response on this occasion to relate your findings to other work on southern hemisphere teleconnections. 2. Southern Hemisphere teleconnection patterns are generally weaker and less robust in summer than in winter. The averaging periods for the geopotential height anomalies shown in figure A2 a-c appear to have been chosen "...to maximise signals...". How sensitive are the patterns to the exact choice of the averaging period? Are the anomalies statistically-significant? It is standard practice to indicate areas of statistical significance on plots like these.

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Please also note the supplement to this comment:
https://www.the-cryosphere-discuss.net/tc-2020-130/tc-2020-130-RC1-supplement.pdf

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