

# ***Interactive comment on “Brief communication: Changing mid-twentieth century Antarctic sea ice variability linked to tropical forcing” by Chris S. M. Turney et al.***

## **Anonymous Referee #1**

Received and published: 23 May 2017

Short summary: In this manuscript Turney and colleagues investigate the possible impact of the equatorial Pacific temperature on sea ice extent off George V land and in the Amundsen sea. It is hypothesised that the equatorial Pacific temperature variability generates Rossby waves that lead to modify the atmospheric pressure in an area of the South West Pacific and in the Amundsen Sea Low with implications for the Antarctic sea ice. This hypothesis is checked using reanalysis and an intermediate complexity climate model assimilating surface temperature observations.

General comments: The precise goal of this manuscript is not clear. In particular it is not clear what are the time scales of interest to the author. The title says that there is a link between tropical forcing and Antarctic sea ice variability. In the introduction and

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in the conclusion multi-decadal to centennial variability seem to be the interest because trends of sea ice extent over multiple decades are discussed. On the other hand most of the manuscript seem to be about inter-annual variability using seasonally averaged detrended ERA-interim surface pressure and HadSST Nino3.4 to show linear correlation between different regions. The physics of short and long time scales is not the same for example Ferreira et al. 2015 show that the same wind anomaly produces opposite effect on sea ice extent at short and long time scales.

Therefore my recommendation is that the authors make clear what they are trying to show and align their demonstration accordingly. If the focus is the inter-annual variability of sea ice then the conclusions cannot be used to explain the multi-decadal trend observed during the satellite period. If the focus is on the multi-decadal trend of sea ice extent then a detrended Nino3.4 index doesn't seem to be a good index to use because the time scale of El-Nino is 2 to 7 years. Maybe the Interdecadal Pacific Oscillation would be a better index (see Meehl et al. 2015).

Specific comments: Whatever the time scale chosen by the authors for this work, the choice to correlate first Nino3.4 to SWP and then SWP to sea ice extent is not sufficient. If the hypothesis is that there is a relation between the tropical Pacific and sea ice then these two variables should be correlated directly.

To investigate the relation between equatorial Pacific and sea ice I would strongly recommend to use a climate model without data assimilation in which the temperature is changed in the equatorial Pacific and the response is analysed. Using a climate model in which surface temperature is assimilated and showing that the behaviour is qualitatively similar to geopotential height from reanalysis and satellite observations of sea ice extent seems useless.

The abstract says the results of this manuscript provide new insight in Antarctic ocean circulation but this is not the case. There is no discussion about ocean circulation in the manuscript.

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Details: Fig.2a: The unit of “yr<sup>-1</sup>” is not very readable, maybe % per decade would be clearer

References: Ferreira, D., Marshall, J., Bitz, C. M., Solomon, S., & Plumb, A. (2015). Antarctic Ocean and Sea Ice Response to Ozone Depletion: A Two-Time-Scale Problem. *Journal of Climate*, 28(3), 1206–1226. <http://doi.org/10.1175/JCLI-D-14-00313.1>  
Meehl, G. A., Arblaster, J. M., Bitz, C. M., Chung, C. T. Y., & Teng, H. (2016). Antarctic sea-ice expansion between 2000 and 2014 driven by tropical Pacific decadal climate variability. *Nature Geoscience*, 9(8), 590–595. <http://doi.org/10.1038/ngeo2751>

[Interactive comment on The Cryosphere Discuss.](#), doi:10.5194/tc-2017-51, 2017.

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