

El Nino Project Proposal - Patrick Orenstein

I would like to use the El Nino 3.4 anomaly data we've been using (or something different if you have a suggestion, like the SOI) to see if there's a significant correlation between ENSO and sea ice extent. My idea would be to first test the null hypothesis that El Nino does not affect the monthly ice anomaly (after removing the seasonal and long-term trends) as measured by an index from the National Snow and Ice Data Center [1]. After that, I'd like to do a linear regression excluding the most recent year and see if I can create a forecast for the final data point.

Yuan and Martinson [2] arrived at the problem from the other direction, looking for global teleconnections with Antarctic sea ice. They did both a lagged-month correlation analysis (which I would like to do as well) and looked for global teleconnections using EOF analysis. Gloersen [3] used a "multiple-window harmonic analysis scheme" to find correlations between ENSO and both Antarctic and Arctic sea ice coverage. Although I may not do that level of processing, comparing the two regions has interesting implications for the actual physics of the system, particularly how the warm water masses of an El Nino event generate a corresponding SST anomaly closer to either pole (as explored, for instance, by Song et al. [4]).

[1] Fetterer, F., K. Knowles, W. N. Meier, M. Savoie, and A. K. Windnagel. 2017, updated daily. *Sea Ice Index, Version 3*. [Monthly 1979-2020]. Boulder, Colorado USA. NSIDC: National Snow and Ice Data Center. doi: <https://doi.org/10.7265/N5K072F8>. [Accessed 11/5/2020].

[2] Yuan, X. & Martinson, D. G. Antarctic Sea Ice Extent Variability and Its Global Connectivity. *J. Climate* **13**, 1697–1717 (2000).

[3] Gloersen, P. Modulation of hemispheric sea-ice cover by ENSO events. *Nature* **373**, 503–506 (1995).

[4] Song, H.-J. *et al.* The central Pacific as the export region of the El Niño-Southern Oscillation sea surface temperature anomaly to Antarctic sea ice. *Journal of Geophysical Research: Atmospheres* **116**, (2011).

Other References:

Jevrejeva, S., Moore, J. C. & Grinsted, A. Influence of the Arctic Oscillation and El Niño-Southern Oscillation (ENSO) on ice conditions in the Baltic Sea: The wavelet approach. *Journal of Geophysical Research: Atmospheres* **108**, (2003).

Liu, J., Curry, J. A. & Hu, Y. Recent Arctic Sea Ice Variability: Connections to the Arctic Oscillation and the ENSO. *Geophysical Research Letters* **31**, (2004).

Liu, J., Curry, J. A. & Martinson, D. G. Interpretation of recent Antarctic sea ice variability. *Geophysical Research Letters* **31**, (2004).

Yuan, X. ENSO-related impacts on Antarctic sea ice: a synthesis of phenomenon and mechanisms. *Antarctic Science* **16**, 415–425 (2004).

