Occurrence and trends of eastern and central Pacific El Niño in different reconstructed SST data sets
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Abstract
Interest in El Niño diversity has increased in the past decade, with much attention given to the hypothesis that there exist distinct eastern Pacific (EP) and central Pacific (CP) types. It is well known that classification systems in the literature differ, sometimes dramatically, by methodology. We test to what extent differences may occur due to the use of different sea surface temperature (SST) reconstructions, focusing on the newly released version 4 of the Extended Reconstructed Sea Surface Temperature (ERSST) data set, two earlier versions of the ERSST data set, and an independent data set, Hadley Centre Global Sea Ice and Sea Surface Temperature (HadISST). The updated ERSST data set identifies more CP El Niños than the two older versions of ERSST and HadISST. Classification differences occur throughout the entire record rather than being restricted to the early period. We explore the potential influence of SST data set choice on the study of El Niño diversity impacts using precipitation anomalies in the western United States.

Methods
- Years classified as EP El Niño if the boreal winter (Dec.-Jan.-Feb.) Niño 3 index exceeded 0.5 °C and the Niño 4 index and as CP El Niño if the DJF Niño 4 index exceeded 0.5 °C and the Niño 3 index exceeded 0.5 °C.
- Classifications made independently for ERSST.v4, ERSST.v3b, ERSST.v2, and HadISST.
- Composite EP (CP) events refer to the average SST anomalies (SSTA) of the red and blue boxes shown, respectively.

Main Result: Differences in classification due to differences in SST reconstruction data sets persist throughout the entire historical record.

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<td># CP events</td>
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1871-2009

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<td>% CP events</td>
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Differences in classification due to differences in SST reconstructions are shown in Figure 2.

Conclusions
- The differences in El Niño classification due solely to differences in SST data sets are substantial and comparable to those due to different classification methodologies.
- From the case study of precipitation anomalies, it can be seen that the choice of SST data set can affect the statistical significance of results when studying the impacts of El Niño diversity.

References and Acknowledgements

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Figure 1
Summary of Niño regions used by NOAA and this study, from https://www.ncdc.noaa.gov/teleconnections/enso/indicator/sst.php#oni+

Figure 2
Composite EP and CP events as identified by all four SST reconstruction data sets analyzed.

Figure 3
Occurrence of (a) EP El Niño and (b) CP El Niño events by decade. Classification differs substantially, even between 1980 and 2009.

Figure 4
(a) Difference between the Niño 3 and Niño 4 regions over time for each SST data set. (b) Sliding 11-year correlation between the Niño 3 and 4 indices from ERSST.v4 with those from the other three data sets. Despite the near-perfect correlation past 1960, the data sets continue to produce different classification results.

Figure 5
Case study of precipitation anomalies (from the Global Precipitation Climatology Project) over the eastern United States for the composite EP and CP El Niño events using the four different data sets. Examples of (a) EP (DJF 1997-1998) and (b) CP (DJF 2004-2005) events with particular strong anomalies are provided for comparison.

Shading represents precipitation as a fraction of the 1980-2015 mean. Contours mark precipitation anomalies normalized through division with the interannual, ENSO-corrected standard deviation. Positive (negative) anomalies with magnitudes greater than 0.5, 1, and 2 standard deviations are shown in shades of blue (red).

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Take-Home Message: It is important to check results using multiple methods and data sets when studying El Niño diversity, even when restricting analysis to periods with more reliable data.

References and Acknowledgements
Diamond & Bennartz [2015] paper can be accessed via the QR code provided on this poster.

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