

## ***Interactive comment on “A unified proxy for ENSO and PDO variability since 1650” by S. McGregor et al.***

**Anonymous Referee #2**

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This paper attempts to construct a long, accurate ENSO record since 1650. I think that the results are useful and should be published subject to the authors addressing the following comments.

1. Page 2186, first sentence. Decadal variability is of interest in this paper. Please report the correlations between the UEP and the SOI, Kn34, Hn34 and Bn34 indices after they have been filtered so that the decadal signal and lower frequency variability remains. Bn34 claims to have constructed a monthly Niño-3.4 index that has been verified with closely physically related indices on both interannual and decadal time scales since 1877 so it would be particularly interesting to see the correlation of the UEP with this index for decadal and longer variability.
2. Page 2189, second paragraph. Visually the chronologies in Fig. 6 often do not

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line up very well. The authors carry out a Monte Carlo procedure to show that there is a significant correspondence between the UEP and ENSO chronologies at the 99% level. But this is not impressive if the correspondence between the chronologies is low. One way to measure the correspondence between the UEP and another time series numerically would be to consider the set containing all years (say N years) when either the UEP or the other time series predicts an El Niño. For these N years for each time series allot unity for an El Niño and zero otherwise. Remove the means of each time series and calculate the correlation coefficient. This correlation coefficient might be significantly different from zero, but if it is less than (say) 0.4, the correspondence would not be impressive.

3. Page 2192, third paragraph. “... there is a clear linear increasing trend in the number of El Niño events ...” in each of the time series in Fig. 9b-e. By eye I do not see such a clear linear increasing trend. What is the correlation coefficient for a straight line regression fit to the data? Does the 95% confidence interval only include positive values of the correlation coefficient?

### Minor editorial comments

Page 2180. The last sentence of the first paragraph is awkward. I suggest “Every ENSO event is different and each event creates a slightly different spatial teleconnection pattern (Trenberth and Stepaniak 2001). Therefore proxies derived from different regions could be expected to have slightly different signals of ENSO variability.”

Page 2181, first word. Replace “this” by “these”.

Page 2181, second paragraph. Remove the comma after “Whilst”. Also replace “the proxy data is” by “the proxy data are” since “data” is a plural word.

Page 2185, second paragraph. The paragraph would read better if there were a comma between “and” and “depending” and another comma between “used” and “the”. Start the last sentence with “since” and remove “therefore”.

Page 2185, last paragraph and also elsewhere in the text. Replace “Bunge and Clark” with “Bunge and Clarke”.

Page 2185, first paragraph. For future reference the method of Ebisuzaki (1997, *J. Climate*, 10, 2147-2153) is better than that of Davis (1976).

Page 2186, first sentence. . . Hn34 and Bn34 are . . .

Page 2186, second paragraph. Here and elsewhere the authors use “Further to this” when “Furthermore” would be better.

Page 2191, last paragraph. Replace “statically” by “statistically”.

Page 2193, second paragraph. Replace “data is sourced from Southern Chile, at latitude that” by “data are from Southern Chile, at a latitude that”.

Page 2212, Fig. 1 caption could be more clearly written. Replace it with “Time series of (a) the 10 reconstructions (Table 1) of ENSO variability (gray) and the mean of these reconstructions (black). (b) Standard deviation of the 10 reconstructions.”

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