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Separation of a Signal of Interest from a Seasonal Effect in Geophysical Data: I. El Niño/La Niña Phenomenon

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ABSTRACT

Geophysical signals N of interest are often contained in a parent signal G that also contains a seasonal signal X at a known frequency f_x . The general issues associated with identifying N and X and their separation from G are considered for the case where G is the Pacific sea surface temperature monthly data, SST3.4; N is the El Niño/La Niña phenomenon and the seasonal signal X is at a frequency of $1/(12 \text{ months})$. It is shown that the commonly used climatology method of subtracting the average seasonal values of SST3.4 to produce the widely used anomaly index Nino3.4 is shown not to remove the seasonal signal. Furthermore, it is shown that the climatology method will always fail. An alternative method is presented in which a $1/f_x$ ($= 12 \text{ months}$) moving average filter F is applied to SST3.4 to generate an El Niño/La Niña index N_L that does not contain a seasonal signal. Comparison of N_L and Nino3.4 shows, among other things, that estimates of the relative magnitudes of El Niños from index N_L agree with observations but estimates from index Nino3.4 do not. These results are applicable to other geophysical measurements.

KEYWORDS

El Niño/La Niña, Climate, Seasonal

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