

The variability of seasonality

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The seasons are the complex non-linear response of the terrestrial climate system to the regular annual solar forcing and there is no a priori reason why they should remain invariant from year to year, as is often assumed in climate studies when extracting the seasonal component. The widely used econometric X-11 seasonal adjustment procedure allows for changing seasonal shape, and it can yield advantages in the study of climate variability.

The procedure is applied to the monthly mean Nino-3.4 Sea Surface Temperature (SST) index and global gridded NCAR/NCEP reanalyses of 2m surface air temperature. The resulting seasonal component shows marked variations in time over many parts of the globe. Typically during warm El Nino events, late autumn and winter are warmer whereas spring is cooler than normal, which causes the annual cycle to have a weaker amplitude and a phase advanced by about a month. By taking these variations in seasonality into account, it is possible to define less ambiguous ENSO indices. Using X-11, it can be demonstrated that the three cold ENSO episodes from 1998 are due to an increased variability in seasonality rather than being three distinct La Nina events. Variations in the seasonal component represent a substantial fraction of the year-to-year variability in global temperatures. In addition, strong teleconnections can be discerned from mean conditions in the warm pool and the magnitude of seasonal variations across the globe. Such relationships might be usefully exploited to improve seasonal forecasts.

Monday IV (Talk)