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Removing ENSO-related trends from the climate record.

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Distinguishing anthropogenic and potentially predictable natural multi-decadal climate signals from climate noise is an important problem in climate research. The ENSO phenomenon is the largest signal in the climate system on interannual scales, but on longer scales it is climate noise. Unfortunately, ENSO has a rather long "low-frequency tail", so even natural fluctuations in the number of El Nino and La Nina events within, say, 50 year intervals can give rise to substantial 50 year trends. Such trends are inherently unpredictable. Anthropogenic climate changes, as well as coherent multi-decadal natural climate variations, have to be measured against this ENSO-related climate noise background to assess their impacts around the globe.

We have developed a multi-pattern filter for isolating the ENSO component in evolving global SST fields, based on the observed dynamical evolution of ENSO events, using the technique of Penland and Matrosova (2006). We have applied this filter to isolate the ENSO and non-ENSO components of observed SST fields on a month-by-month basis in the 136 year (1871-2006) HadISST dataset. The results suggest that the general observed warming trend over most oceanic regions has a substantial ENSO component. Interestingly, our analysis also suggests an ENSO-unrelated cooling trend in the eastern tropical Pacific. Such a cooling is not discernible by most other methods, but has a physical basis in being associated with stronger surface easterlies, and hence stronger equatorial oceanic upwelling in response to the warming of the Indo-Pacific warm pool.