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Stratospheric role in the multi-decadal variability of the El Niño signal in European rainfall

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Previous studies have shown that the stratospheric response to El Niño is dependent on the position of the sea surface temperature (SST) anomalies in the equatorial Pacific. Indeed, El Niño eastern Pacific SST anomalies tend to weaken the polar vortex and favour the stratospheric pathway of the ENSO teleconnection to Europe that is responsible for an important part of the ENSO impact on this area. Conversely, Central Pacific El Niño events seem to have in average a lower impact on the stratosphere, being opposite depending on the occurrence of a sudden stratospheric warming in that winter. On the other hand, a multi-decadal variability in the El Niño signal in the European rainfall has been recently discovered, with alternated periods of important and negligible El Niño effects on Europe in late winter.

In this study, we analyse the stratospheric pathway of the El Niño teleconnection to Europe from 1948-2012 in NCEP/NCAR reanalysis in periods with and without a strong response in precipitation in this sector. Preliminary results indicate that the location of El Niño-related SST anomalies also shows a multi-decadal variability that determines different teleconnections to Europe in a similar way as it happens between Eastern Pacific and Central Pacific El Niño. For instance, El Niño in periods with a relevant signal in Europe is typically Eastern Pacific El Niño that has associated a strengthening of the Aleutian low and an enhanced upward propagation of wavenumber-1 wave activity that weakens the polar vortex. These stratospheric anomalies descend and reach the troposphere in late winter contributing to the European response to ENSO. In contrast, this pathway is not detected in El Niño events during periods with a weak impact on the European rainfall where the SST anomalies are primarily located over the central Pacific. Differences in SSTs and atmospheric background states might be responsible for these discrepancies.