

Does the polar stratosphere play any role in interdecadal changes of El Niño impacts over Europe?

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The European precipitation response to El Niño (EN) has been found to present interdecadal changes, with alternated periods of important or negligible EN impact in late winter. These periods are associated with opposite phases of multi-decadal sea surface temperature (SST) variability, which modifies the tropospheric background and EN teleconnections. In addition, other studies have shown how SST anomalies in the equatorial Pacific, and in particular, the location of the largest anomalous SST, modulate the stratospheric response to EN. Nevertheless, the role of the stratosphere on the stationarity of EN response has not been investigated in detail so far. Using reanalysis data, we present a comprehensive study of EN teleconnections to Europe including the role of the ocean background and the stratosphere in the stationarity of the signal. The results reveal multidecadal variability in the location of EN-related SST anomalies that determines different teleconnections. In periods with relevant precipitation signal over Europe, the EN SST pattern resembles Eastern Pacific EN and the stratospheric pathway plays a key role in transmitting the signal to Europe in February, together with two tropospheric wavetrains that transmit the signal in February and April. Conversely, the stratospheric pathway is not detected in periods with a weak EN impact on European precipitation, corresponding to EN-related SST anomalies primarily located over the central Pacific. SST mean state and its associated atmospheric background control the location of EN-related SST anomalies in different periods and modulate the establishment of the aforementioned stratospheric pathway of EN teleconnection to Europe too.