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ENSO influence on the North Atlantic: Interaction between the stratospheric and the tropospheric pathways (Young Scientist Travel Award)

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El Niño Southern Oscillation (ENSO) can exert a remote impact on the North Atlantic and European (NAE) winter climate. This teleconnection is influenced by the superposition and interaction of different pathways. In this study, we focus on the stratospheric and tropospheric pathways through the North Pacific. Due to potential nonlinear and nonstationary behavior and due to the limited time period covered by reanalysis datasets, the dynamical mechanisms that drive this teleconnection are still not fully understood. In order to resolve this question, we use a simplified physics atmospheric model forced with seasonally varying prescribed sea surface temperature (SST) following the evolution of different ENSO phases with linearly varying strength at a fixed location. Simulations nudging the stratospheric winds to climatological conditions are also conducted in order to isolate the contribution of the tropospheric pathway. In the North Pacific, the circulation response to the tropical SST forcing becomes nonlinear for strong ENSO events, due to the nonlinear relationship between the SST and the precipitation response in the tropics. This nonlinear behavior has impacts downstream in the North Atlantic, where Sudden Stratospheric Warmings (SSW) lead to a negative phase of the North Atlantic Oscillation (NAO), independently of the ENSO forcing. In the absence of SSW events, only a strong El Niño forcing tends to lead to a significant negative NAO phase. Our experiments also show a strong decrease in the interannual NAO variability when the stratospheric winds are nudged to climatological conditions, thereby weakening the dynamical link between the North Pacific and North Atlantic circulation. These findings may have important impacts for long-range prediction and potential changes in the diversity of ENSO with climate change.