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El Niño teleconnection to the Euro-Mediterranean late-winter: the role of extratropical Pacific modulation

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El Niño Southern Oscillation (ENSO) represents the major driver of interannual climate variability at global scale. Observational and model-based studies have fostered a long-standing debate on the shape and intensity of the ENSO influence over the Euro-Mediterranean sector. Indeed, the detection of this signal is strongly affected by the large internal variability that characterizes the atmospheric circulation in the North Atlantic-European (NAE) region. This study explores if and how the low-frequency variability of North Pacific sea surface temperature (SST) may impact the El Niño-NAE teleconnection in late winter, which consists of a dipolar pattern between middle and high latitudes. A set of idealized atmosphere-only experiments, prescribing different phases of the anomalous SST linked to the Pacific Decadal Oscillation (PDO) superimposed onto an El Niño-like forcing in the tropical Pacific, has been performed in a multi-model framework, in order to assess the potential modulation of the positive ENSO signal. The modelling results suggest, in agreement with observational estimates, that the PDO negative phase (PDO₋) may enhance the amplitude of the El Niño-NAE teleconnection, while the dynamics involved appear to be unaltered. On the other hand, the modulating role of the PDO positive phase (PDO₊) is not reliable across models. This finding is consistent with the atmospheric response to the PDO itself, which is robust and statistically significant only for PDO₋. Its modulation seems to rely on the enhanced meridional SST gradient and the related turbulent heat-flux released along the Kuroshio-Oyashio extension. PDO₋ weakens the North Pacific jet, whereby favoring more poleward propagation of wave activity, strengthening the El Niño-forced Rossby wave-train.

These results imply that there might be conditional predictability for the interannual Euro-Mediterranean climate variability depending on the background state.