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Enhanced ENSO precursors in the Western North Pacific due to greenhouse gas forcing

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We present evidence that the de-trended, boreal winter sea surface temperature anomalies (SSTA) in the western North Pacific (WNP) are a skillful predictor for the development of the El Niño-Southern Oscillation (ENSO) by the following winter. The WNP shares some similarities with the Meridional Mode (MM) located in the subtropical central and eastern North Pacific: both are linked to off-equatorial SSTA/low-level wind anomalies and both appear to be strongly related to wintertime variability in the North Pacific Oscillation (NPO). However, in contrast with the MM, the WNP is associated with an opposite-signed SSTA dipole located off southeastern Asia and in the western tropical Pacific, which is accompanied by equatorial winds that may influence the level of oceanic Kelvin wave activity that precedes ENSO events. We also observed a strengthening relationship between boreal winter WNP SSTA and the development of ENSO by the following year. The increased WNP-ENSO association emerged in the mid 20th century and has grown through the present, reaching correlation coefficients as high as ~0.70 in recent decades. Fully coupled climate experiments with the Community Earth System Model (CESM) replicate the WNP-ENSO association and indicate that greenhouse gases (GHG) are largely responsible for the observed increase. We speculate that shifts in the amplitudes of positive SST trends between the subtropical and tropical western Pacific impacts the low-level circulation in a manner that reinforces the link between the WNP and the development of ENSO. This strengthened GHG-driven relationship between the WNP and ENSO provides an example of how anthropogenic climate change can directly impact, and potentially improve, the skill of intraseasonal-to-interannual climate prediction.