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**Title:** Salinity-Induced Eastward Flow in Boreal Spring Favors Extreme El Niño

**Abstract:** Classic El Niño-Southern Oscillation (ENSO) theories do not account for the influence of ocean salinity variations. With ocean reanalysis products, we have identified a robust boreal spring western Pacific salinity pattern that can boost El Niño amplitude. Climate models that capture this salinity-El Niño connection tend to simulate a stronger ENSO. This spring salinity pattern consists of fresher equatorial and saltier off-equatorial anomalies that give rise to a meridional gradient in steric sea level, which induces surface geostrophic currents shifting the warm pool edge eastward and generates downwelling equatorial Kelvin waves, both favorable for El Niño development. Based on our large-ensemble model simulations, this salinity mechanism can enhance El Niño amplitude by ~20% and almost double the probability of extreme El Niño. This salinity pattern results mainly from ocean advective processes induced by spring zonal wind anomalies, with a secondary contribution from surface freshwater flux changes.

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