

The relationship between lower-stratospheric ozone at southern high latitudes and sea surface temperature in the East Asian marginal seas in austral spring

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Using satellite observations, reanalysis data, and model simulations, this study investigates the effect of sea surface temperature (SST) on interannual variations of lower-stratospheric ozone at southern high latitudes in austral spring. It is found that the SST variations across the East Asian marginal seas (5°S – 35°N , 100 – 140°E) rather than the tropical eastern Pacific Ocean, where ENSO occurs, have the most significant correlation with the southern high-latitude lower-stratospheric ozone changes in austral spring. Further analysis reveals that planetary waves originating over the marginal seas in austral spring can propagate towards southern middle to high latitudes via teleconnection pathway. The anomalous propagation and dissipation of ultra-long Rossby waves in the stratosphere strengthen/cool (weaken/warm) the southern polar vortex, which produces more (less) active chlorine and enhances (suppresses) ozone depletion in the southern high-latitude stratosphere on one the hand and impedes (favors) the transport of ozone from the southern middle-latitude stratosphere to high latitudes on the other. The model simulations also reveal that approximately 17% of the decreasing trend in the southern highlatitude lower-stratospheric ozone observed over the past 5 decades may be associated with the increasing trend in SST over the East Asian marginal seas.