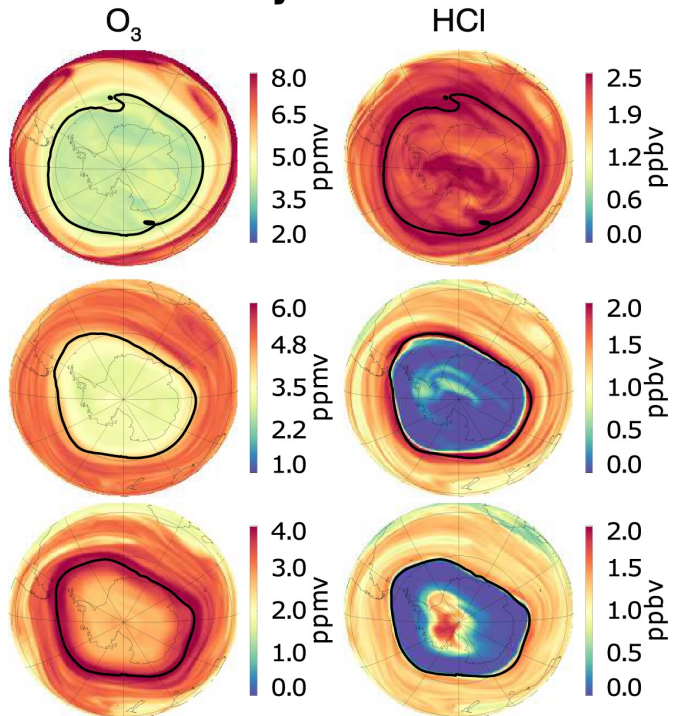


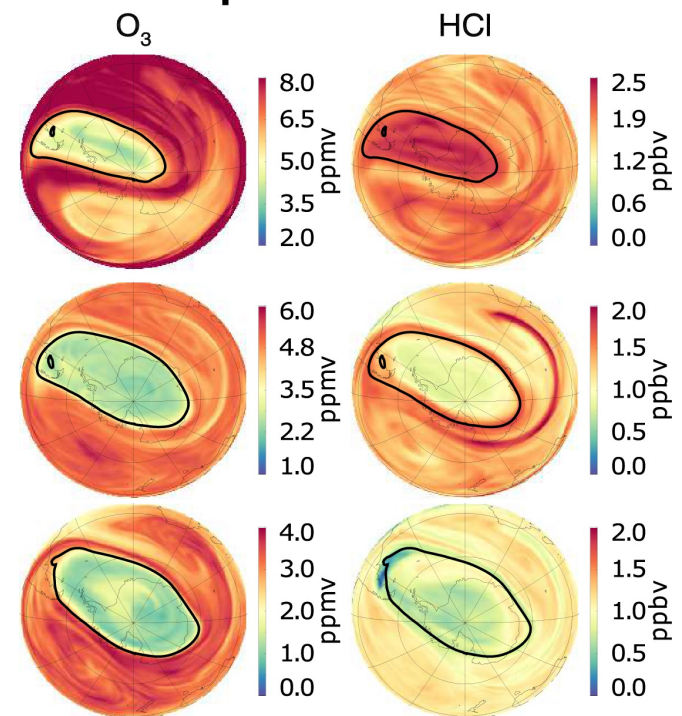
The Anomalous 2019 Polar Stratospheric Chemistry in GMAO's Assimilation Experiments

1 July 2019



Large polar vortex (black contour). Chlorine activation indicated by very low concentrations of the chlorine reservoir compound, HCl at 600 K and below. No significant chemical ozone depletion yet.

17 September 2019



Smaller, distorted and displaced polar vortex following the sudden stratospheric warming. Low ozone. Increased HCl signals chlorine deactivation. Evidence of wave breaking.