



Why has the tropical lower stratosphere stopped cooling since 1997?

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The impact of ozone depleting substances on global lower stratospheric temperature trends is widely recognized. In the tropics, however, understanding lower stratospheric temperature trends has proven more challenging. While the tropical lower stratospheric cooling observed from 1979 to 1997 has been linked to tropical ozone decreases, those ozone trends cannot be of chemical origin, as active chlorine is not abundant in the tropical lower stratosphere. The 1979-1997 tropical ozone trends are believed to originate from enhanced upwelling which, it is often stated, would be driven by increasing concentrations of well-mixed greenhouse gases. Using simple arguments based on observational evidence after 1997, combined with model integrations with incrementally added single forcings, we argue that ozone depleting substances, not well-mixed greenhouse gases, have been the primary driver of temperature and ozone trends in the tropical lower stratosphere until 1997, and this has occurred because ozone depleting substances are key drivers of tropical upwelling and of the entire Brewer-Dobson circulation.