



## **Evidence that a continuous decline in lower stratospheric ozone is offsetting ozone layer recovery**

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The Montreal Protocol (MP) was enacted to halt damage to the protective ozone layer that resulted from emissions of halogen-containing ozone-depleting substances. Measurements of total column ozone, the ozone between the Earth's surface and the top of the atmosphere, indicate that the ozone layer has stopped declining. While Montreal Protocol related recovery in the upper stratosphere (above 32 km, between 60S-60N) has been confirmed from 1998, no clear increase has been seen at latitudes outside the polar regions (60-90 degrees). We report evidence from multiple satellite measurements that ozone in the lower stratosphere between 60S and 60N has continuously declined since 1985. Even though upper stratospheric ozone is recovering the lower stratospheric decreases more than compensates this, thus stratospheric column ozone between 60S and 60N continues to deplete. Further, total column ozone (60S-60N) appears not to have decreased, which is attributable to increases in tropospheric column ozone that compensate the stratospheric decreases. However, the reasons for the continued reduction of lower stratospheric ozone are not clear as state-of-the-art chemistry climate models do not reproduce these trends. Therefore, the causes now urgently need to be established.