

Redecrease of HCl total column density observed with Fourier transform infrared spectroscopy at Tsukuba

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Chlorine species such as chlorofluorocarbon usually saved as reservoir molecules such as HCl at the stratosphere. It is converted to active chlorine under the specific conditions in early spring in the Polar regions. Then it causes ozone depletion. Therefore the amount of stratospheric HCl is one of the potential index of ozone depletion.

The total HCl have begun to decrease worldwide from the second half of 1990 's under the Montreal Protocol. But Mahieu et al. [2014] found the reincrease of HCl density at the Northern hemisphere lower stratosphere after 2007 by the high-resolution Fourier transform spectrometer (FTIR) observations at 8 stations including Tsukuba under the Network for the Detection of Atmospheric Composition Change from 1997 to 2011. They made it clear that the reincrease caused by the short-term deceleration of the atmospheric circulation in the Northern hemisphere for several years by comparing of atmospheric model and observational result.

In this study, we analyzed time series of HCl total column density at Tsukuba from 2001 to 2016 to make it clear that the reincrease of HCl total column density after 2007 is " short-term".

The temporal variation of derived HCl total column density increase from 2007 to 2011, and again decrease from 2012, which indicates that the increase after 2007 was really short-term. Further, we confirmed that downward flow at the lower stratosphere at 36° north was strengthened from 2007 to 2012 and upward flow was strengthened after 2012 by analyzing zonal mean residual vertical velocity using ERA Interim reanalysis datasets made by European Centre for Medium-Range Weather Forecasts.

Downward flow leads the increase of the column of HCl and upward flow leads the decrease. Thus, this result consist with the temporal variations of HCl total column density. However, it'll be necessary to check the variation of the global residual vertical velocity to see the variation of stratospheric general circulation which carries HCl .

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