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Observed and simulated time evolution of HCl, ClONO2, and HF total columns

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Total column abundances of HCl and ClONO2, the primary components of the stratospheric inorganic chlorine (Cly) budget, and of HF have been retrieved from ground-based, high-resolution infrared solar absorption spectra recorded at 17 sites of the Network for the Detection of Atmospheric Composition Change (NDACC) located at latitudes between 80.05°N and 77.82°S. These data extend over more than 20 years (through 2007) during a period when the growth in atmospheric halogen loading has slowed in response to the Montreal Protocol (and ammendments). These observed time series are interpreted with calculations performed with a 2-D model, the 3-D chemistry-transport models (CTMs) KASIMA and SLIMCAT, and the 3-D chemistry-climate models (CCMs) EMAC and SOCOLv2.0.
The observed Cly and in particular HCl column abundances decreases significantely since the end of the nineties at all stations, which is consistent with the observed changes in the halocarbon source gases, with an increasing rate in the last years. In contrast to Cly, the trend values for total column HF at the different stations show a less consistent behaviour pointing to the fact that the time development of the HF columns is peaking. There is a good overall qualitative agreement regarding trends between models and data. With respect to the CTMs the agreement improves if simulation results for measurement days only are used in the trend analysis instead of simulation results for each day.