Session: C15 Poster: T62B

## Changes in atmospheric composition discerned from long-term NDACC measurements: Total atmospheric bromine, chlorine, and fluorine trends and age of the air from the NOAA GMD Cooperating Network

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The Montreal Protocol on Substances that Deplete the Ozone Layer and its subsequent amendments has been successful in decreasing the total equivalent chlorine of man-made halocarbons in the atmosphere by 13% since its peak in 1994-5. The National Oceanic and Atmospheric Administration's Earth System Research Laboratory (NOAA/ESRL) maintains a global in situ and flask network for the measurement and analysis of halocarbons and other atmospheric trace gases. Measurements of nitrous oxide and chlorofluorocarbons -11 and -12 started in 1977. The purpose of this work is to study atmospheric trace gases that affect climate change, stratospheric ozone depletion, and air quality from observations at NOAA and cooperating stations. The analysis of flask samples and data are conducted within the Global Monitoring Division (GMD) in Boulder, Colorado, USA. Through collaborations with the National Aeronautics and Space Administration (NASA) and the National Science Foundation, NOAA/ESRL also operates a number of in situ and flask collection instruments from manned and unmanned aircraft up to 21 km, and balloon platforms up to 32 km .. We measure over 40 trace gases in the atmosphere including nitrous oxide (N2O), chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs), methyl halides, numerous halocarbons, sulfur gases (COS, SF6, CS2), and selected hydrocarbons. This presentation will highlight our recent observations of halocarbons and other trace gases from the NSF and NOAA sponsored HIAPER Pole-to-Pole Observations over NDACC and NOAA stations from 2009 to 2011 and the NASA and NOAA sponsored Unmanned Aircraft Systems Missions. For more information see http://www.esrl.noaa.gov/gmd/hats and our data are available via anonymous ftp at ftp://ftp.cmdl.noaa.gov/hats.