Improving Our Understanding of Ozone-depleting Substances in the Upper Atmosphere

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The Montreal Protocol on Substances that Deplete the Ozone Layer and its subsequent amendments has been successful in decreasing the atmospheric burden of total equivalent chlorine from man-made halocarbons by ~13% since its peak in 1994-5. The National Oceanic and Atmospheric Administration, Earth System Research Laboratory (NOAA/ESRL) maintains a global, ground-based *in situ* and flask sampling network for the measurement and analysis of halocarbons and other atmospheric trace gases. Through collaborations with the National Aeronautics and Space Administration (NASA) and the National Science Foundation (NSF), NOAA/ESRL also operates a number of *in situ* and flask sampling systems from manned and unmanned (drone) aircraft up to 21 km, and from balloon platforms up to 32 km. We measure over 40 trace gases in the atmosphere including nitrous oxide, chlorofluorocarbons, hydrochlorofluorocarbons, hydrofluorocarbons, methyl halides, numerous halocarbons, sulfur gases (COS, SF_6, CS_2), and selected hydrocarbons. We will present an overview of our ground-based and airborne measurements while highlighting some of our recent observations of halocarbons and other trace gases from the NSF and NOAA sponsored HIAPER Pole-to-Pole Observations airborne campaign over Network for the Detection of Atmospheric Composition Change and NOAA stations from 2009 to 2011, and the NASA and NOAA sponsored Unmanned Aerial Systems Missions.

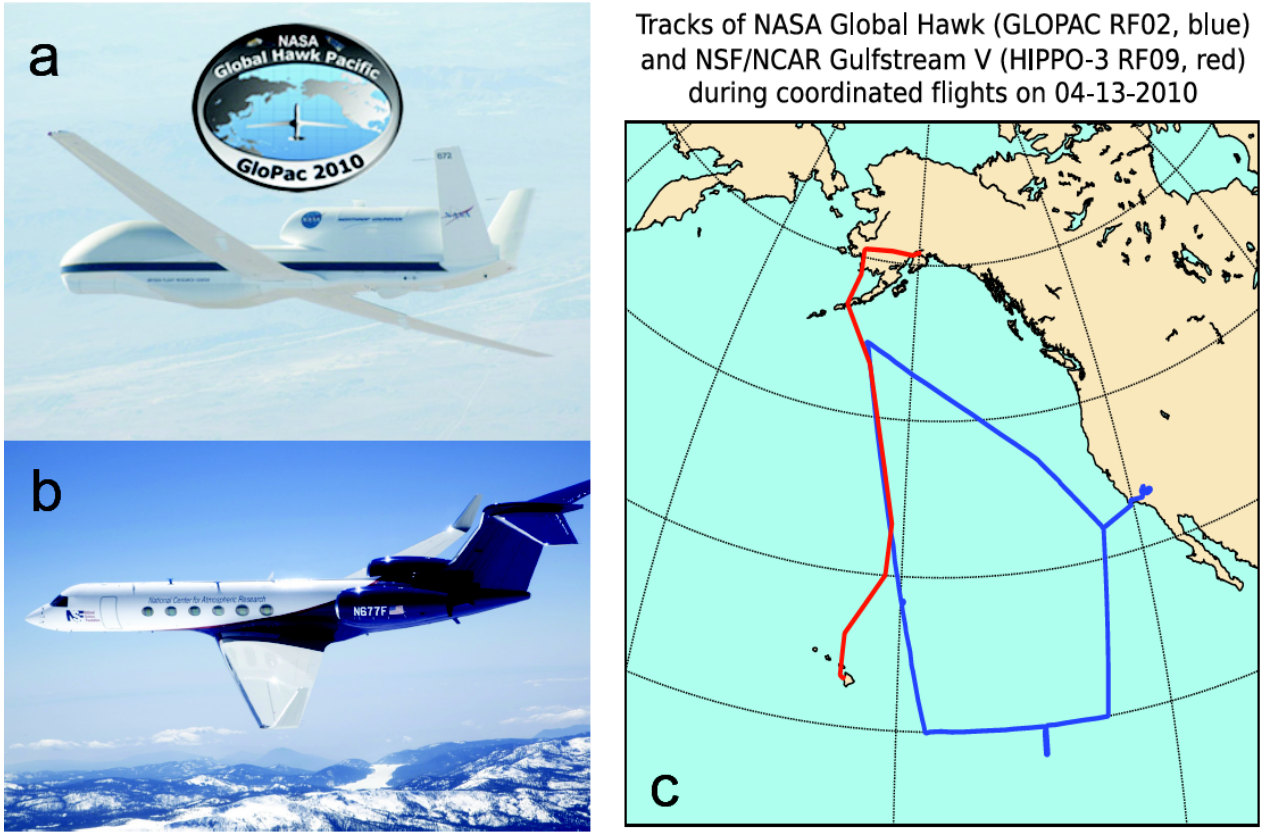

Figure 1. NASA Global Hawk (a) and NSF/National Center for Atmospheric Research (NCAR) Gulfstream V (b) with flight tracks shown for coordinated GloPac-HIPPO flights over the Pacific Ocean on April 13, 2010 (c).