Ozone Depletion in Filaments of the Arctic Polar Vortex, Observed During the First Global Hawk UAS Science Mission

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One of the important potential uses of the NASA Global Hawk Unmanned Aircraft System (UAS) in scientific research is to study stratospheric ozone depletion in polar regions. Manned flights involve remote and hazardous duty, which pose great risks to pilots, crew, and scientists. Arctic ozone depletion observed in the Spring of 2010 by satellites, manned aircraft campaigns and ground stations was less severe than that observed in 2011. The Global Hawk UAS flight on 7 April 2010 was the first to observe ozone-depleted air with a UAS platform. Temperatures in the polar vortex were cold enough for Type II Polar Stratospheric Clouds (PSC) to form for a short period (days) at 50 hPa in 2010, and cold temperatures that were sufficiently low for almost 2 months for Type I PSC formation. Based on the NOAA Global Monitoring Division's Unmanned aircraft systems Chromatograph for Atmospheric Trace Species ozone versus nitrous oxide tracer correlation plot (below), there is 25% less ozone in air from a polar filament sampled on 7 April 2010, compared to the Arctic air sampled later on 23 April 2010. The NOAA Chemical Science Division UAS Fast Ozone Instrument showed a similar pattern with respect to N_2O. The low value of on-board SF_6 observations indicate air inside the polar vortex rather than in midlatitude air. The results from the Global Hawk are compared to those from the manned GV aircraft during HIPPO/3, MLS on the Aura satellite, and ozone loss from models. The Global Hawk UAS flights were part of the Global Hawk Pacific Experiment (GloPac), which demonstrated flights up to 28.6 hr duration, altitudes as high as 19.8 km and a maximum range of 9200 nm while carrying a payload of *in situ* and remote instrumentation for atmospheric chemical and aerosol tracers.

Figure 1. The NASA Global Hawk UAS.

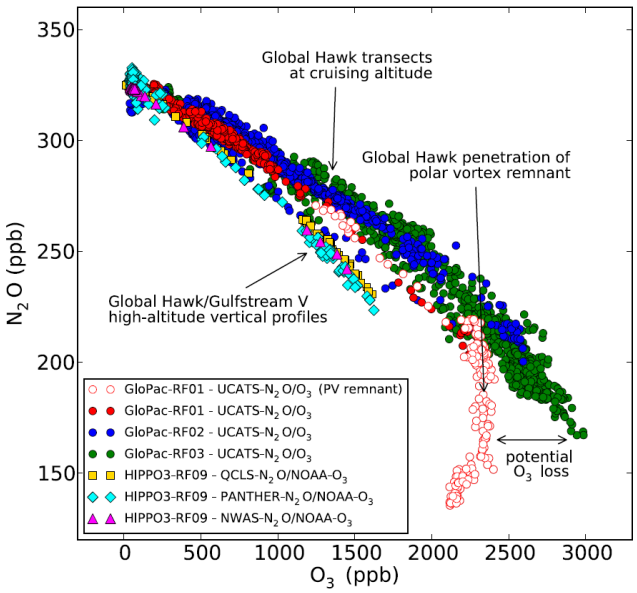

Figure 2. N_2O vs. O_3 showing O_3 loss in 2010.