Nov 9–10, 2011 – ATTREX Science Flight

Takeoff: 1817 UT, Landing: 1701 UT, Duration: 23:24

This flight was essentially flown as planned (see Figure 1), and it was extremely successful. The flight included multiple profiles through the TTL, with sampling of thin cirrus near the tropopause and aged anvil cirrus throughout the TTL. Air recently detrained from deep convection was sampled at 43 kft, and low altitude legs were included for the jet crossings on the southbound and northbound transits. Instruments on the aircraft generally performed well.

After flying west to Lost Link over the Pacific, the aircraft headed SSE down to about 18 N before heading west. Along the southbound transit, the aircraft descended to 45 kft for a 35-min leg to sample tracers across the subtropical jet. The turning point was moved slightly north to avoid convection on the westbound leg. As the aircraft headed west toward a cold tropopause region, considerably TTL cirrus was evident in the real-time CPL imagery, and the cold point temperature was monitored using the MTP data. The cirrus included a thin layer near the tropopause and patchy cirrus below this layer. After turning back east along the same track, the aircraft descended to about 47 kft through the TTL cirrus, followed by an ascent. The pilots became concerned as we climbed back up toward the temperature minimum and approached the structural temperature limit. Therefore, we descended back down to 47 kft before reaching cruise altitude. In the following ascent, the temperatures were warm enough such that we could climb back up to cruise altitude (about 58 kft). The aircraft then turned northwest and started another vertical profile. However, the fuel temperature had dropped below the yellow fault for the fuel we were using (-39 F), so the pilots commanded the aircraft back to cruise altitude instead of continuing the descent into colder air. At about 19 N, the aircraft headed WSW toward a region with cold tropopause temperatures and detrainment from deep convection. The CPL data indicated clouds essentially throughout the TTL (from 12 to 16 km) along this leg (see Figure 2). After turning back east, the aircraft descended to 43 kft for sampling of the convective outflow and aged anvil cirrus. The ice saturation ratio based on preliminary MMS and DLH data along the 43 kft leg (mostly in cirrus as indicated by FCDP data‘) was variable but averaging near saturation, as expected (Figure 3). The ozone concentration dropped to 30–50 ppbv, as expected for air detrained from clean maritime convection.

After turning NNW, a porpoising maneuver was conducted hitting a sequence of altitude minima and maxima of approximately 48, 54, 50, 53, and 49 kft before ascending back to cruise altitude. On the transit back north, the aircraft descended to 43 kft as we crossed the subtropical jet.

Instruments appeared to be working very well on this flight. flight. In addition to its value for evaluating instrument performance, the data collecting on this flight will be valuable scientifically.

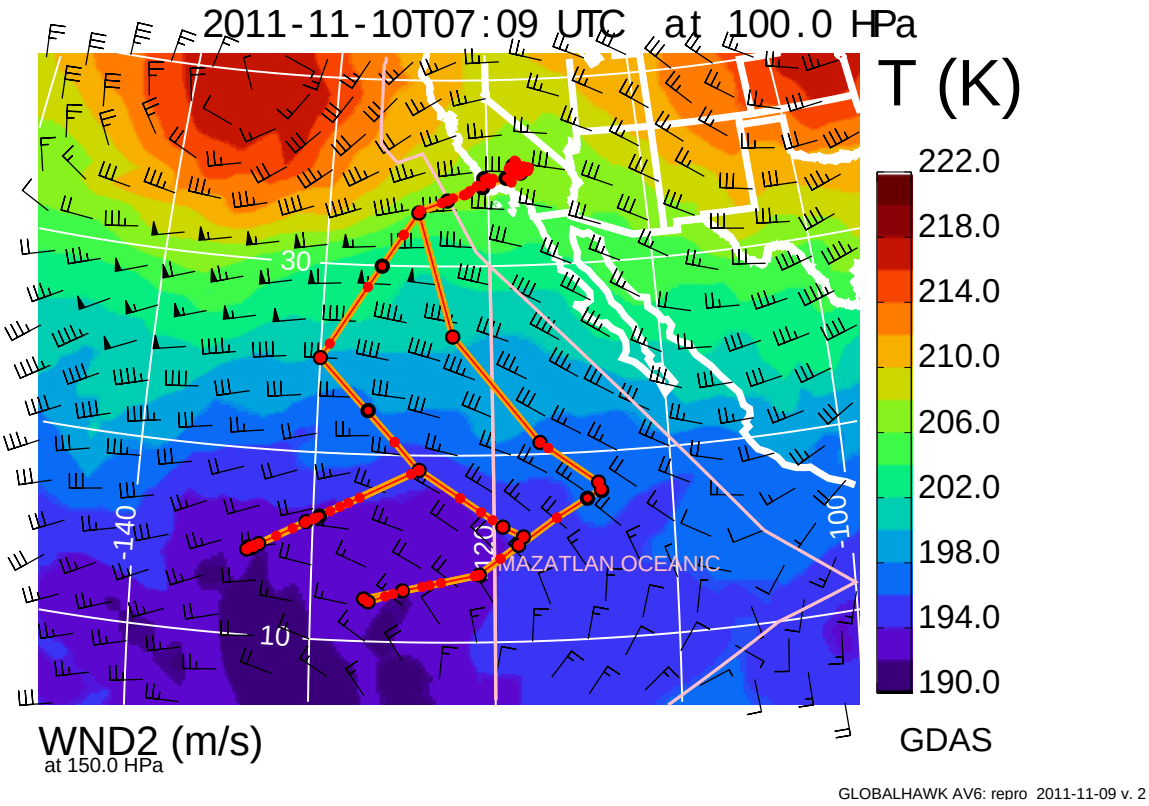

Figure 1: Global Hawk flight path overlaid on the GEOS5 temperature field at 100 hPa. Wind barbs are also shown.

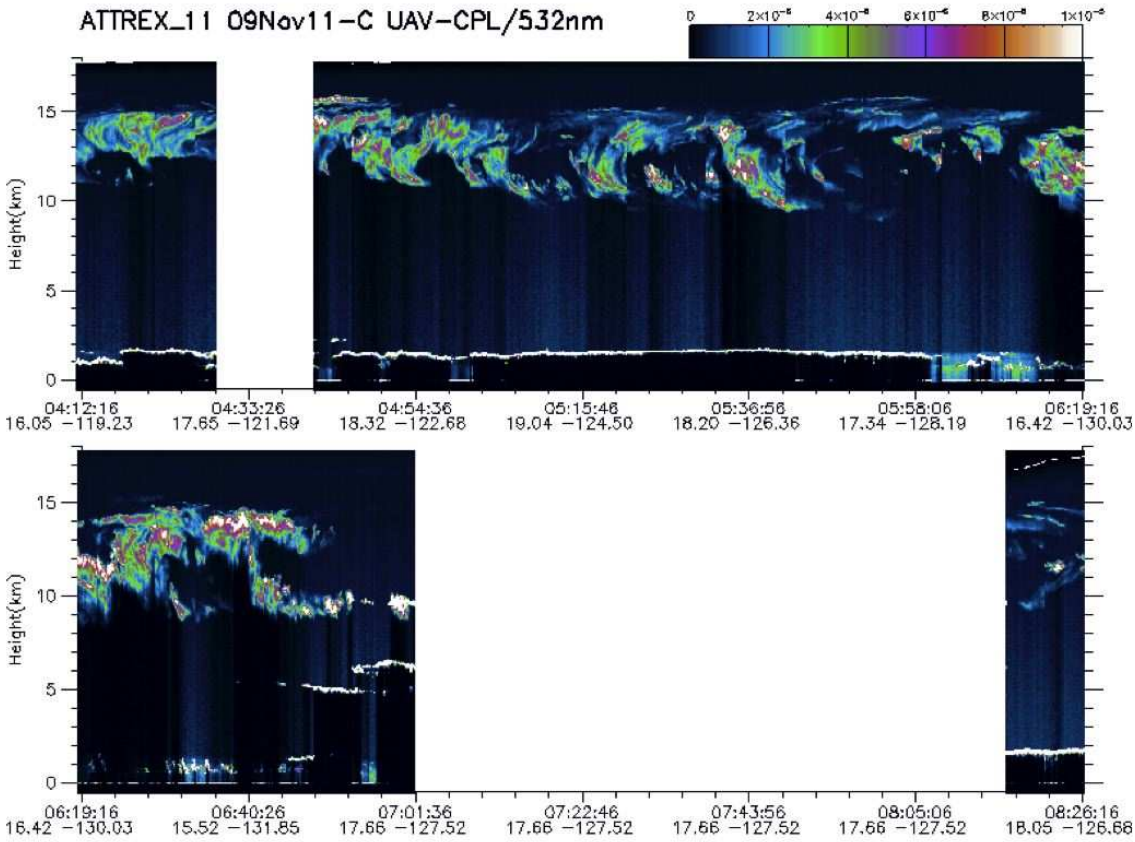

Figure 2: CPL imagery along the leg west (top) above convective outflow and back east (bottom). The lidar was turned off when we descended to 43 kft.

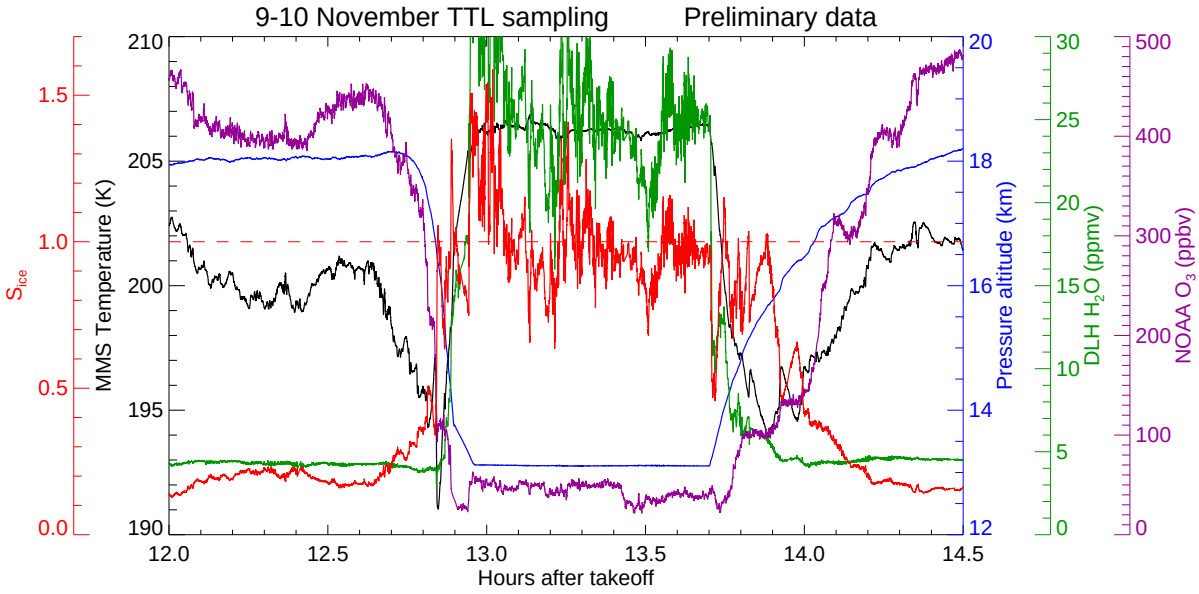

Figure 3: Time series of pressure altitude (blue), temperature (black), DLH water vapor mixing ratio (green), ice saturation ratio (red), and ozone mixing ratio (magenta) including the leg at 43 kft in the convective outflow region.