ATTREX Science Flight Report

2014-03-04 RF03

Takeoff: 17:29 UT March 4 (03:29 March 5 Guam local)
Landing: 06:10 March 5 (16:10 local), duration: 12.7 hours
Mission Scientists: Eric Jensen, Charles Bardeen, Leonhard Pfister, Troy Thornberry
Payload Managers: David Fratello, David Jordan, Steve Toderov

Summary:

The Global Hawk profiled through the TTL (45 – 58 kft) in the vicinity of Typhoon Faxai, which was still active just north of the flight track. Cirrus was sampled from 45 kft up to the cold point tropopause through much of the flight. The cirrus was likely a mix of cloud generated directly by Faxai and cloud formed in situ in the TTL. Temperature variability apparent near the tropopause was likely caused by waves forced by Faxai. Low ozone was measured throughout the upper troposphere. Tracer measurements should provide a wealth of information about convective transport to the upper troposphere/lower stratosphere region.

Flight Description:

The primary objective of the flight was to measure the impact of tropical storm (later typhoon) Faxai on TTL tracers, cirrus clouds, and water vapor. Transport models predicted air detrained from Faxai would be primarily west of the storm (north and northwest of Guam) at the time of the flight. As a result, the bulk of the flight consisted of an east-west leg along approximately 18°N latitude. At the time we passed Faxai, it was just north of the flight track (see IR image below).

After takeoff, the aircraft ascended to cruise altitude (initially about 52.5 kft) in the UA zone, passing through a band of cirrus produced by Faxai. Next, we headed northwest and began our first descent. The purpose of the northwest point was to ensure sampling outside of Faxai's influence. UCATS O_3 indicated concentrations on the order of 10 ppbv throughout the upper troposphere on most of the flight. Cirrus was present right up to the cold-point tropopause on the climb back up to cruise altitude. We made it over 53 kft for CPL power up after the first profile.

The aircraft turned east at about 18°N as planned and continued profiling. Cirrus was present through much of the TTL as we headed east. Cold temperatures forced us to descend before reaching the cold point on some of the ascents (see time series of pressure altitude and temperature below). Whenever we got near the tropopause, temperature was quite variable,

presumably as a result of waves forced by Faxai. We diverted down to about 17°N in the middle of the east-west leg to stay a safe distance from Faxai, and then returned to 18°N.

The decision was made to stick with sampling east and west of Faxai's course rather than heading down south as originally planned. Therefore, upon reaching the easternmost point of the flight plan, we simply turned back on our course at 18°N. Preliminary tracer data indicate a strong influence of the storm on the composition of the 100–150 hPa altitude range.

Late in the flight, the aircraft was light enough to ascend to about 58.7 kft, at which point ozone reached about 250 ppbv.

Instrument performance was generally good, except that SSFR (Spectral Solar Flux Radiometer) failed after the first 5 hours of the flight. UCATS ozone was noisier than usual. Takeoff and landing were conducted under crosswind conditions created by Faxai (as forecast). Some wind reporting issues caused the aircraft to "go around" once on landing until within limit conditions were assured.

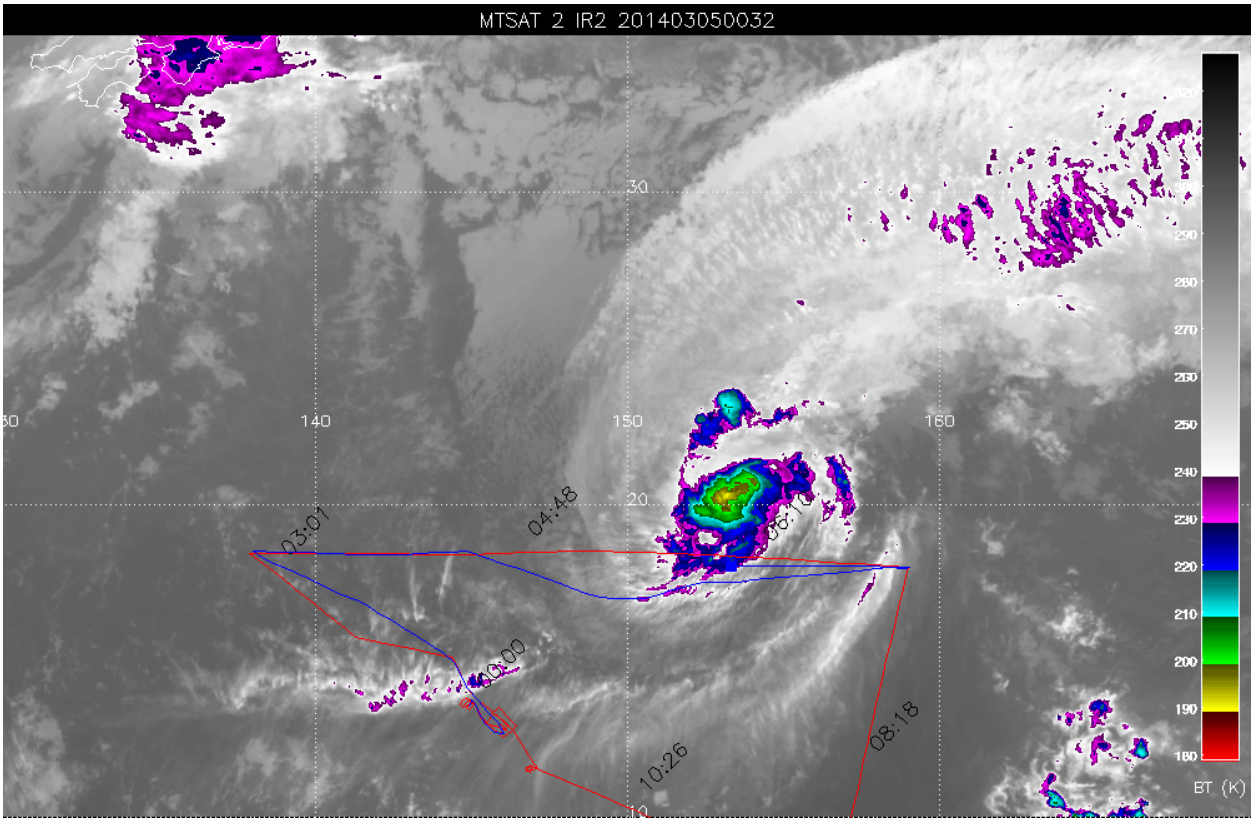

Figure 1. The actual flight path (blue) is overlaid on an infrared satellite image showing typhoon Faxai just north of the flight path. The blue square is the aircraft position at about 00:32 UT.

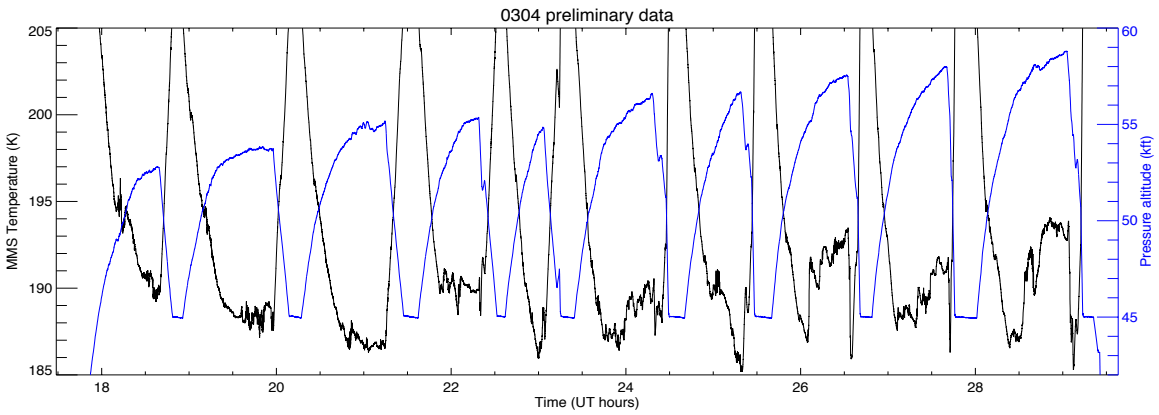

Figure 2. Time series of aircraft pressure altitude and temperature. Note the variability in temperature near the tropopause. Also, some of the vertical ascents were cut short because of extremely cold temperatures.