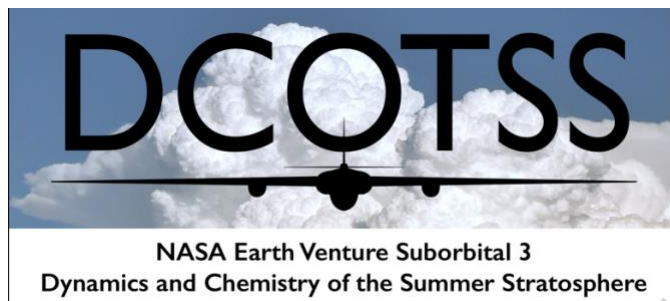


# DCOTSS ER-2 Mission Scientist Flight Summary Report



**Flight identifier:** RF13

**Science goals:** Sample the outflow from active convection over Central Oklahoma

**Start of flight (UTC):** 2022-05-31 22:59Z

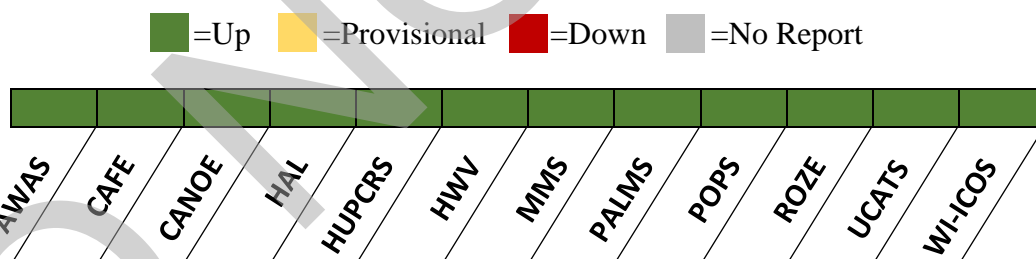
**End of flight (UTC):** 2022-06-01 04:07Z

**ER-2 Pilot:** Kirt Stallings

**Mission Scientist:** Chuntao Liu

Version	Report date and time (UTC)	Author
1	2022-06-04 23:00 Z	Chuntao Liu
2	2022-06-07 18:00 Z	Kenneth Bowman, Frank Keutsch

## Instrument Performance:



**Aircraft Performance:** Good

## Science Objectives:

On 2022-05-31, low tropopause altitudes were predicted by the GFS model over the Nebraska-Kansas region corresponding to an upper-level trough (Figure 1 top left panel). Associated with the upper-level trough a belt from the north TX panhandle to northern MO had strong low-level instability favoring intense convection on the evening of 31 May (Figure 1 top right panel). The high-resolution forecast model (HRRR) indicated that the convection could reach above 50 kft and overshoot the lapse rate tropopause (Figure 1 bottom left panel). Based on the HRRR model output, the outflow material from the overshoot convection would be transported to the east

(Figure 1 bottom right panel), while the line of convection would remain nearly stationary and move slowly to the northeast. The main objective for science flight RF13 was to sample tracers in the fresh outflow from overshooting convection over central and southwest Oklahoma.

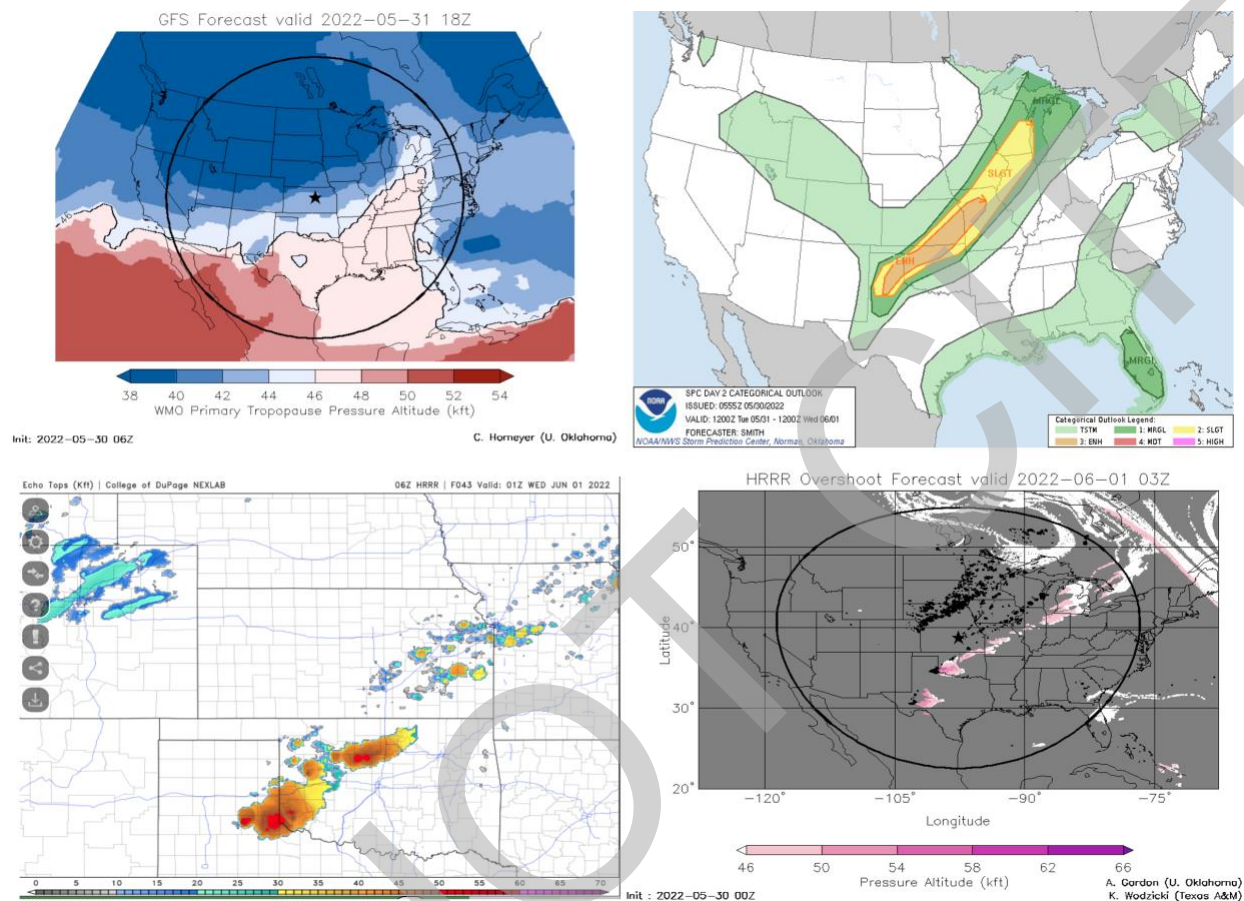


Figure 1. Top left panel shows tropopause height at 1800 UTC on 2022-05-31 predicted by GFS. Top right panel shows the National Weather Service Storm Predict Center convective outlook for 31 May. There is a belt region from north TX to north MO with an enhanced probability of intense convection. Bottom right panel shows HRRR model predicted echo top height at 0300 UTC on 1 June. Bottom right panel shows altitude of particles from overshoot convection predicted by HRRR model using the trajectory tool and GFS predicted wind.

### Flight plan:

The flight plan (Figure 2) was designed to stay southeast of the convective line predicted by HRRR model and to sample the outflow to the east. The ER-2 climbed to maximum altitude from KSLN to P1 before descending to 46 kft near the tropopause at P2. The background near the tropopause was sampled at 46 kft from P2 to P3. Then two short vertical profiles between P3 and P2 were collected by climbing to 52 kft and descending to 48 kft at P2. After that, six legs were planned between P2 and P3, with altitudes to be adjusted based on the enhanced tracer features in the profiles. The flight plan ended with a climb to maximum altitude with an MMS maneuver and a slow descent to obtain the final profile over KSLN.

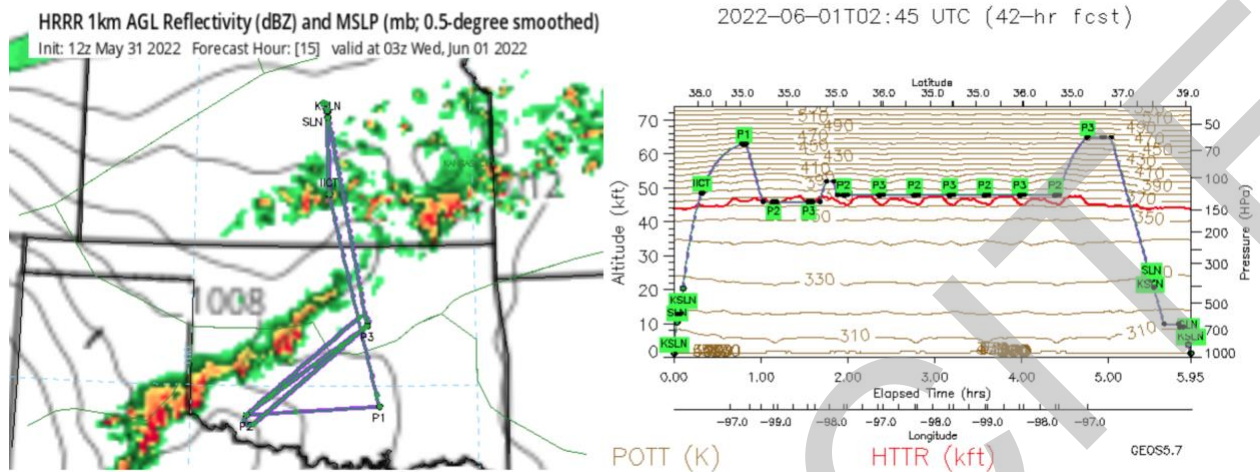


Figure 2. Right panel shows the radar reflectivity field predicted by HRRR model and flight plan and way points. Left panel shows the vertical cross section of GFS predicted potential temperature (contour), tropopause height (red line) and the flight plan altitude and the way points.

### Flight Summary:

The airplane took off on time at 2259 UTC. The flight path deviated from the plan in order to fly over the strong convection along the planned flight track. After descending to P1, active convection near NP3 (Figure 3 and 4) led to changes in the flight planned flight path. The ER-2 carried out stacked level legs between P1 and NP2. Following radar indications of the collapse of the cell near NP3, the ER-2 sampled between NP2 and NP3. Near NP3, turbulence was observed around 0230 UTC and the ER-2 climbed up to 54 kft and turned back to NP2. Because local convective development was observed near Salina that could affect landing, the ER-2 was called back at 0248 UTC while approaching NP2. The ER-2 then climbed to 60 kft and returned to KSLN. The aircraft landed at 0407 UTC for a total flight time of 5:08 minutes.

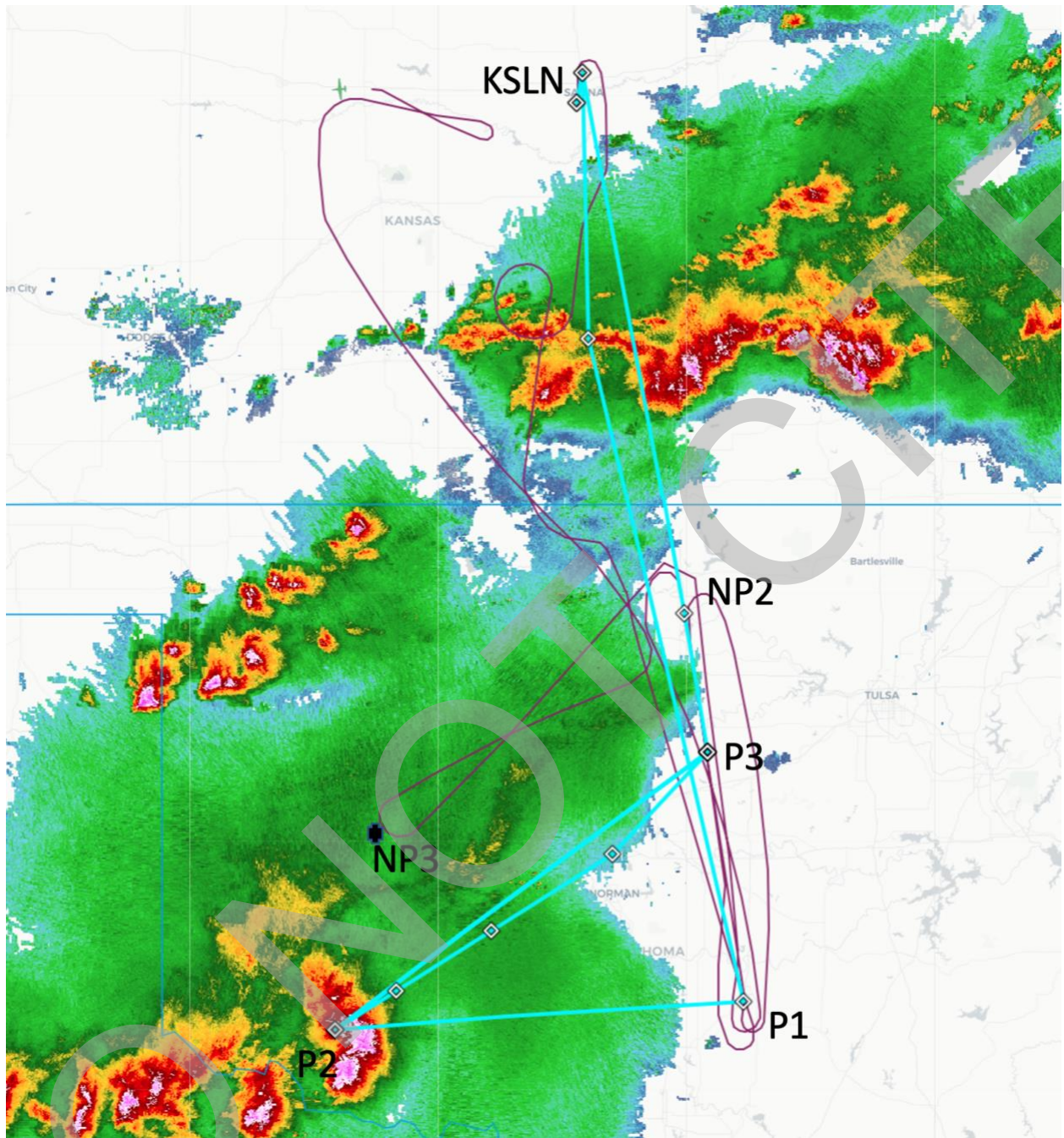


Figure 3. The flight plans of ER-2 (light blue line) and the realtime flight track (purple line) overlaid on the NEXRAD reflectivity near the end of RF13. Multiple convective systems developed over North Texas and southwest Oklahoma.

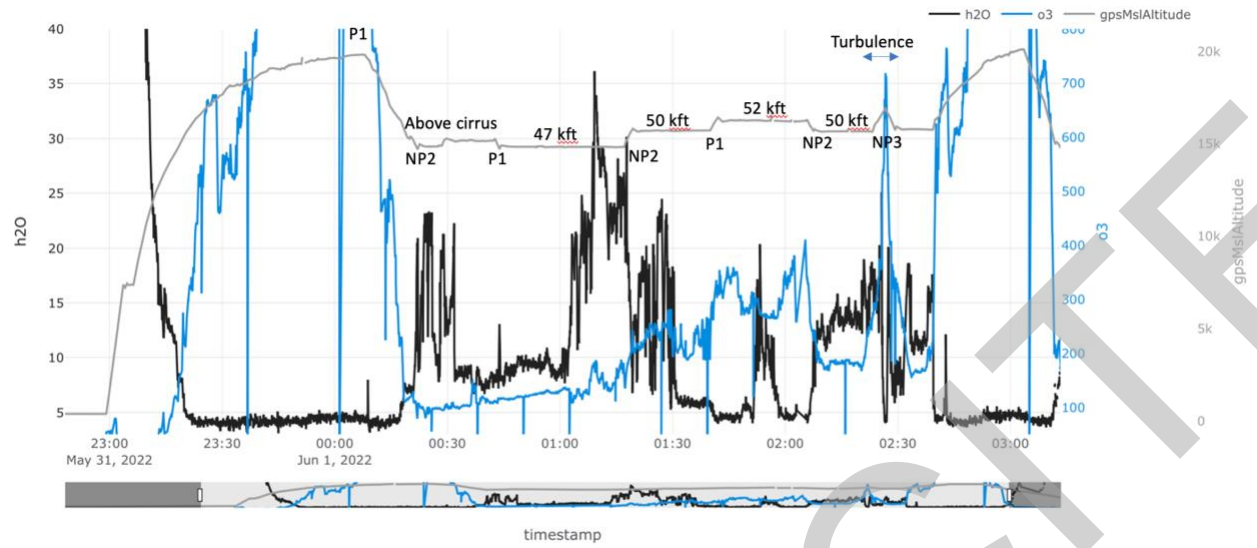


Figure 4. Timeseries of MMS aircraft GPS altitude, ROZE ozone, and HWV water vapor from MTS.