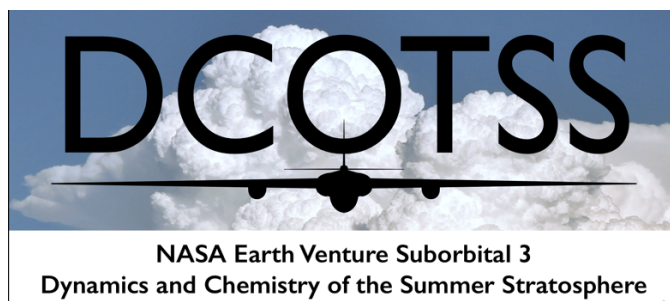


# DCOTSS ER-2 Mission Scientist Flight Summary Report



**Flight identifier:** RF11

**Science goals:** Intensively sample 2-day old overshoot material from Sierra Madre; 1-day old material from west Texas & eastern Mexico

**Start of flight (UTC):** 2021-08-19 13:57Z

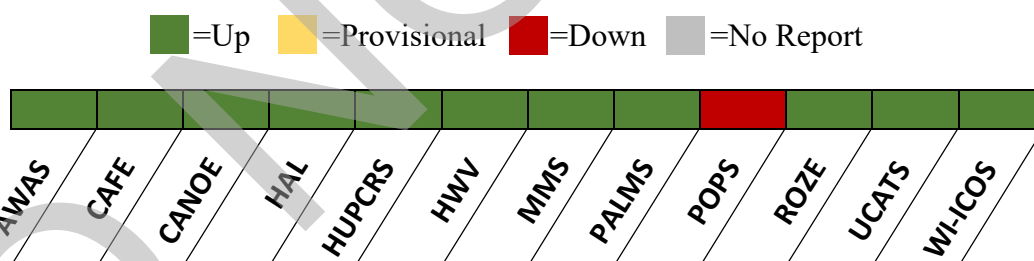
**End of flight (UTC):** 2021-08-19 21:04Z

**ER-2 Pilot:** Tim Williams

**Mission Scientist:** Cameron Homeyer

Version	Report date and time (UTC)	Author
1	2021-08-19 22:00Z	Homeyer, Cameron
2	2021-08-20 17:00Z	Bowman, Ken; Keutsch, Frank

## Instrument Performance:



**Aircraft Performance:** Good

## Science Objectives:

Widespread overshooting over the Sierra Madre in Mexico on August 17 coupled with a favorable evolution in the lower stratosphere flow led to broad regions of GOES-diagnosed overshoot material being transported northward into the United States by August 19. Overshooting outflow in west Texas and eastern Mexico on August 18 was also advected into a similar domain. The Sierra Madre overshoot material was the primary target for this mission, and the west Texas and eastern Mexico material was the secondary target. Figures 1 and 2 show the overshoot history and forecast trajectory plume locations during the flight, respectively.

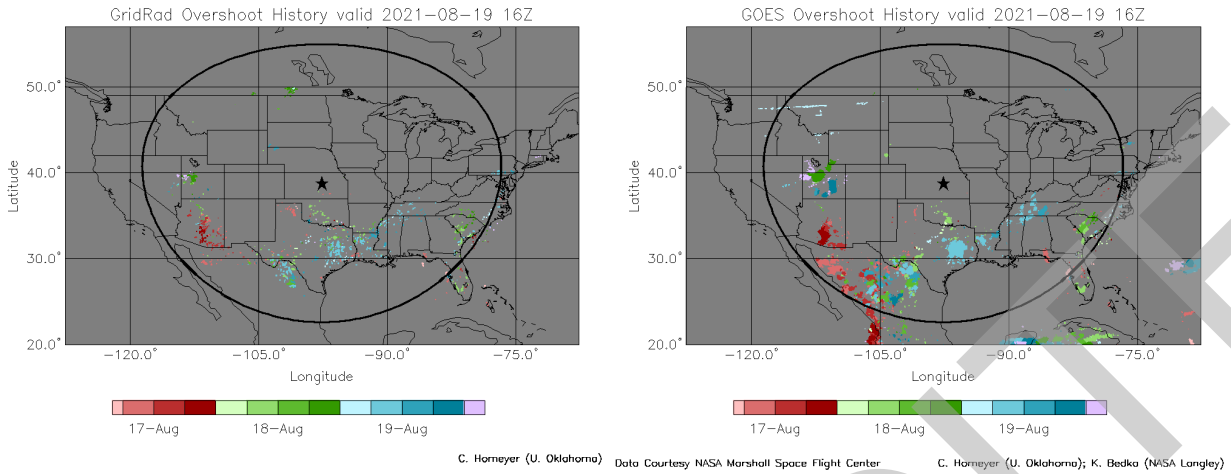


Figure 1: Overshoot history from (left) GridRad and (right) GOES, valid 16 UTC on 19 August 2021.

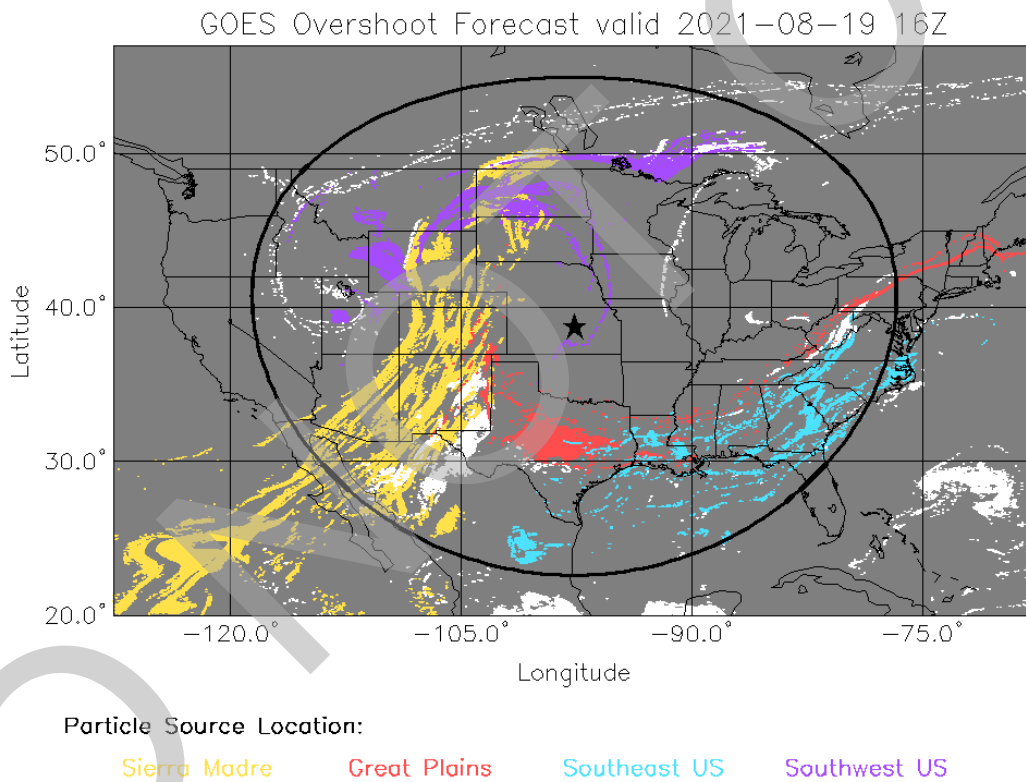


Figure 2: Forecast locations of GOES overshoot trajectory particles (colored by their source locations), valid 16UTC on 19 August 2021.

Figures 3 and 4 summarize the flight plan, showing a map of the path overlaid on overshoot trajectory forecasts during the flight (from MTS) and a vertical curtain of forecast GOES overshoot particle density along the planned flight path, respectively. The northeast-to-southwest oriented segment of the track was a 1-kft bowtie pattern from 47 kft to 52 kft. The westernmost plumes were Sierra Madre outflow and the plume at the eastern end of the leg was the 1-day old material.

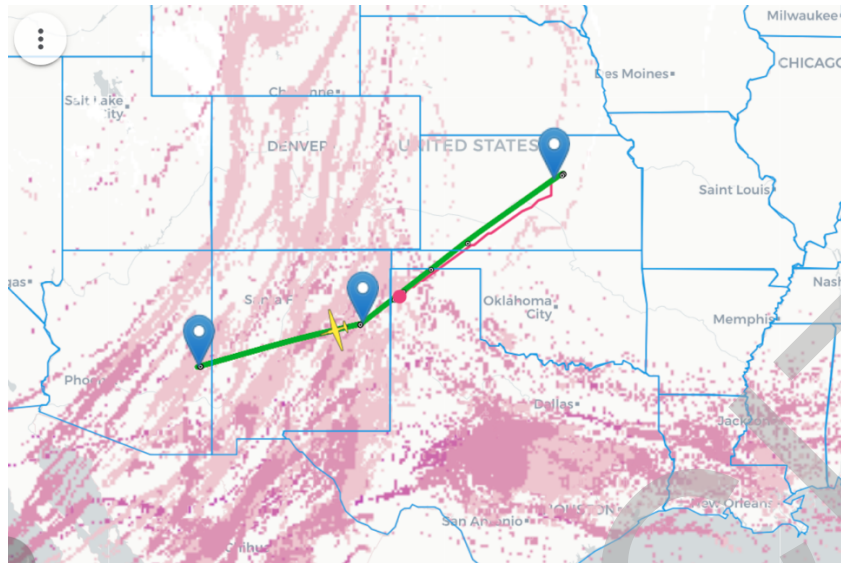


Figure 3: Map of forecast trajectory particles during RF11 and the flight plan superimposed (from MTS).

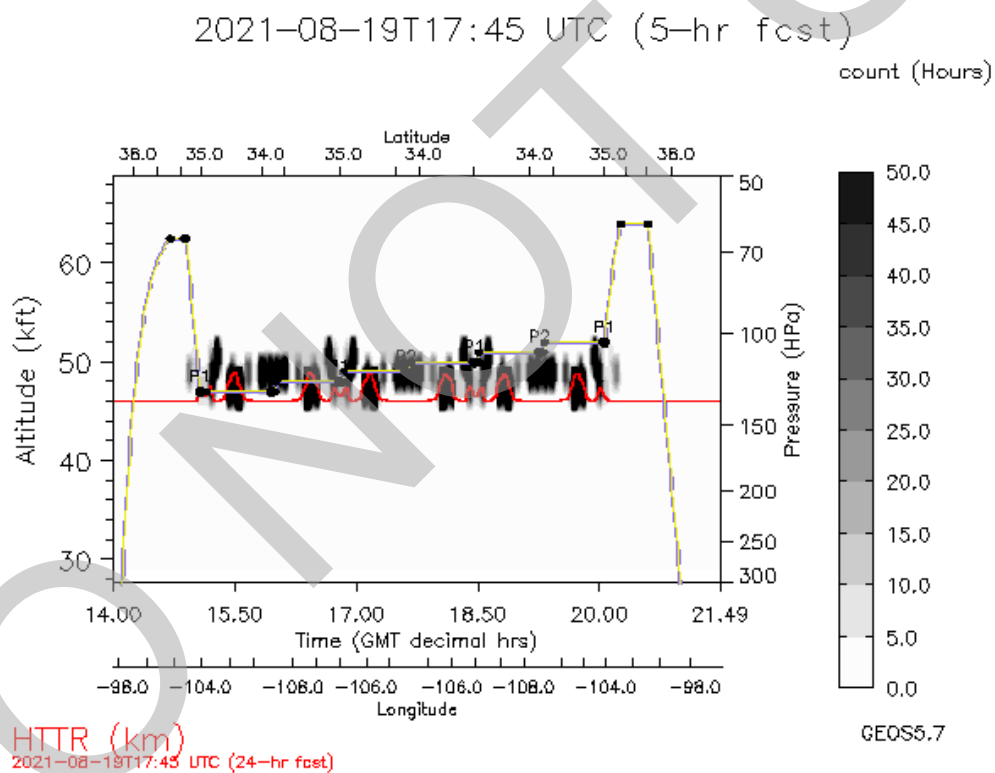


Figure 4: Curtain of forecast GOES-initialized trajectory particle density along the flight path. The red line is the GEOS-5 tropopause height.

## Flight Summary:

The ER-2 departed Salina an hour later than planned due to a pilot suit pressurization issue. DPOPS had a fail indication prior to takeoff and did not function during the mission. After takeoff the ER-2 had a landing gear malfunction indicator. Successful deployment of the landing gear was verified with the onboard PTZ camera, and the original flight plan was continued. Unfortunately, it will not be possible to carry out the final planned research flight, as the aircraft will be returning to Palmdale for required maintenance on the landing gear. ROZE measurements were unusual near the beginning of the flight (oscillating between negative and positive values for some time), postulated to be related to excess diesel exhaust in the hangar prior to takeoff that had clung to the walls of the instrument and was destroying ozone. In addition, HWV was not available in real time within MTS due to a time registration issue, but the data packets were monitored periodically throughout the flight. UCATS water vapor and ozone were monitored throughout the flight to identify enhanced water features and coordinate AWAS cans. Finally, the pilot reported turbulence at approximately the same location (just east of Albuquerque, NM) from 47-50 kft, gone by 51 kft.

Despite abundant overshoot material forecast along the flight path, only marginal water vapor enhancements were observed over much of the domain. This will be confirmed when data from the Harvard Water Vapor instrument are available. The only exception was some large enhancements within the younger overshoot material at the eastern end of the bowtie pattern. The largest water vapor concentrations seen were ~13 ppmv in this material, while enhancements in the vicinity of the Sierra Madre plumes appeared to be no greater than ~2 ppmv above background, although likely spatially quite extensive. Based on the general lack of strong water vapor enhancements, the final 52 kft west-to-east leg of the bowtie was sacrificed for a longer segment at max altitude on return to Salina (originally planned to be 20 minutes long). Figure 5 shows several real-time products from MTS during the flight.

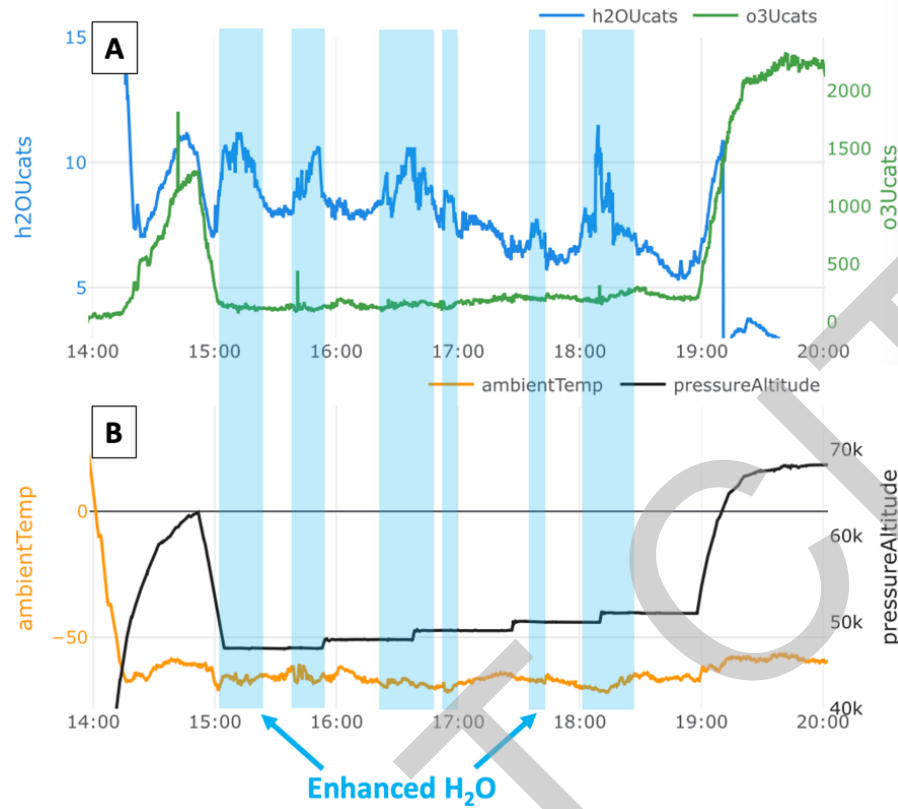


Figure 5: Timeseries of (a) UCATS ozone and water vapor, and (b) pressure altitude and temperature from MTS during the flight. Time periods during the horizontal legs where suggestion of enhanced water vapor (diagnosed as time trends in UCATS data at constant altitude) was observed are indicated by blue vertical color-fill.