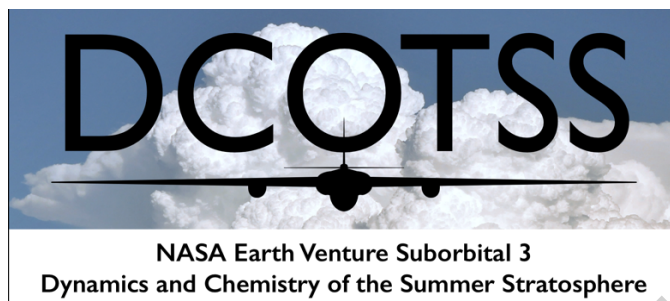


DCOTSS ER-2 Mission Scientist Flight Summary Report



Flight identifier: RF23

Science goals: Intensively sample ~3-day-old Sierra Madre overshoot material over the Pacific

Start of flight (UTC): 2022-07-11 19:04Z

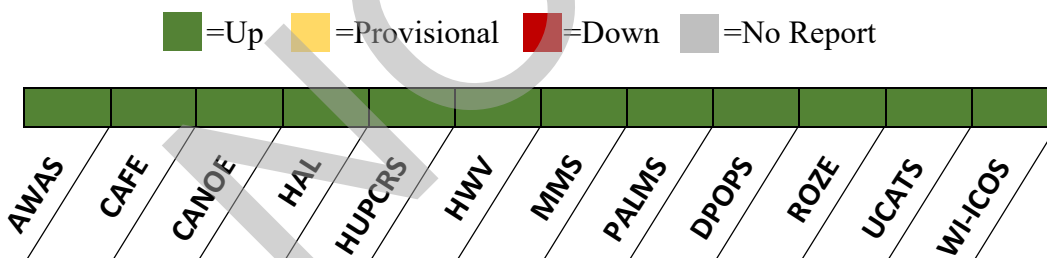
End of flight (UTC): 2022-07-12 03:04Z

ER-2 Pilot: Tim Williams

Mission Scientist: Cameron Homeyer

Version	Report date and time (UTC)	Author
1	2022-07-25 20:00Z	Homeyer, Cameron

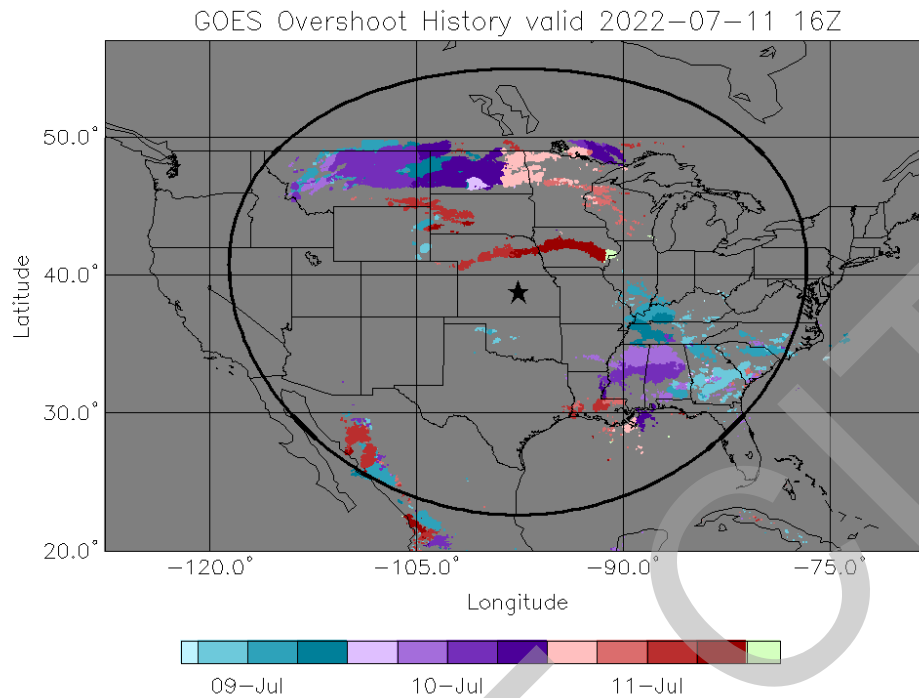
Instrument Performance:



Aircraft Performance: Good

Science Objectives:

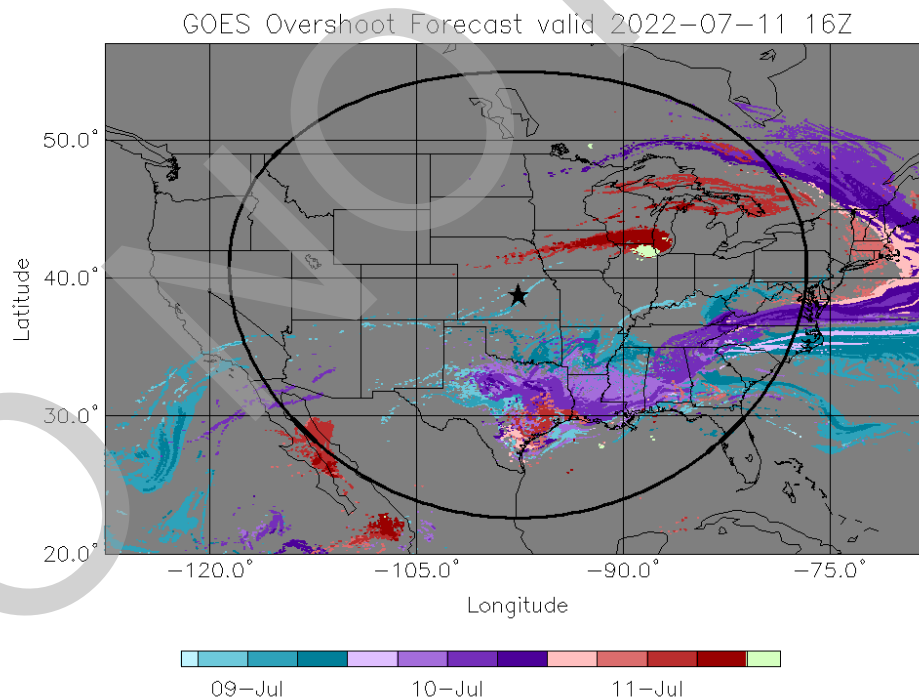
Widespread overshooting in the central and Northern Sierra Madre of Mexico on July 8-9 (Figure 1, blue colors) resulted in dense plume material over the eastern Pacific and southwest of California and primarily within the 52-58 kft pressure altitude layer on July 11 (Figure 2). This aged Sierra Madre overshoot material (blue colors in Figs. 1 & 2) was the target of the mission, was advected slowly to the west and north within the North American monsoon anticyclone, and was forecast to be dense up to ~1.5 km above the tropopause. The tropopause was 50-52 kft within the broad area of the anticyclone, which stretched from the east pacific across the southern US and Mexico. The entire planned flight track was within the monsoon anticyclone.



Data Courtesy NASA Marshall Space Flight Center

C. Horneyer (U. Oklahoma); K. Bedka (NASA Langley)

Figure 1: Overshoot history from GOES, valid 16 UTC on 11 July 2022.



GOES Data Courtesy NASA Marshall Space Flight Center

C. Horneyer (U. Oklahoma); K. Bedka (NASA Langley)

Figure 2: GOES overshoot trajectory forecast, valid 16 UTC on 11 July 2022.

Figures 3 and 4 summarize the flight plan, showing a map of the flight path overlaid on GOES overshoot trajectory altitude forecasts during the flight (from MTS) and a vertical curtain of forecast GOES overshoot particle density along the path, respectively. The northwest-to-southeast oriented segment of the track at the farthest range southwest of Palmdale, CA was a 1-kft racetrack pattern from 52 to 56 kft to target the dense overshoot material and avoid a large area of restricted air space to the east of the flight, with a profile from 58 kft to 50 kft during the final southeast-to-northwest pass. An MMS maneuver was planned at 59 kft after the initial ascent out of Palmdale and a level leg at 54 kft was added on the northeast to southwest transit over the Pacific on approach to the racetrack pattern to attempt to sample overshoot material along that portion of the flight as well.

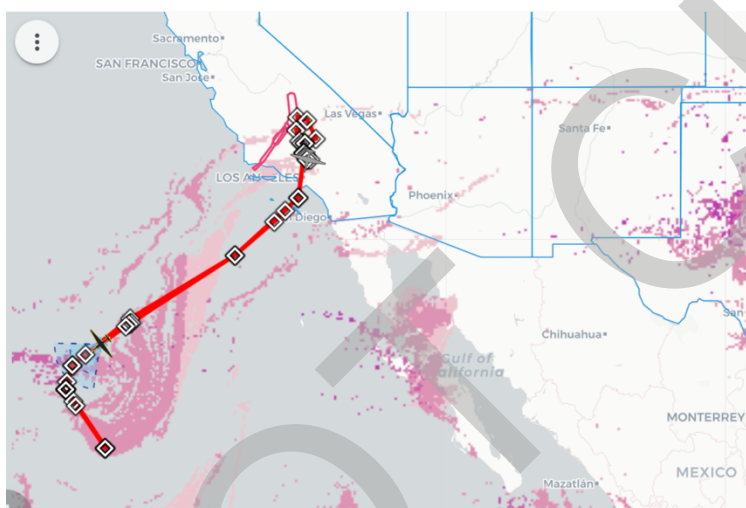


Figure 3: Map of forecast trajectory particles during RF23 and the flight plan superimposed (from MTS).

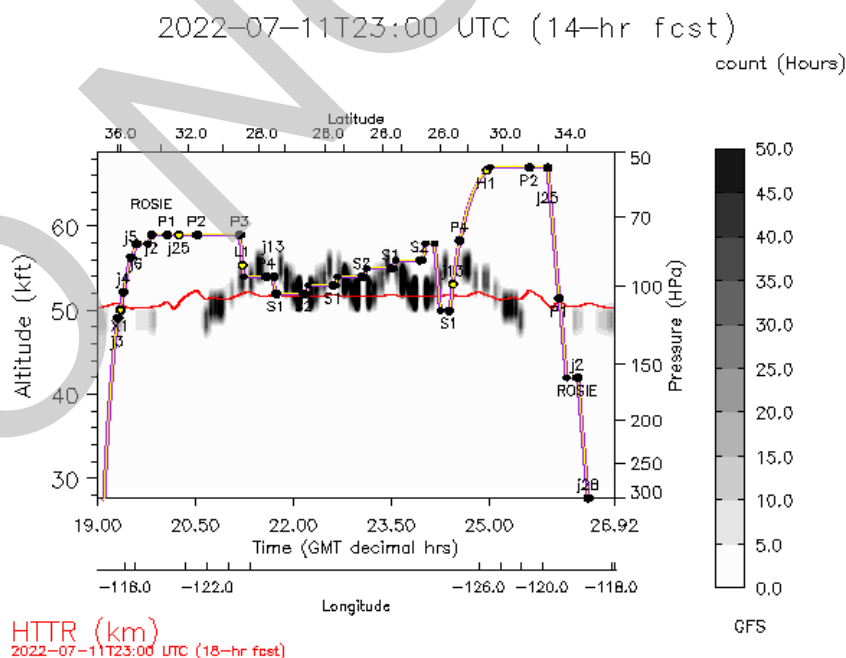


Figure 4: Curtain of forecast GOES-initialized trajectory particle density along the flight path. The red line is the GFS tropopause height.

Flight Summary:

There were no deviations from the planned flight and no instrument issues reported by the pilot. After taking off from Palmdale at 19:04 UTC, the aircraft ascended to 59 kft and completed an MMS maneuver near the airfield. Following the MMS maneuver, the transit to the Sierra Madre overshoot material racetrack began (~1 hour into the flight). Figure 5 shows a timeseries of several instruments' real-time data from 20Z on July 11 to ~02:30Z on July 12. Based on local temperature minima during the initial ascent and final descent, as well as the profiling along the racetrack pattern, the tropopause was observed near 51 kft. The UTLS was cold, with temperatures as low as 197.4 K observed, especially during the 52 and 53 kft legs of the racetrack. Water vapor was apparently enhanced (above a background concentration of ~4 ppmv) along nearly the entire racetrack pattern at altitudes of 52-55 kft. Aerosol was also enhanced, especially at the lower altitudes sampled. Both were also evident from ~55 kft to the tropopause at ~51 kft during the profile along the final pass of the racetrack and the ascent immediately after on the return to Palmdale. During all these periods (and the entire flight), the pilot reported that there was no cirrus in the vicinity of the aircraft.

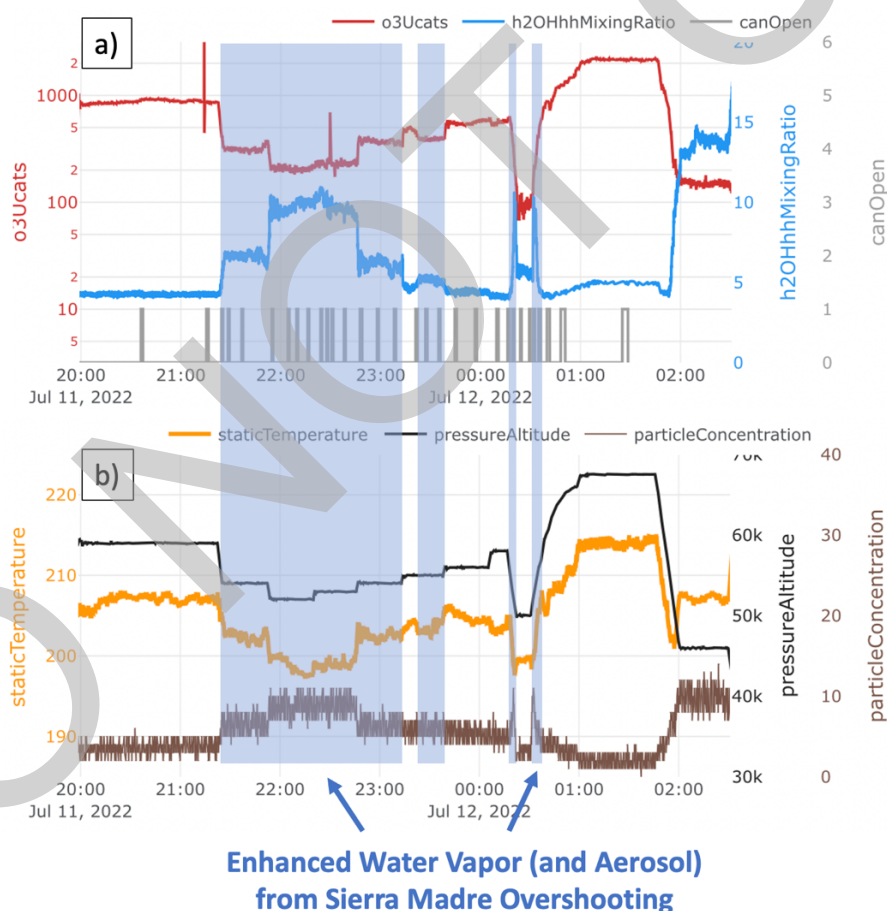


Figure 5: Timeseries of (a) UCATS ozone (red), HWV water vapor (blue), and AWAS open can times (gray), and (b) pressure altitude (black), MMS static air temperature (orange), and DPOPS particle concentration (brown) from MTS during the flight. Time periods during the flight where enhanced water vapor and aerosol was observed are indicated by blue vertical color-fill.

Finally, in recognition of this being the final flight of the DCOTSS campaign, an image immediately after landing from the forward-facing camera is included in Figure 6.



Figure 5: The final landing of the DCOTSS mission in Palmdale, CA from the ER-2 forward-facing camera, valid 03:05 UTC on 12 July 2022.