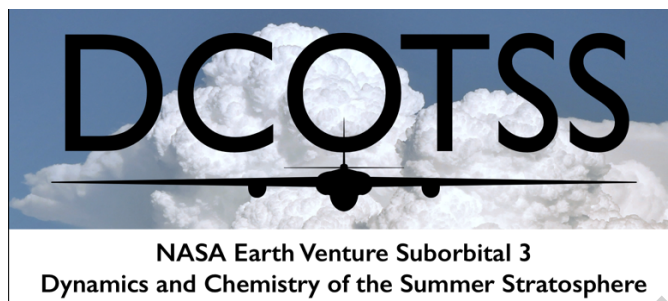


# DCOTSS ER-2 Mission Scientist Flight Summary Report



**Flight identifier:** TR04

**Science goals:** Survey large-scale gradient from northwestern US to North American Monsoon anticyclone center on transit from Salina to Palmdale.

**Start of flight (UTC):** 2022-06-29 17:18Z

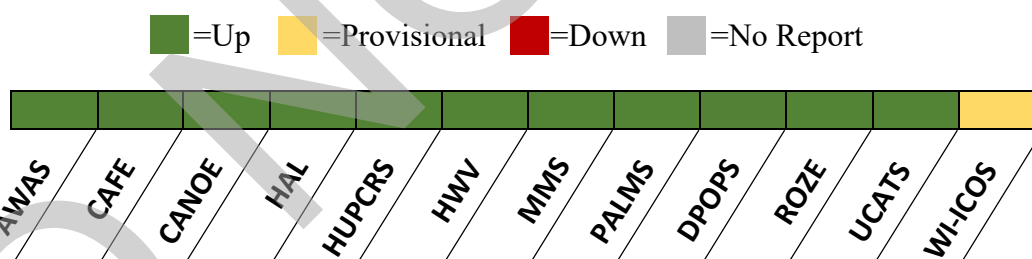
**End of flight (UTC):** 2022-06-30 00:54Z

**ER-2 Pilot:** Dean “Gucci” Neeley

**Mission Scientist:** Cameron Homeyer

Version	Report date and time (UTC)	Author
1	2022-06-30 02:05Z	Homeyer, Cameron
2	2022-07-05 14:00Z	Frank Keutsch and Kenneth Bowman

## Instrument Performance:



**Aircraft Performance:** Good

## Science Objectives:

The primary objective of this mission was to survey the large-scale stratospheric environment and North American Monsoon anticyclone during the 2022 return transit from Salina to Palmdale. The anticyclone became established over the southwest US during the week prior to the flight. For up to ~5 days prior to the flight, overshooting convection was frequent in the southeast US and its outflow was advected westward into the anticyclone center. Figure 1 shows several days' worth of overshooting history in the SE US from GridRad and GOES during the most active period. Figure 2 shows ~3-day forecast trajectory positions of the most recent

overshoot material from the Arkansas/Louisiana region on 26-27 June 2022 (blue colors), but transport pathways for the 24-25 June and 25-26 June clusters were similar.

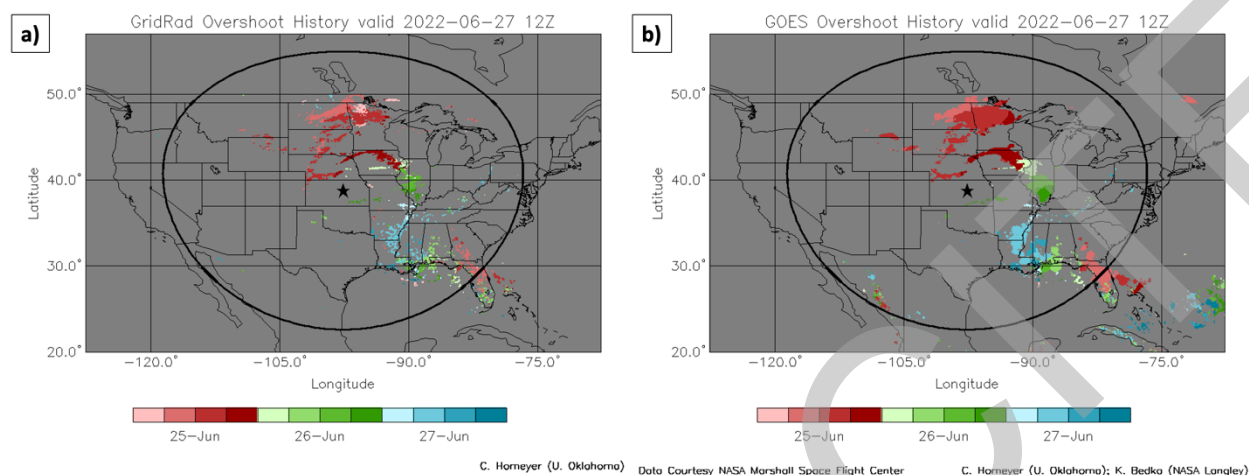


Figure 1: Overshoot history from (a) GridRad and (b) GOES between 12Z on 24 June and 12Z on 27 June 2022.

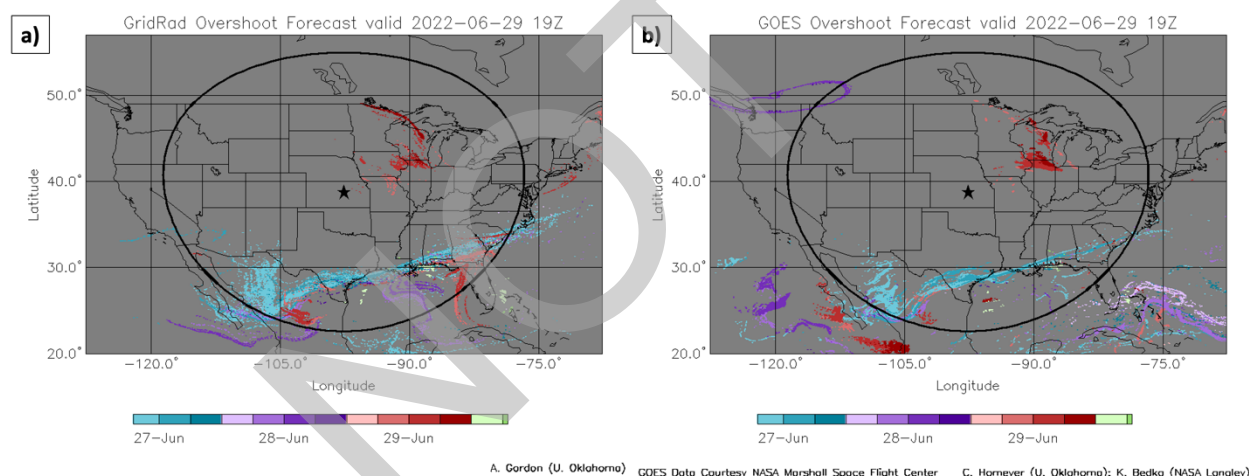


Figure 2: Overshoot particle trajectory forecast valid 19Z on 29 June 2022, initialized from (a) GridRad and (b) GOES.

The flight plan for the survey flight aimed to maximize sampling of the large-scale north-to-south gradient in stratospheric composition in the western US and included 8 profiles distributed roughly evenly between the takeoff and landing profiles. Following initial ascent out of Salina, the flight plan included a long transit northwest into a low-tropopause environment over Washington, then a long northwest-to-southeast transit into the anticyclone center near the Arizona border with Mexico, followed by ascent briefly to the east and a turn towards Palmdale with a climb to max altitude before landing. Figures 3 and 4 summarize the flight plan.

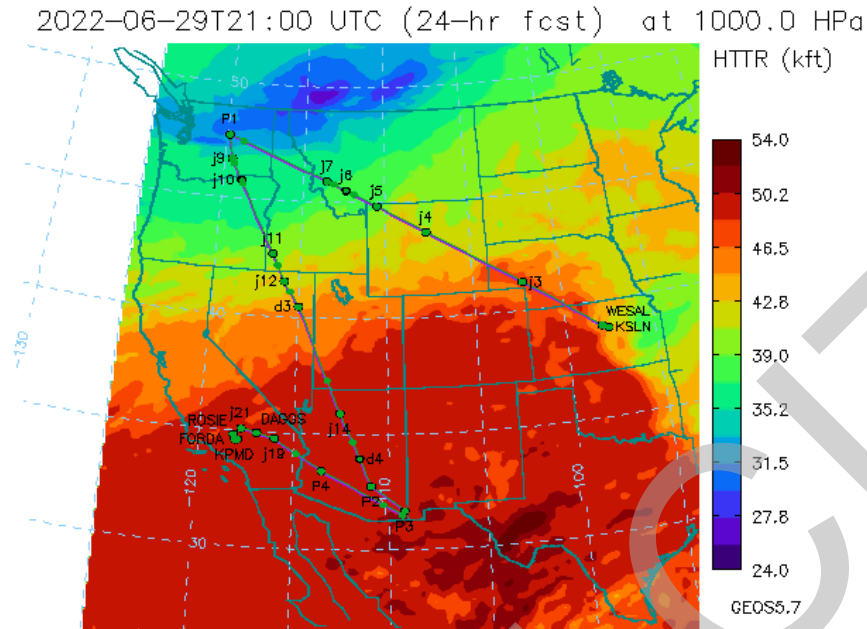


Figure 3: Map of TR04 flight plan superimposed on GEOS-5 forecast tropopause altitude.

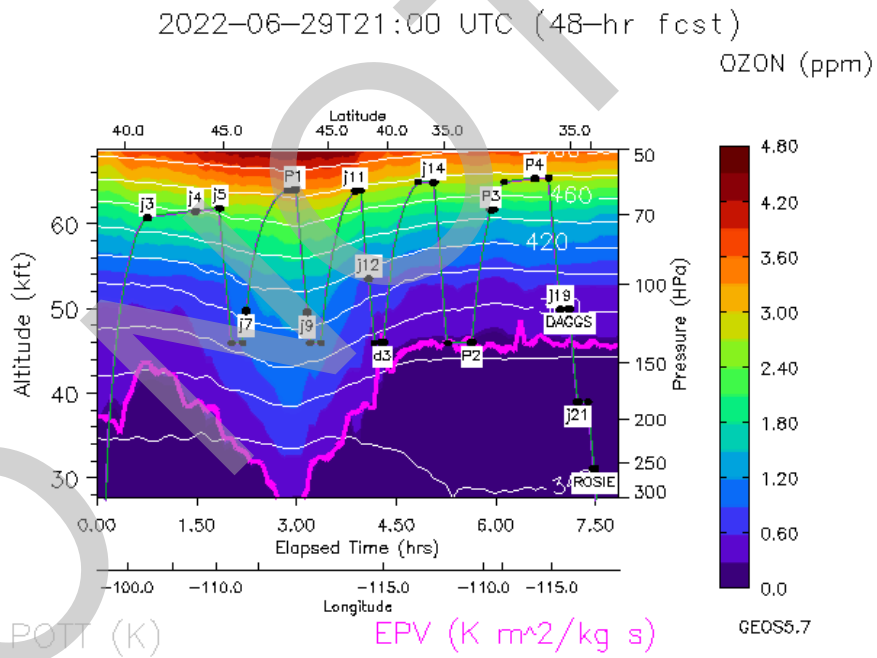


Figure 4: Curtain of GEOS-5 forecast ozone concentration along the flight path. The magenta line is the GEOS-5 tropopause height and white contours show potential temperature iso-surfaces in K.

## Flight Summary:

The flight was carried out as planned. Figure 5 shows the flight plan superimposed on a visible satellite image from during the flight and Figure 6 shows select timeseries observations from MTS during the flight. MTS was down during the morning of the flight due to a hardware failure and restored nearly 3 hours into the flight. During several profiles after MTS restoration, some notable variability in water vapor was observed in the lower stratosphere just above the tropopause, as well as in the upper troposphere during the long 46 kft leg on approach to P2. There were numerous shallow thunderstorms along the 46 kft leg approaching P2 and near the turn at P3, which are highlighted in a select few pictures from the forward camera here (Figure 7). The final ascent after P2 included an elevated water layer between  $\sim 53.5$  and  $\sim 56$  kft, above the tropopause at  $\sim 52$  kft. The maximum altitude reached during the final ascent was  $\sim 67.9$  kft.

Following the flight, the pilot reported that the navigation system was fully operational, resolving issues that have impacted many of the recent science flights. In addition, moderate turbulence was experienced during the low altitude leg near the northwest point of the flight track.

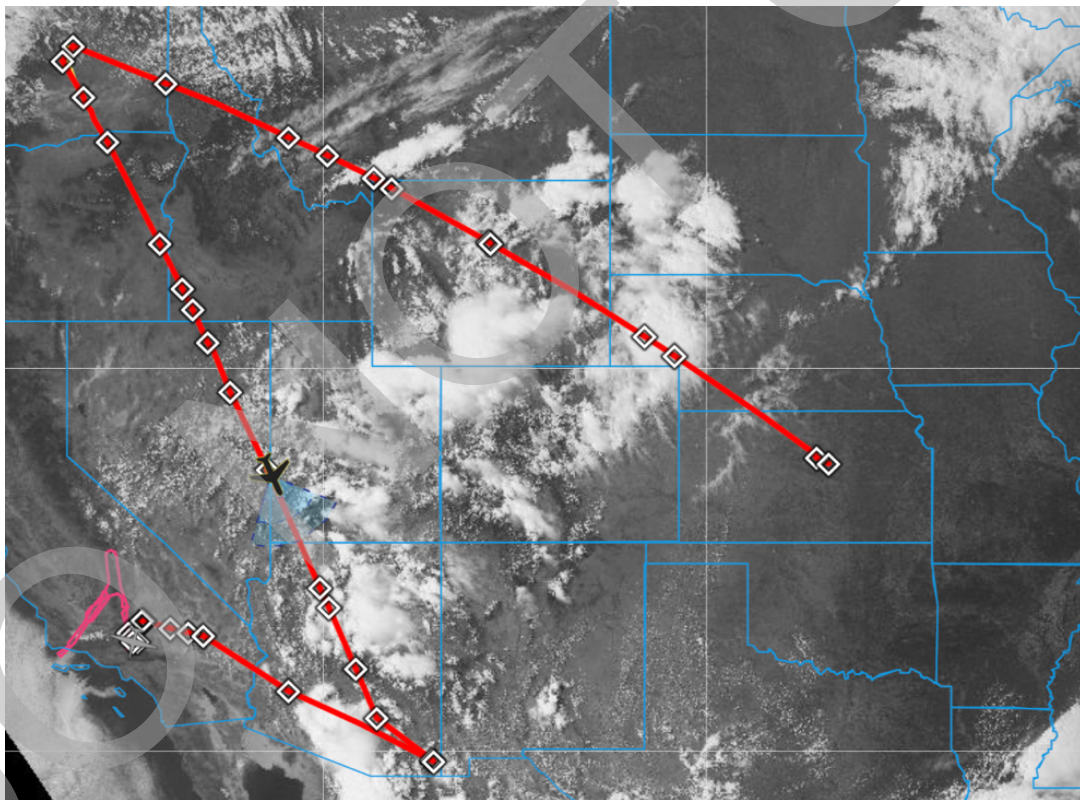
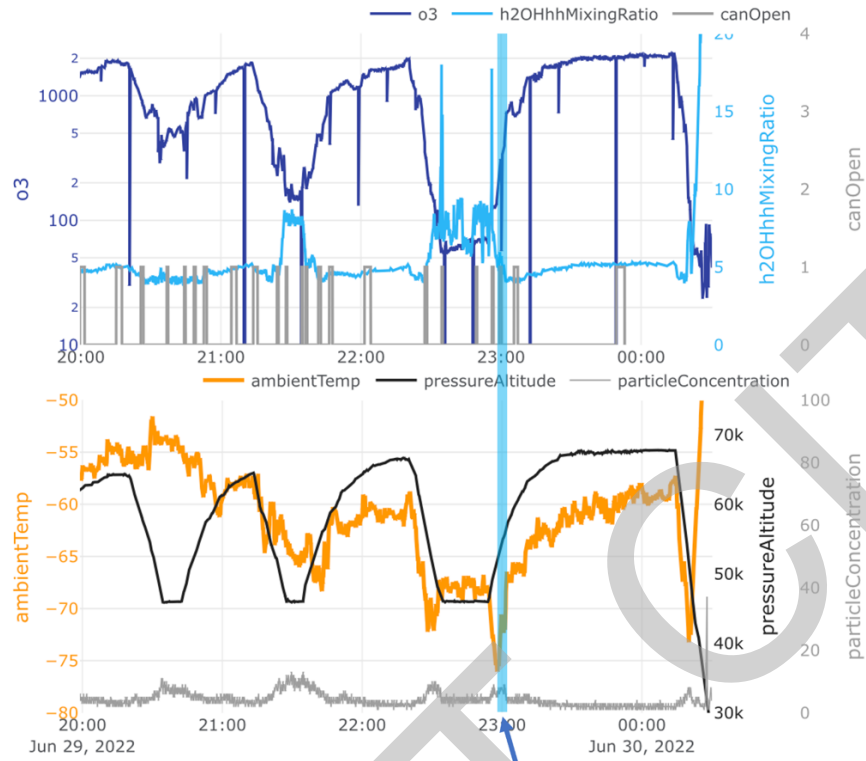


Figure 5: Visible satellite image with flight plan superimposed during the flight from MTS.



#### Enhanced Water Vapor Above Tropopause Near Anticyclone Center

Figure 6: Timeseries of (a) ROZE ozone (dark blue), HWV water vapor (light blue), and AWAS open can times (gray), and (b) pressure altitude (black), ambient temperature (orange), and DPOPS particle concentration (gray) from MTS during the flight. Enhanced water vapor measured in the lower stratosphere near the North American Monsoon anticyclone center is highlighted by the blue vertical color-fill.



Figure 7: Snapshots from the forward-facing camera at (left) 22:35, (middle) 23:14, and (right) 23:46 UTC.