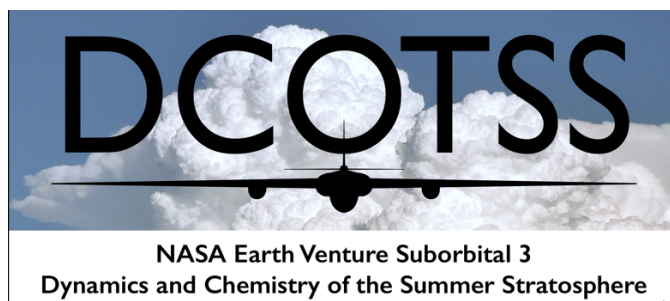


DCOTSS ER-2 Mission Scientist Flight Summary Report



Flight identifier: RF12

Science goals: Sample recent (0-1 day old) overshoot material over northern Wisconsin and southeastern Minnesota

Start of flight (UTC): 2022-05-29 11:02Z

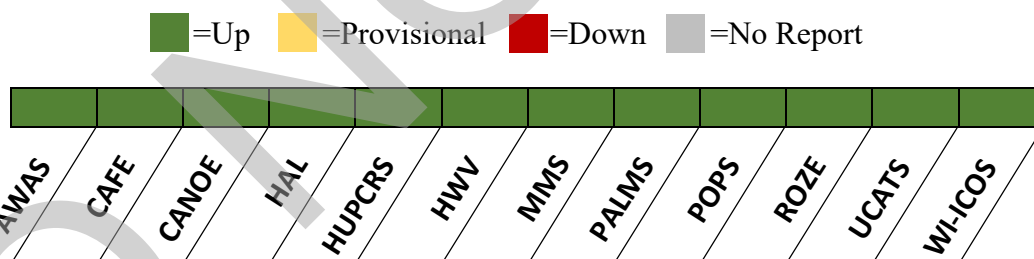
End of flight (UTC): 2022-05-29 16:00Z

ER-2 Pilot: Tim Williams

Mission Scientist: Kristopher Bedka

Version	Report date and time (UTC)	Author
1	2021-06-01 15:00Z	Kristopher Bedka
2	2021-06-05 15:24Z	Ken Bowman

Instrument Performance:



Aircraft Performance: Good

Science Objectives:

During the overnight and early morning hours of 29 May 2022, overshooting top producing storms occurred across South Dakota, Nebraska, and Minnesota. Overshooting detected by both GridRad and GOES persisted for at least ~15 hours prior to and during the flight (green in upper panels, Fig. 1) with varying vertical extent, ranging from ~40 kft (just above the GFS tropopause) up to ~55 kft via GridRad. The lowest overshooting material with the highest density moved northeastward faster than material injected to higher altitudes (lower-right, Fig. 1). The intent of RF12 was to sample dense material in the 40-46 kft layer across northern Wisconsin and southeastern Minnesota, that appeared to originate from overshooting in

Nebraska (lower-left, Fig. 1) early in the storm outbreak based on real-time GridRad trajectories. The initial flight plan (cyan, Fig. 2) also included a leg into Missouri to sample tracer gradients such as carbon monoxide that were thought to have originated from Asian pollution based on GEOS-5 model output. This leg was not conducted (red, Fig. 2) due to a shortened flight duration prompted by strong convection near flight track as well as high winds in Salina, described in the Flight Summary below.

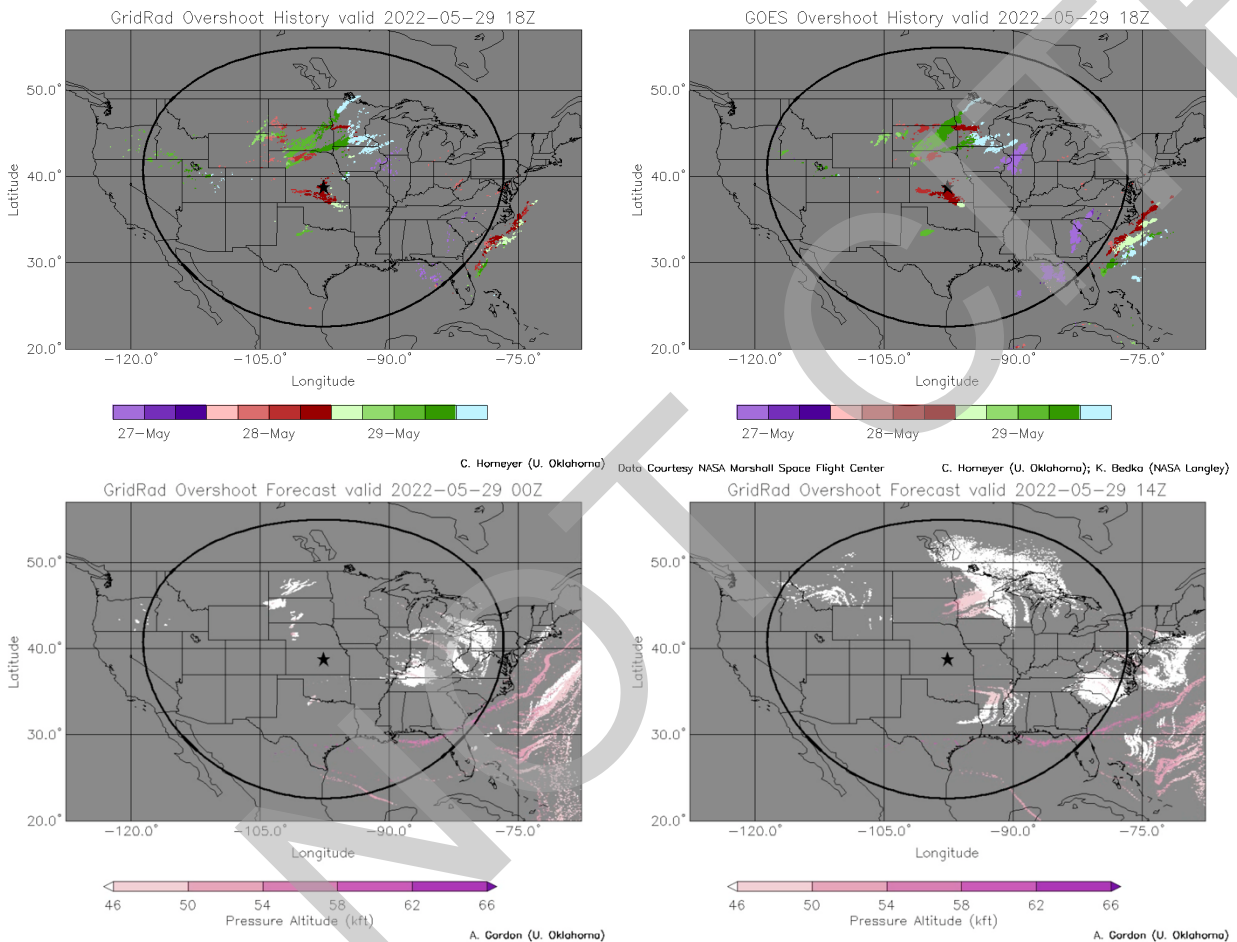


Figure 1: A 3-day overshoot history detected by NEXRAD GridRad (upper-left) and GOES (upper-right), ending at 18 UTC on 29 May 2022. An overshoot material forecast at 00 UTC (lower-left), denoting storm locations early in the event, and at 14 UTC (lower-right) while the ER-2 was sampling at 46.5 kft.

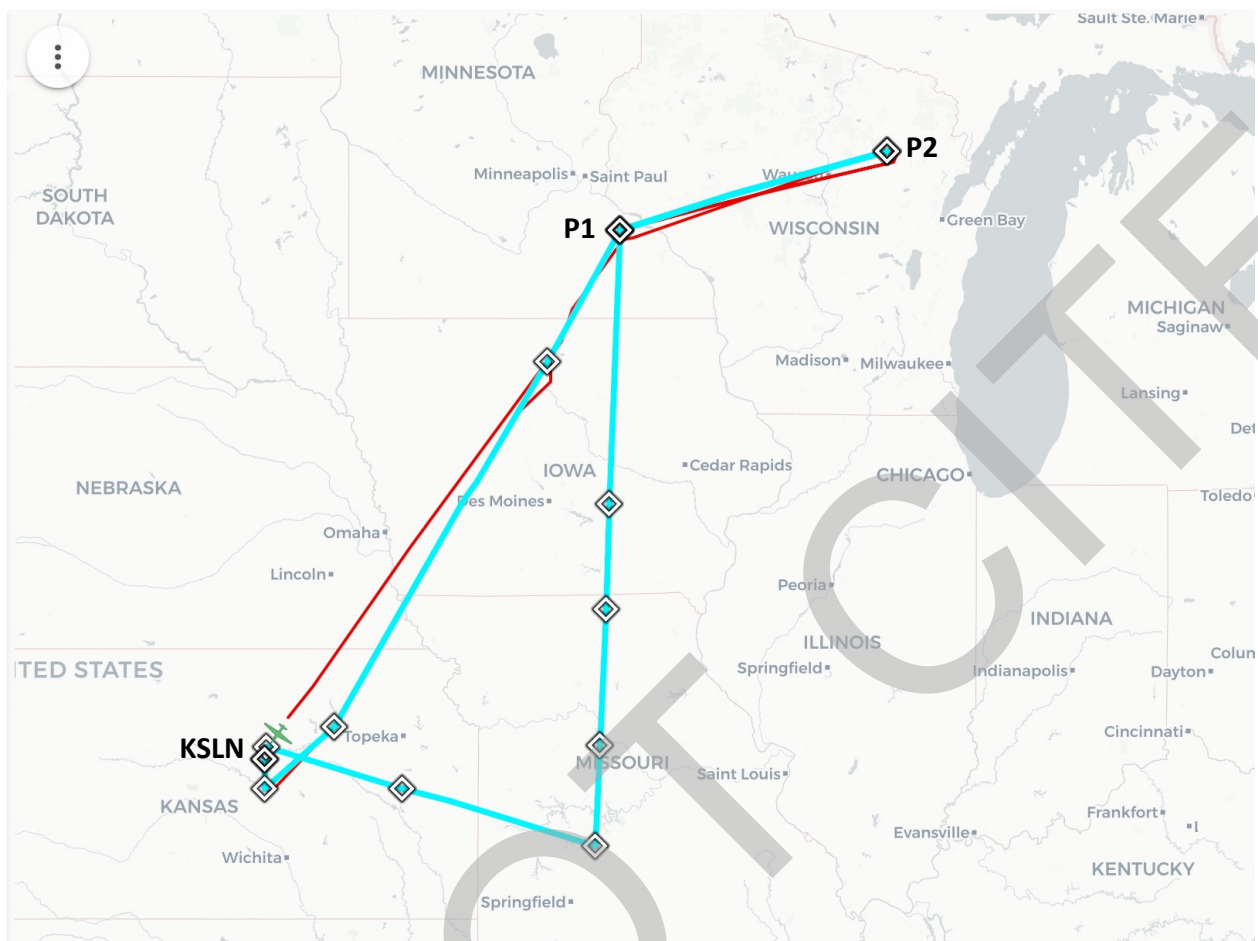


Figure 2: Map of the original RF12 flight plan (cyan) and the actual flight track taken by the ER-2 (red)

Flight Summary

The flight began at 1102 UTC with a climb from Salina (KSLN) toward waypoint P1 in southeastern Minnesota (Fig. 3). A vertical profile was collected during descent from ~63 kft to 42 kft at P1. A HWV water vapor and DPOPS particle concentration enhancement was observed in the 42 to 44 kft layer at the end of the profile right before P1. Four level legs were then conducted along a line from P1 to P2, located in northeastern Wisconsin, at 42, 43.5, 45, and 46.5 kft respectively. Water vapor and particle enhancements were observed during almost the entire 42 kft leg, as well as most of the 43.5 kft segment west of P2, coincident with cirrus reported by the pilot. Moderate intensity turbulence was reported at 42 kft, and light-to-moderate turbulence reported at 43.5 kft during flight within the cirrus. Water vapor enhancements (up to 28 ppmv) were also observed throughout the 45 kft leg.

Strong convection in Minnesota ongoing at takeoff (cyan, upper panels, Fig. 2) continued to move eastward during the flight and was located very near to P1 during the 46.5 kft segment. No water vapor enhancements were observed during this segment, despite enhancements being observed at 45 kft. Surface wind speeds in Salina were sustained at 20-25 kts from the south, with gusts approaching 35 kts during the flight. These gusts are at the limit permissible for ER-2 landing, but were forecasted to be even higher in the early afternoon. Due to the strong

convection and high winds, a decision was made to return to Salina midway through the 46.5 kft leg. The aircraft climbed above 55 kft by P1 and continued to climb up to ~66 kft enroute to Salina. During descent, a 10 minute level leg at a 10 kft altitude was conducted to give the instruments an opportunity to warm before landing. Landing occurred at 1600 UTC, resulting in a 5 hour flight duration.

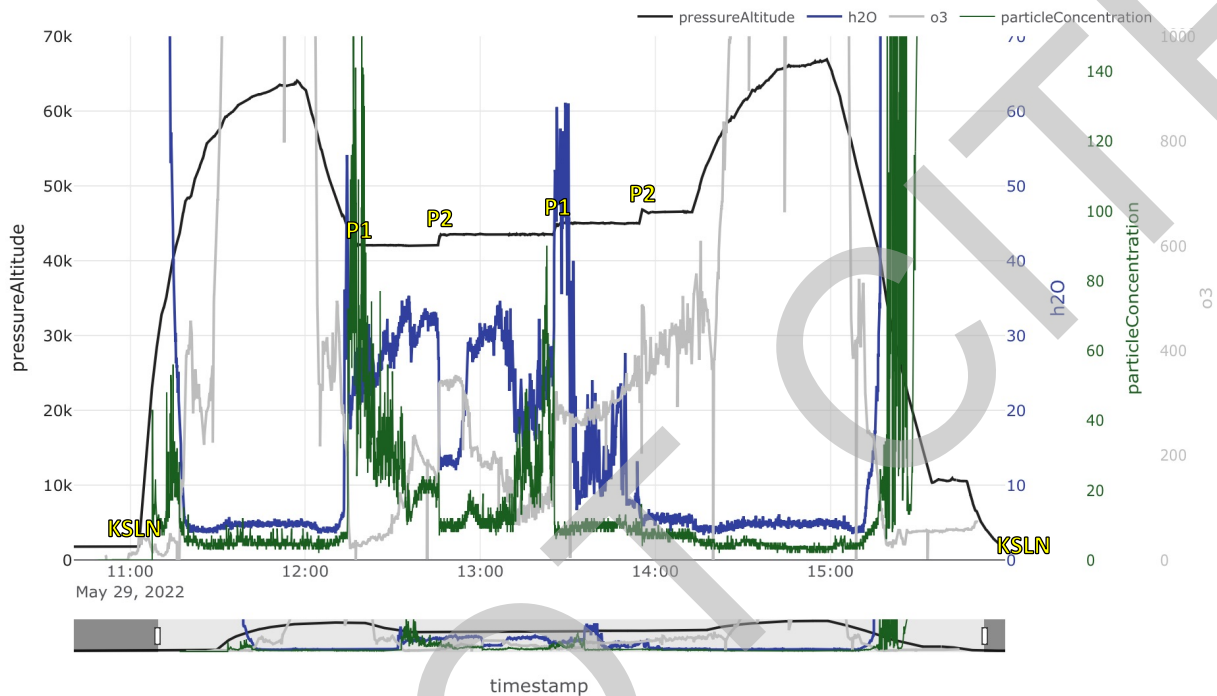


Figure 3: Curtain of flight altitude (black), overlaid with real-time MTS data feeds of Harvard Water Vapor concentration (blue), DPOPS Particle Concentration (green), and ROZE Ozone (grey).