

Meteorological Data from NASA GSFC

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DCOTSS Sci Team Mtg, Nov 14 2023

Outline

1. What data are we dealing with?
2. What makes these data useful?
3. Data plots on the web
4. Exchange files in the archive
4. Long-term data and other possibilities
5. BTW, how did flight planning go?

What data are we talking about?

- GEOS fp (From the Goddard Assimilation Office)
- Assimilation (i.e., real data melded w/ modeling)
- (<https://gmao.gsfc.nasa.gov>)

What does data like this provide?

1. Context – Horizontal:

What was going on around the flight?

2. Context – Vertical:

What was going on above and below the aircraft?

3. Context – Temporal:

What was going on before and after the flight?

Data Plots: what is available

GEOS fp data

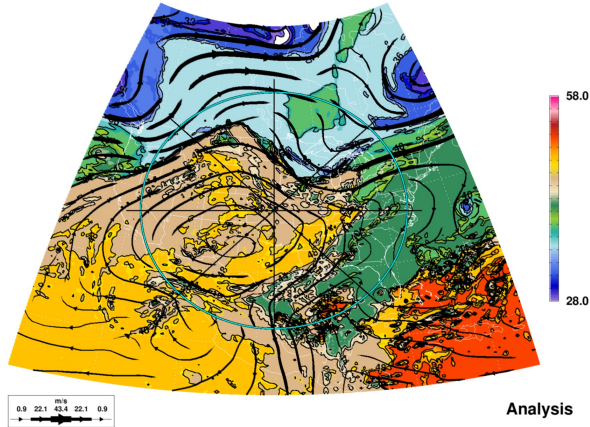
Maps & cross-sections

6-hourly plots covering each flight series (including test flights)

	Rel. Hum.	High Cloud	Med. Cloud	T	PV	O3	Total O3	Trop. Pres.	Trop. T	Trop. Theta	Strat. Frac.	CO	SO2	SO4
Maps	200, 500, 850 hPa	150 hPa	500 hPa	70, 100, 250, 500, 850 hPa	320, 340, 350, 360, 380, 400, 440, 460 K	320, 340, 350, 360, 380, 400, 440, 460 K	trop	trop	trop	trop	320, 340, 350, 360, 380, 400, 440, 460 K	70, 100, 150, 200, 300, 500 mb	70, 100, 150, 200, 300, 500, 850 mb	70, 100, 150, 200, 300, 500 mb
Cross-sections	W-E, N-S, SE-NW, SW-NE				W-E, N-S, SE-NW, SW-NE	W-E, N-S, SE-NW, SW-NE	(N/A)	(N/A)	(N/A)	(N/A)	W-E, N-S, SE-NW, SW-NE	W-E, N-S, SE-NW, SW-NE	W-E, N-S, SE-NW, SW-NE	

Data Plots: samples

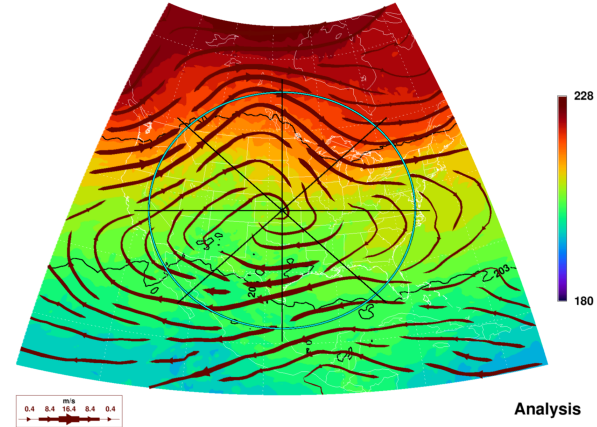
Tropopause Alt(kft) 2021-07-17T06, Sat.



Sat Nov 4 05:08:58 2023

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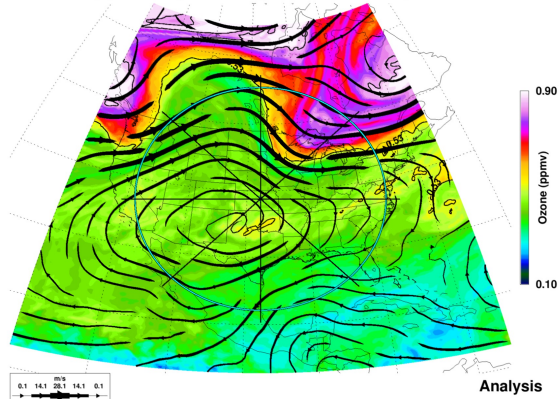
Temperature (K), 100 hPa, 2021-07-17T06, Sat.



Fri Nov 3 22:07:12 2023

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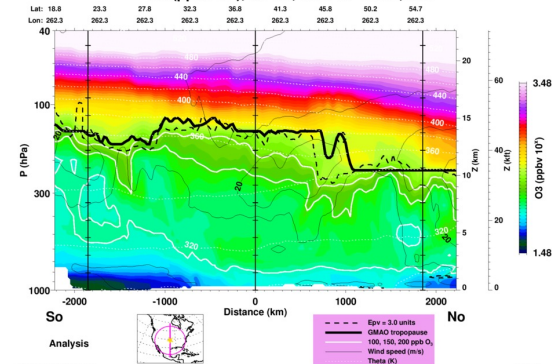
O3_, 380 K (126 hPa), 2021-07-17T06, Sat.



Sat Nov 4 02:45:45 2023

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O3 (ppbv 10³), So-No, 2021-07-17T06, Sat.



Sat Nov 4 16:20:38 2023

Paul A. Newman (NASA)

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Data Plots: how to access them



<https://acd-ext.gsfc.nasa.gov/Missions/DCOTSS/index.html>

Laboratory (Code 614)

ic/Technical Information

series

DCOTSS Meteorological Plots

The Dynamics and Chemistry Of The Summer Stratosphere (DCOTSS) airborne field measurement campaign uses the NASA ER-2 aircraft to examine the fate of air that is injected into the stratosphere by strong thunderstorms in the spring and summer over North America.

The pages here provide plots of meteorological and chemical products from the **GEOS FP** assimilation system run by Goddard Space Flight Center's **GMAO**. These plots may be used to aid in planning flights during deployments, as well as interpreting measurements in post-mission analysis.

Plots Pages

- Forecast and recent days's fields
- DCOTSS Test Flight Series [Palmdale, CA] (June 2021)
- DCOTSS Deployment 1 [Salina, KS] (July-August 2021)
- DCOTSS Test Flight II [Palmdale, CA] (May 2022)
- DCOTSS Deployment 2 [Salina, KS] (May-July 2021)
- DCOTSS Deployment 2 [Palmdale, CA] (July 2021)

Other Links

- The main DCOTSS Mission Site

 [Back to the Code 614 Colleagues home page](#)

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Goddard
SPACE FLIGHT CENTER

Valid-At Date

Quantity

Animation Single Plot

[illegible]

2022-06-06	2022-06-07	2022-06-08	2022-06-09	2022-06-10	2022-06-11
Lail & Newman, DCOTSS	90	88	86	84	82

Data Exchange Files: what is available

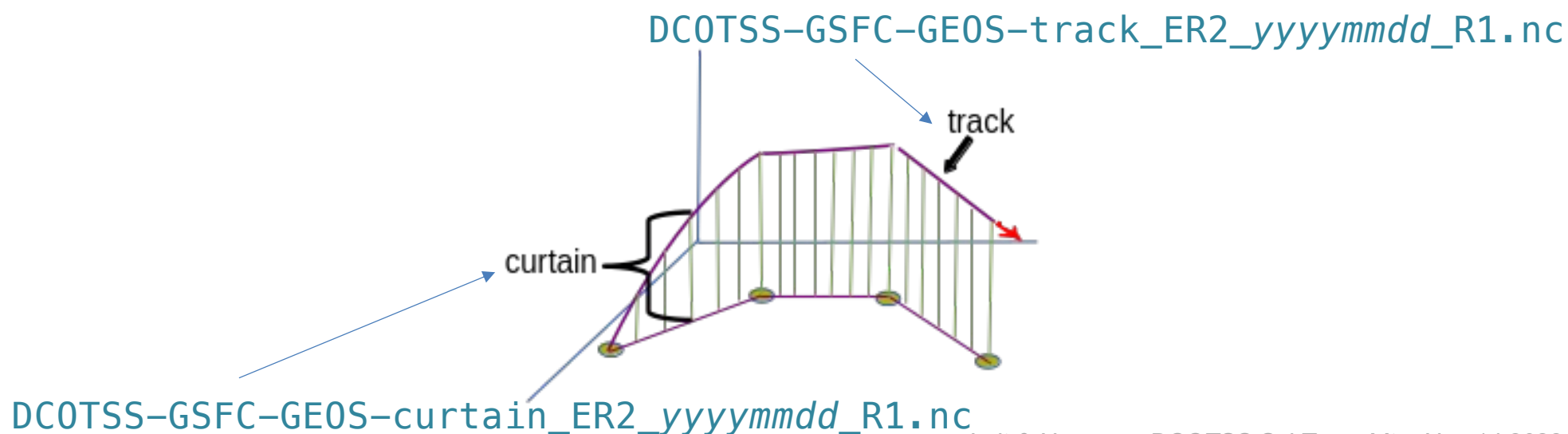
Version R1 submitted to the Langley archive Nov. 7

GEOS fp 6-hourly assimilation interpolated in space and time to the flight track

- track files (“in situ”)
- curtain files (vertical profiles)

Position taken from MMS 1 Hz data.

Netcdf format (can generate in ICARTT if there is demand)

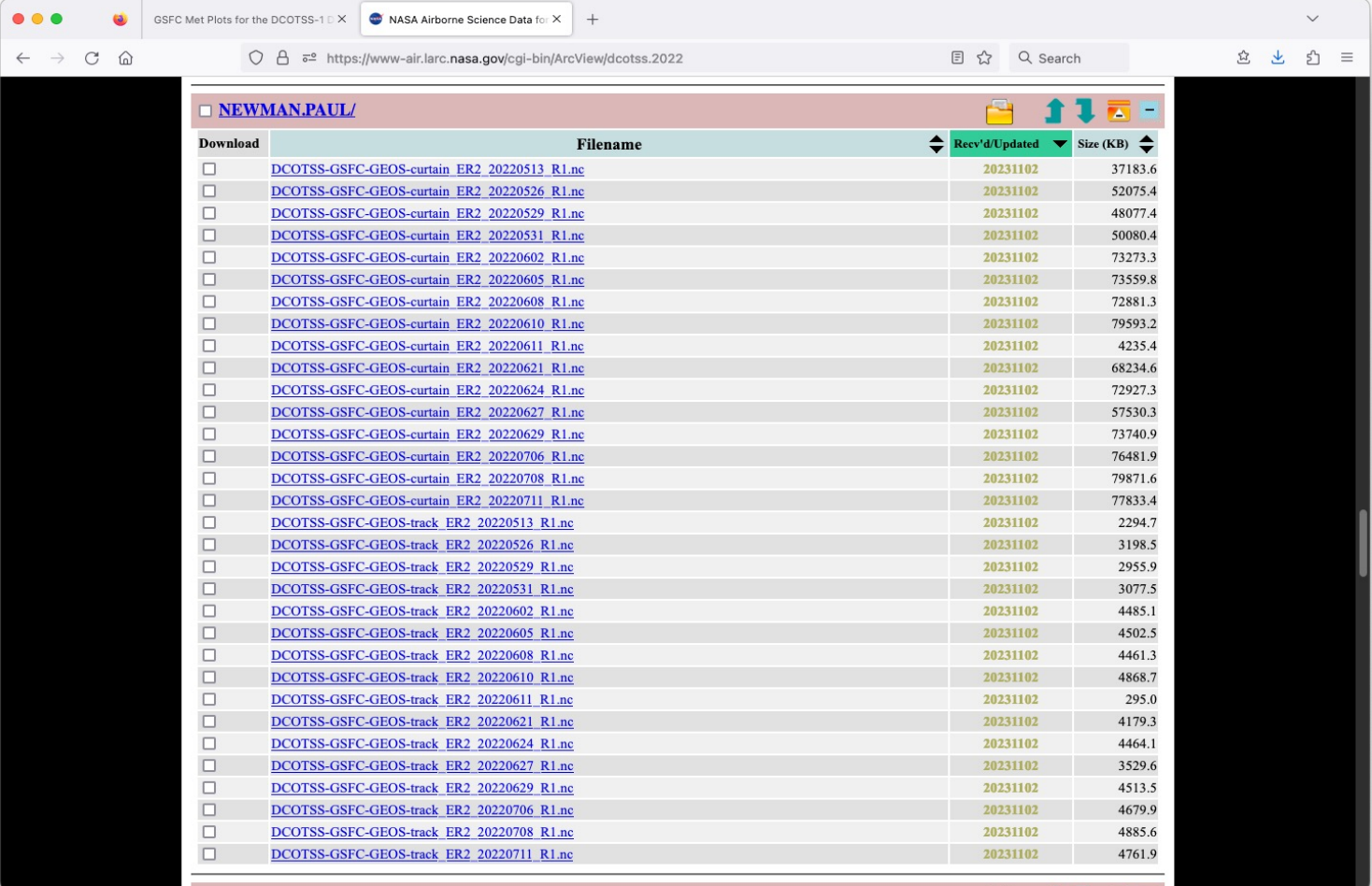


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Data Exchange Files: how to access them

See the Langley DCOTSS Archive Website.

Listed under
“Newman, Paul”



The screenshot shows a web browser window with the URL <https://www-air.larc.nasa.gov/cgi-bin/ArcView/dcotss.2022>. The page displays a list of files for the user 'NEWMAN.PAUL/'. The table has columns for 'Download', 'Filename', 'Recv'd/Updated', and 'Size (KB)'. The files are listed in descending order of size, with the largest file being 37183.6 KB and the smallest being 295.0 KB. The files are categorized by type (ER2, R1.nc) and date (20220513, 20220526, 20220529, 20220531, 20220602, 20220605, 20220608, 20220610, 20220611, 20220621, 20220624, 20220627, 20220629, 20220706, 20220708, 20220711).

Download	Filename	Recv'd/Updated	Size (KB)
☐	DCOTSS-GSFC-GEOS-curtain ER2 20220513 R1.nc	20231102	37183.6
☐	DCOTSS-GSFC-GEOS-curtain ER2 20220526 R1.nc	20231102	52075.4
☐	DCOTSS-GSFC-GEOS-curtain ER2 20220529 R1.nc	20231102	48077.4
☐	DCOTSS-GSFC-GEOS-curtain ER2 20220531 R1.nc	20231102	50080.4
☐	DCOTSS-GSFC-GEOS-curtain ER2 20220602 R1.nc	20231102	73273.3
☐	DCOTSS-GSFC-GEOS-curtain ER2 20220605 R1.nc	20231102	73559.8
☐	DCOTSS-GSFC-GEOS-curtain ER2 20220608 R1.nc	20231102	72881.3
☐	DCOTSS-GSFC-GEOS-curtain ER2 20220610 R1.nc	20231102	79593.2
☐	DCOTSS-GSFC-GEOS-curtain ER2 20220611 R1.nc	20231102	4235.4
☐	DCOTSS-GSFC-GEOS-curtain ER2 20220621 R1.nc	20231102	68234.6
☐	DCOTSS-GSFC-GEOS-curtain ER2 20220624 R1.nc	20231102	72927.3
☐	DCOTSS-GSFC-GEOS-curtain ER2 20220627 R1.nc	20231102	57530.3
☐	DCOTSS-GSFC-GEOS-curtain ER2 20220629 R1.nc	20231102	73740.9
☐	DCOTSS-GSFC-GEOS-curtain ER2 20220706 R1.nc	20231102	76481.9
☐	DCOTSS-GSFC-GEOS-curtain ER2 20220708 R1.nc	20231102	79871.6
☐	DCOTSS-GSFC-GEOS-curtain ER2 20220711 R1.nc	20231102	77833.4
☐	DCOTSS-GSFC-GEOS-track ER2 20220513 R1.nc	20231102	2294.7
☐	DCOTSS-GSFC-GEOS-track ER2 20220526 R1.nc	20231102	3198.5
☐	DCOTSS-GSFC-GEOS-track ER2 20220529 R1.nc	20231102	2955.9
☐	DCOTSS-GSFC-GEOS-track ER2 20220531 R1.nc	20231102	3077.5
☐	DCOTSS-GSFC-GEOS-track ER2 20220602 R1.nc	20231102	4485.1
☐	DCOTSS-GSFC-GEOS-track ER2 20220605 R1.nc	20231102	4502.5
☐	DCOTSS-GSFC-GEOS-track ER2 20220608 R1.nc	20231102	4461.3
☐	DCOTSS-GSFC-GEOS-track ER2 20220610 R1.nc	20231102	4868.7
☐	DCOTSS-GSFC-GEOS-track ER2 20220611 R1.nc	20231102	295.0
☐	DCOTSS-GSFC-GEOS-track ER2 20220621 R1.nc	20231102	4179.3
☐	DCOTSS-GSFC-GEOS-track ER2 20220624 R1.nc	20231102	4464.1
☐	DCOTSS-GSFC-GEOS-track ER2 20220627 R1.nc	20231102	3529.6
☐	DCOTSS-GSFC-GEOS-track ER2 20220629 R1.nc	20231102	4513.5
☐	DCOTSS-GSFC-GEOS-track ER2 20220706 R1.nc	20231102	4679.9
☐	DCOTSS-GSFC-GEOS-track ER2 20220708 R1.nc	20231102	4885.6
☐	DCOTSS-GSFC-GEOS-track ER2 20220711 R1.nc	20231102	4761.9

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Data Exchange Files: how good is this data?

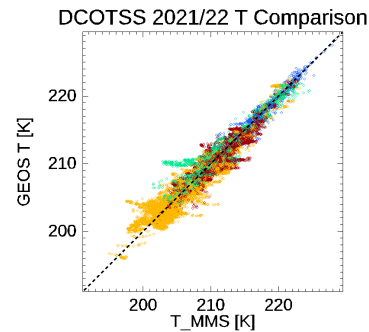
Meteorological Comparisons w/ (merged) MMS Data

Scatterplots

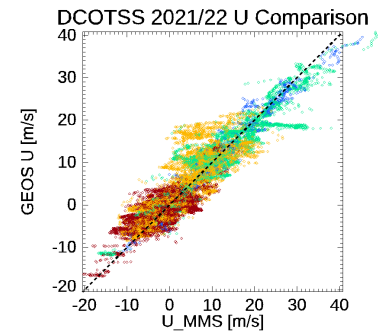
(200, 150, 100, 70 mb)

(Points selected from $\pm 1/2$ km of selected pressure levels)

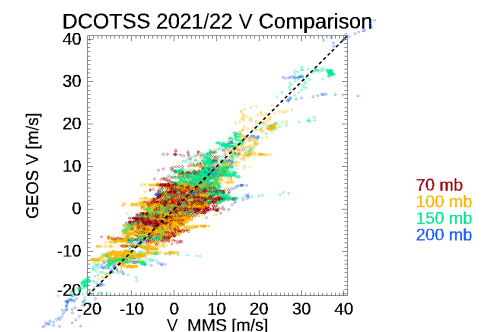
Temperature



U-wind

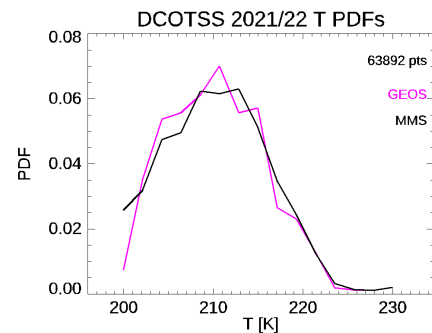


V-wind

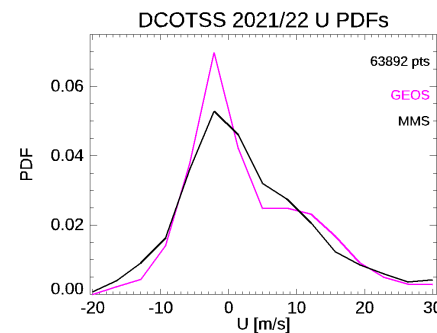


PDFs

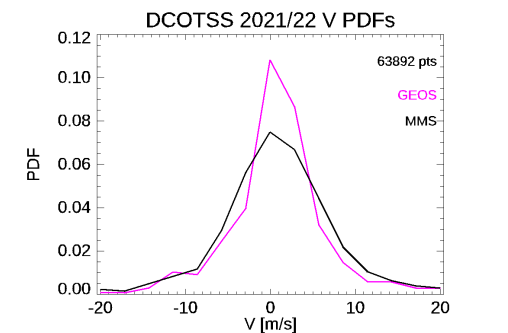
(All points within selected range)



Data between 300 and 10 hPa



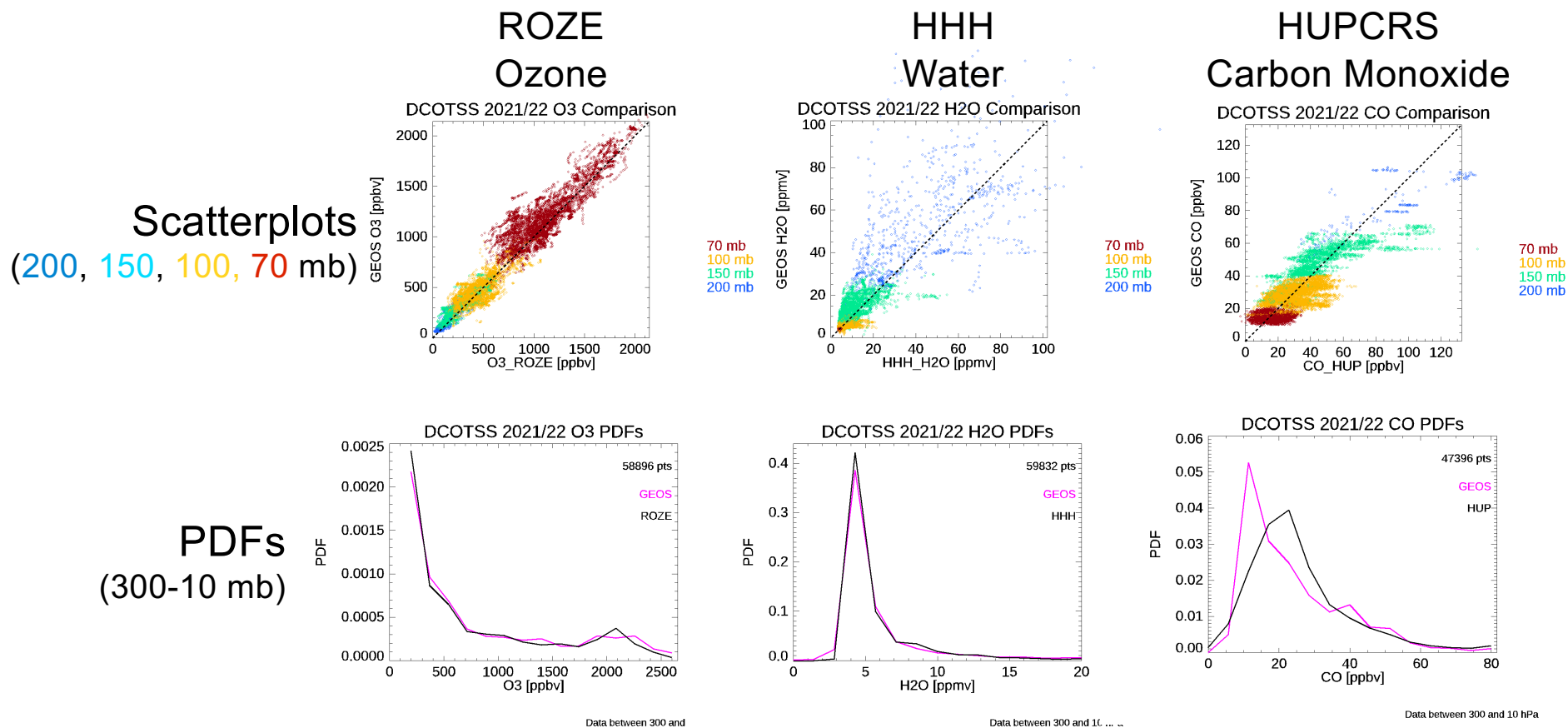
Data between 300 and 10 hPa



Data between 300 and 10 hPa

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Data Exchange Files: how good are these data?



Long-term Data and Other Possibilities

- Long-term meteorological data sets
 - Decades of self-consistent analyses/assimilation
 - MERRA2 (1980-present)
 - GEOS fp = best and latest assimilation current
 - MERRA2 = long-term consistency
 - NCAR/NCEP reanalysis (1958-present)
- Trajectories
 - Special runs
 - Can do thousands of parcels
 - Can use w/ MERRA2 or GEOS FP met fields
 - Isentropic, diabatic, or kinematic trajectories

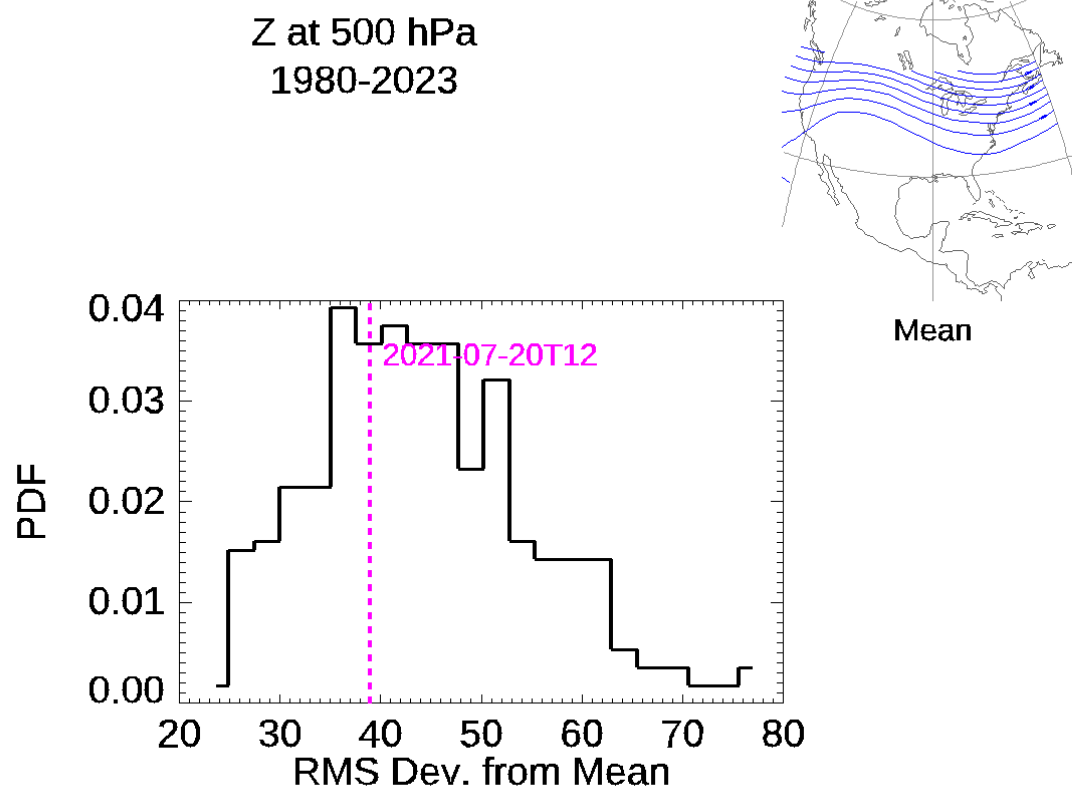
Long-term Data: example use

Example:

Q: Was the CONUS flow pattern on 2021-07-20 typical of all July 20s?

- Use 500 mb Geopot. Hgt.
- Pick days +/- 5, +/- 10 days, 1980 through 2023
- Subtract the mean at each gridpoint
- Look at the histogram of RMS diffs from the mean

A. Yes, quite typical



Long-term Data and Other Possibilities

Contact Leslie.R.Lait@nasa.gov
Or Paul.A.Newman@nasa.gov

Flight Planning: How did it go?

GSFC flight planner software:

Plusses:

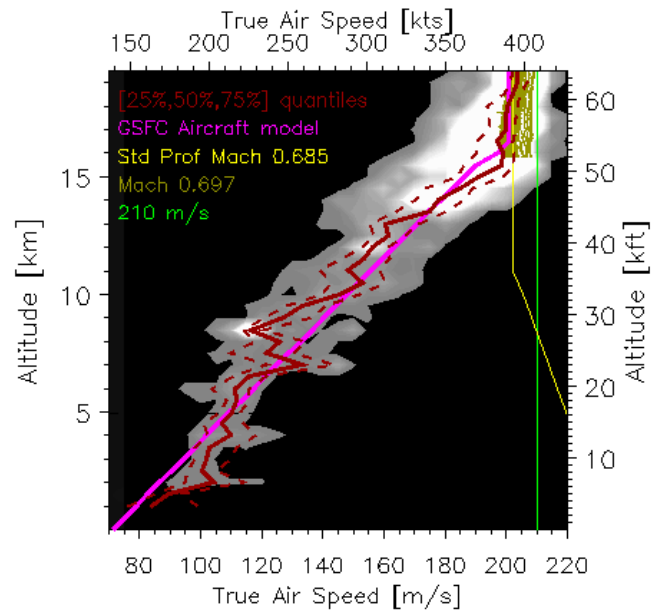
- Able to display OU traj model output
- Able to display WX fcst maps directly from Pivotal
- Able to display GEOS FP forecasts (arbitrary maps, xsects)
- Realistic modeling of aircraft -> good timings (helped catch miscommunications w/ pilots)
- SZA display made planning the sun runs feasible

Minuses:

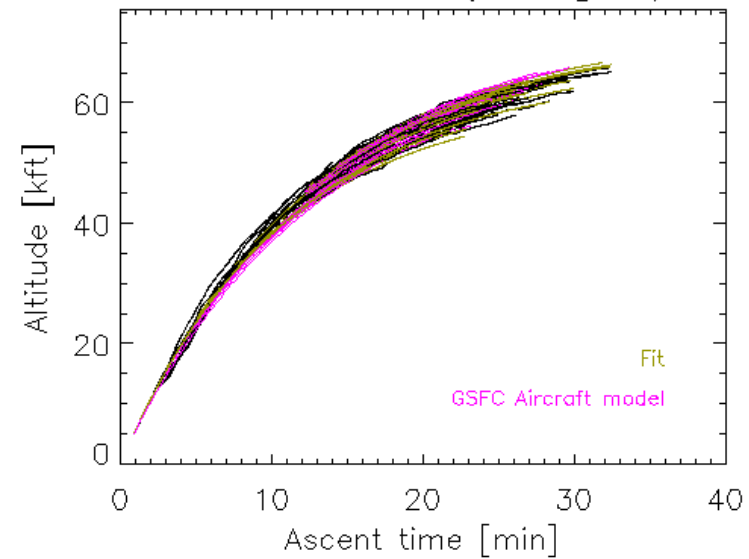
- data acquisition did not work well w/ VPNs
- Unwieldy user interface not suitable for rapid in-flight changes

Flight Planning: How did it go?

Rel. Population of ER-2 Air Speeds



ER-2 Ascents (all flights)



The Goddard flight planner modeled the the ER-2 well.

Conclusions

1. GEOS FP data may be useful putting flights into their larger context
2. Maps and cross-section plots & animations are available on our website
3. Data interpolated to the flight track (both in situ and profile) are in our exchange files on the Langley archive
4. Long-term analyses (for statistics) and special trajectory runs are doable
5. The flight planning software worked pretty well