Atmosphere, Clouds, and Climate: Turbulence and Cumulus Clouds

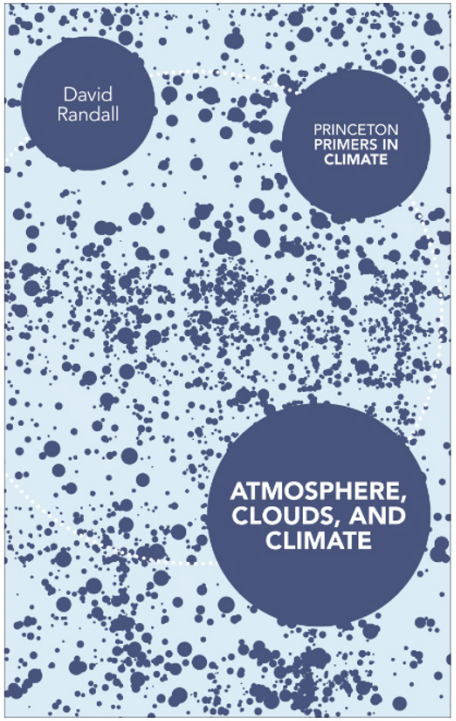
AOSC 680

Ross Salawitch

Class Web Sites:

http://www2.atmos.umd.edu/~rjs/class/fall2022

https://umd.instructure.com/courses/1327017



Lecture 13

20 October 2022

Student Led Discussions of Princeton Primers In Climate

10/20	Turbulence and Cumulus Clouds	Chapter 3 of *Atmospheres, Clouds, and Climate*	AT 13	**Jhayron** Lecture 13		
10/25	Energy Flows and Climate Feedback	Chapters 4 & 5 of *Atmospheres, Clouds, and Climate*	AT 14 Paper/Project Desc	TBD: Lecture 14		
10/27	Water Planet and Weather Predictability	Chapters 6 & 7 of *Atmospheres, Clouds, and Climate*	AT 15	TBD: Lecture 15		
11/01	Basics of Climate and the Oceans	Chapters 1 & 2 of *Climate and the Oceans*	AT 16	Ross Lecture 16		
11/03	Ocean Dynamics and Circulation	Chapters 3 & 4 of *Climate and the Oceans*	AT 17	**Shawn** Lecture 17		
11/08	Oceans Role in Climate & Climate Variability	Chapters 5 & 6 of *Climate and the Oceans*	AT 18	**Rachel** Lecture 18		
11/10	Global Warming and the Ocean	Chapters 7 of *Climate and the Oceans*	AT 19	**Alisha** Lecture 19		
11/15	Introduction to Systems and the Cryosphere	Chapters 1 & 2 of *Climate and Ecosystems* and Chapter 1 of *The Crysophere*	AT 20	Ross Lecture 20		
11/17	Ecosystems	Reading to be determined from *Climate and Ecosystems*	AT 21	**Yixin** Lecture 21		
11/22	None		No AT	Class Meeting On The Elements Of Writing A Good Paper		
11/29	Cryosphere	Reading to be determined from *The Cryosphere*	AT 22	**Natalia** Lecture 22		

Figure 3.6. Sketch illustrating a strong updraft, represented by the large arrow, and surrounding weak downdrafts, represented by the small arrows.
The upward and downward mass flows can cancel.

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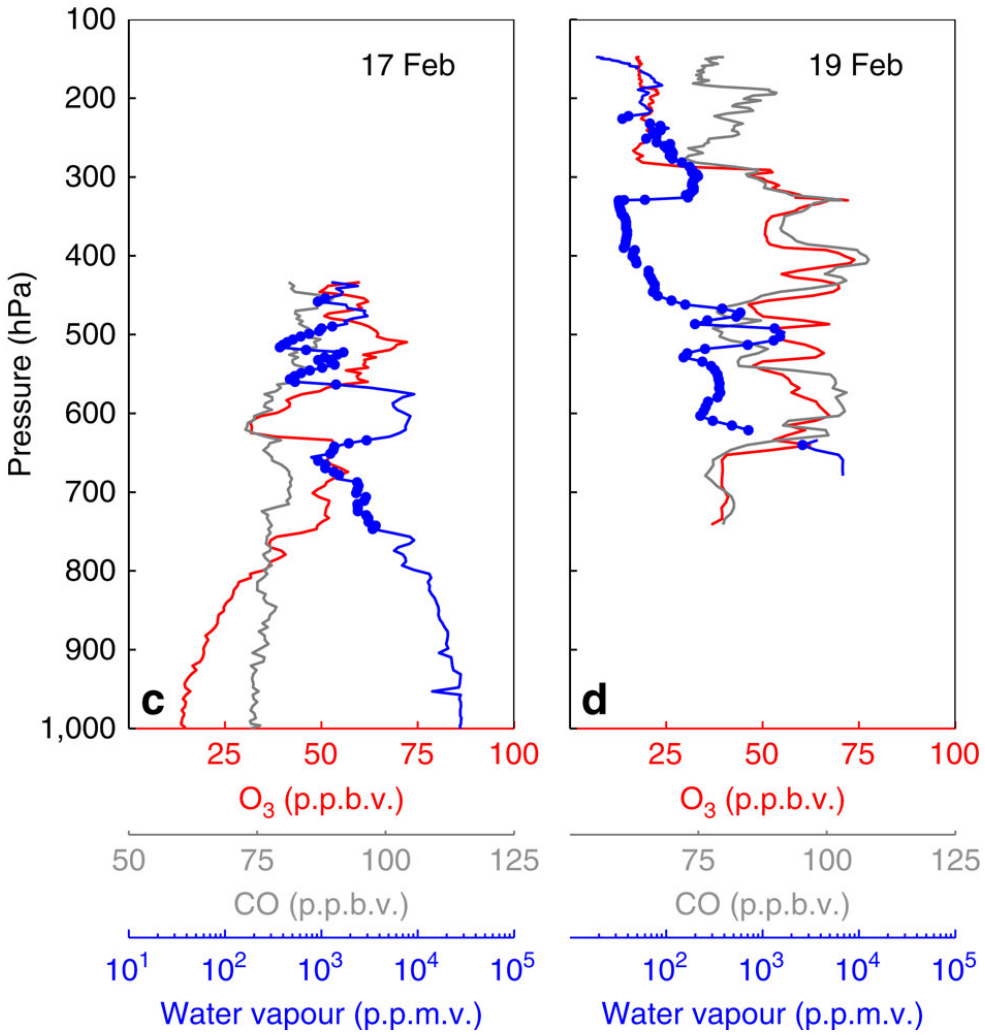

https://www.nature.com/articles/ncomms10267

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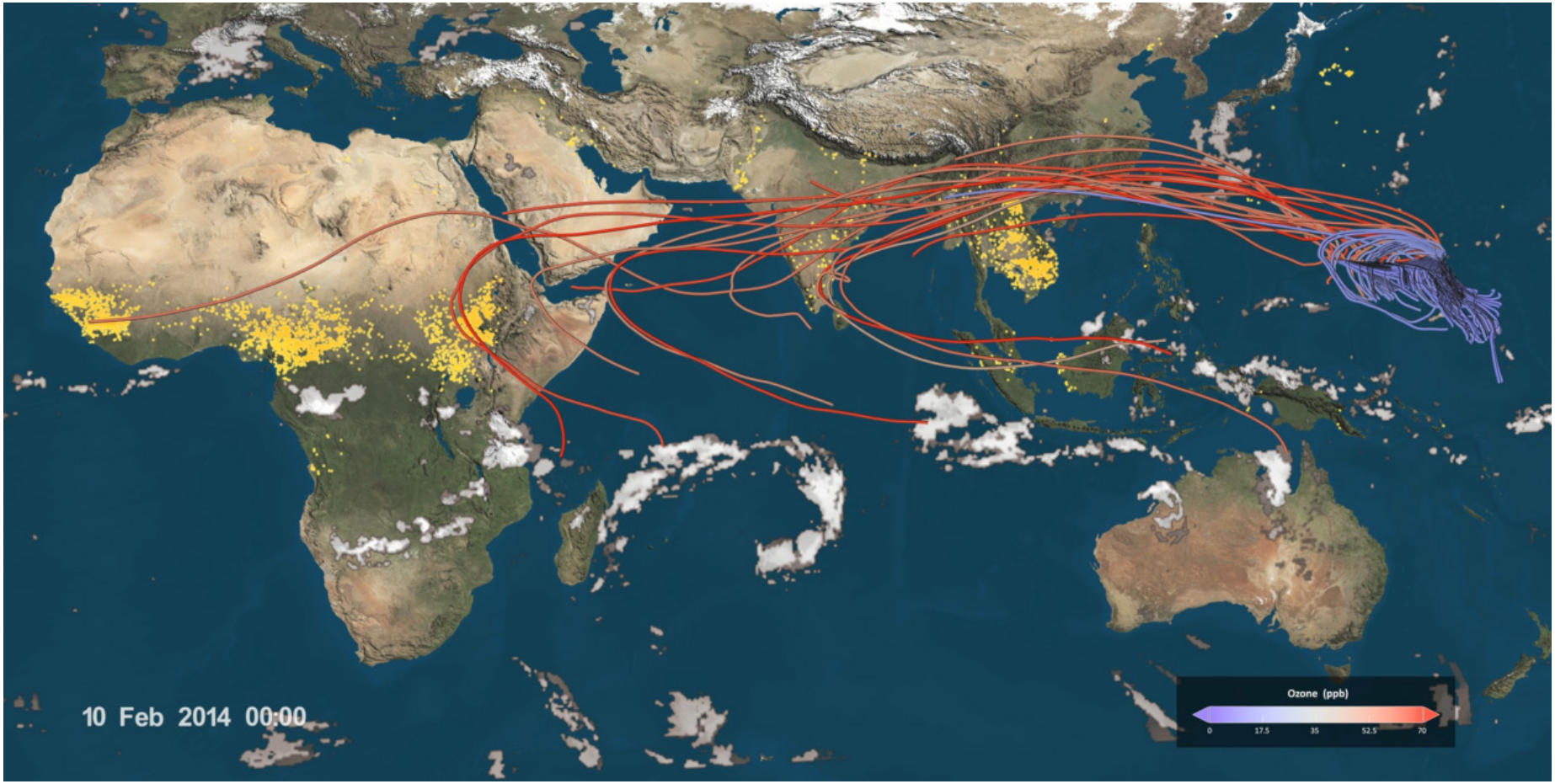

https://www.nasa.gov/feature/goddard/2016/tropical-fires-fuel-elevated-ozone-levels-over-western-pacific-ocean

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nature COMMUNICATIONS

ARTICLE

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A pervasive role for biomass burning in tropical high ozone/low water structures

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Air parcels with mixing ratios of high O_3 and low H_2O (HOLW) are common features in the tropical western Pacific (TWP) mid-troposphere (300–700 hPa). Here, using data collected during aircraft sampling of the TWP in winter 2014, we find strong, positive correlations of O_3 with multiple biomass burning tracers in these HOLW structures. Ozone levels in these structures are about a factor of three larger than background. Models, satellite data and aircraft observations are used to show fires in tropical Africa and Southeast Asia are the dominant source of high O_3 and that low H_2O results from large-scale descent within the tropical troposphere. Previous explanations that attribute HOLW structures to transport from the stratosphere or mid-latitude troposphere are inconsistent with our observations. This study suggest a larger role for biomass burning in the radiative forcing of climate in the remote TWP than is commonly appreciated.

https://www.nature.com/articles/ncomms10267

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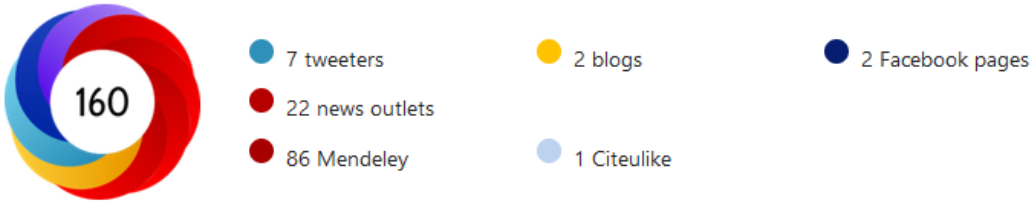
Article Accesses	Web of Science	CrossRef

Online attention



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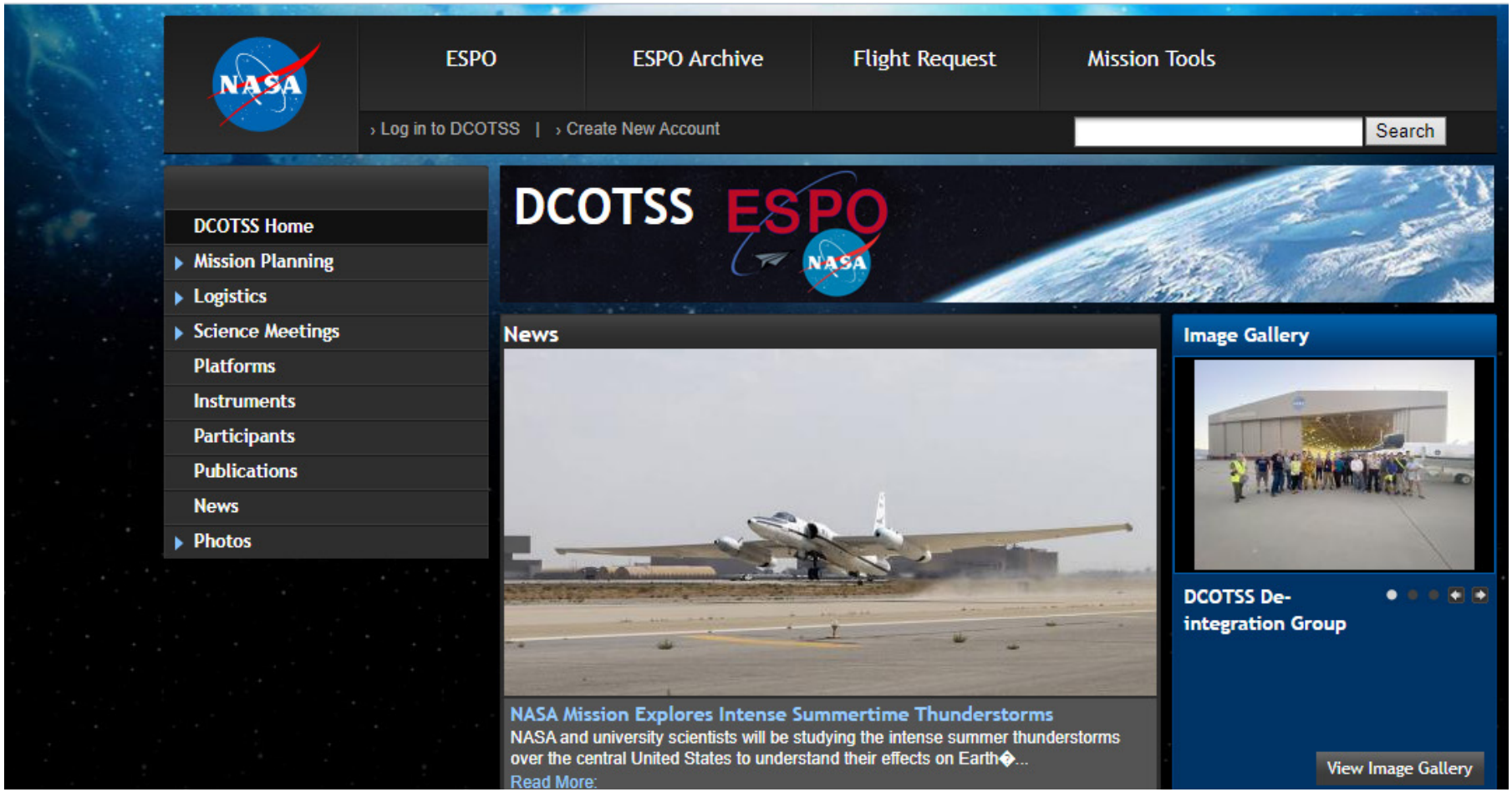
Under conditions that will be explained later in this chapter, some of the thermals that grow near the surface can break away from the boundary layer and grow into thunderstorms, like the ones shown in the upper portion of Figure 3.1. A typical thunderstorm is 5 to 10 km across. In the atmosphere as a whole, many thousands of thunderstorms are occurring at any given moment. The storms grow rapidly upward because they contain strong, organized updrafts, with speeds of 20 m s^{-1} or more, much faster than any elevator you have ever ridden on. The updrafts lift energy through the depth of the troposphere, and sometimes even stab into the lower stratosphere. They also lift moisture, momentum, and various chemical species.



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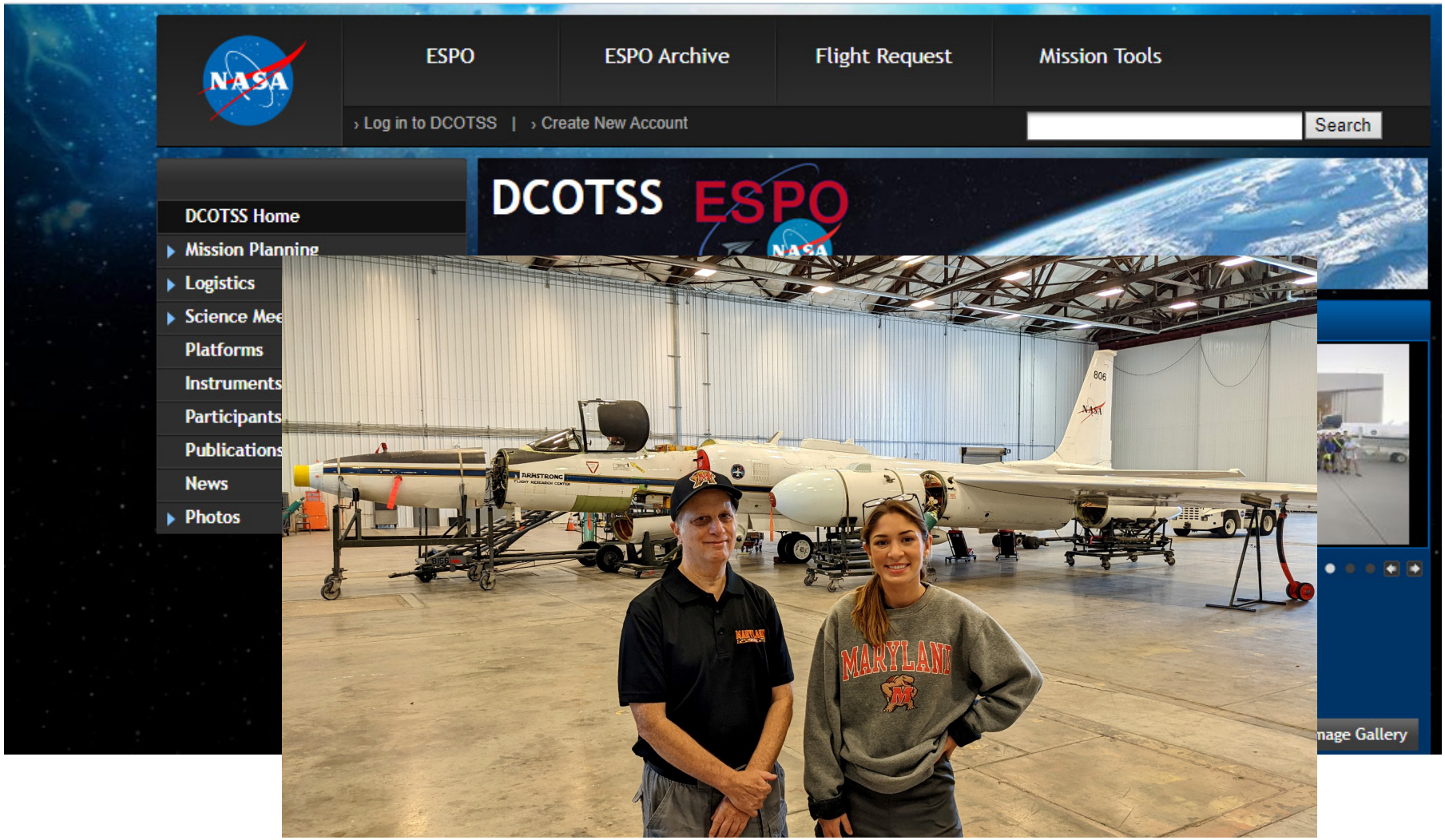

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