

Atmosphere of the Earth - Earth's atmospheric & Space Environment



SPAT0055-1 - **SPAT0048-4**
Space Sciences Aerospace engineering

Sep. 2026

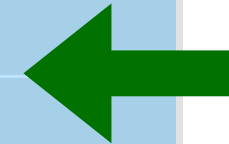


SPAT0055-1 - SPAT0048-4

Space Sciences

Aerospace engineering

SPAT0048-4	Earth's atmospheric and space environment	
	SPAT0048-C-a	Introduction to atmospheric physics, 37h Th
	SPAT0048-B-a	Space environment, 15h Th ●
SPAT0048-5	Earth's atmospheric and space environment	
	SPAT0048-B-a	Space environment, 15h Th ●
	SPAT0048-A-d	Applied space environment, 15h Pr

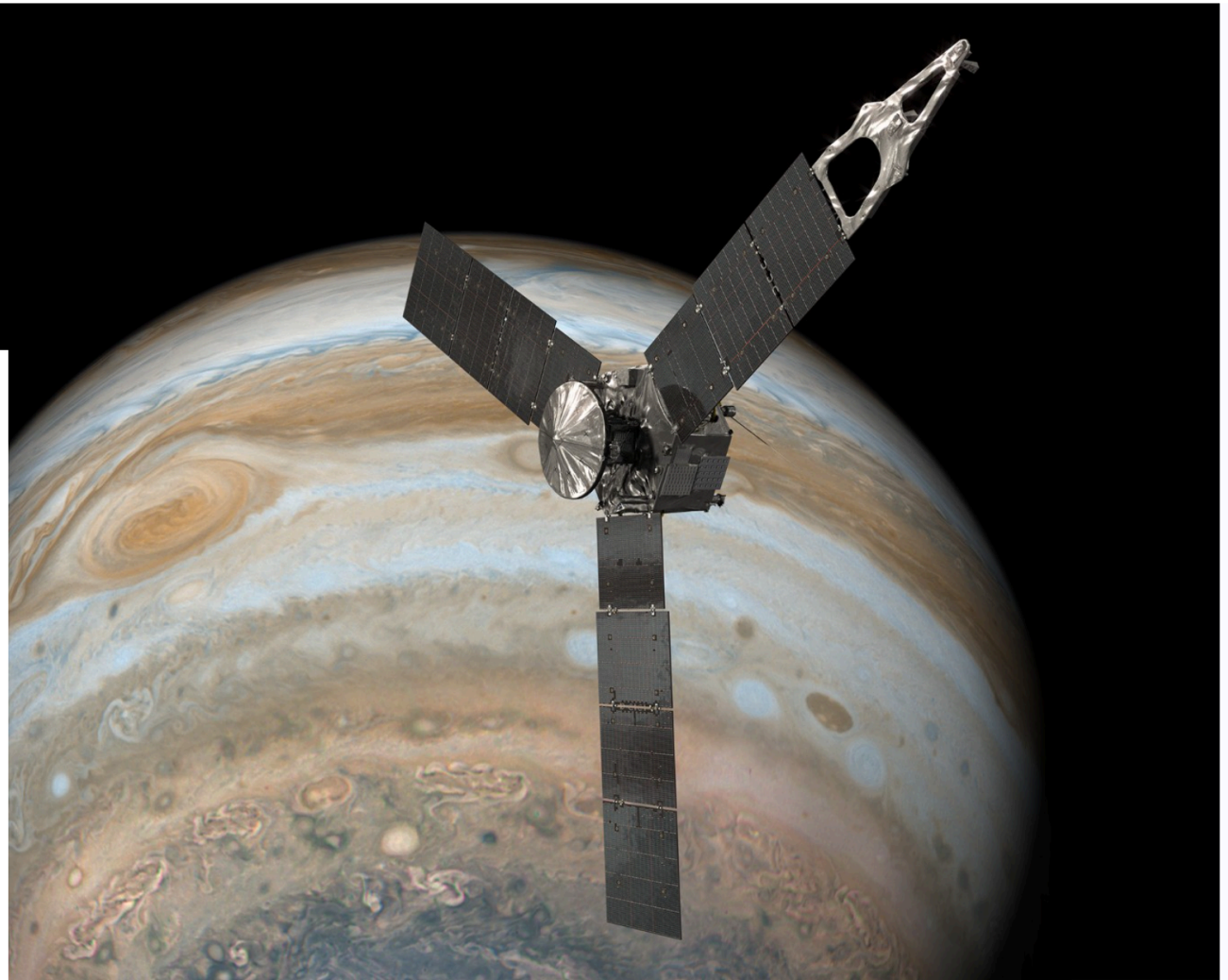


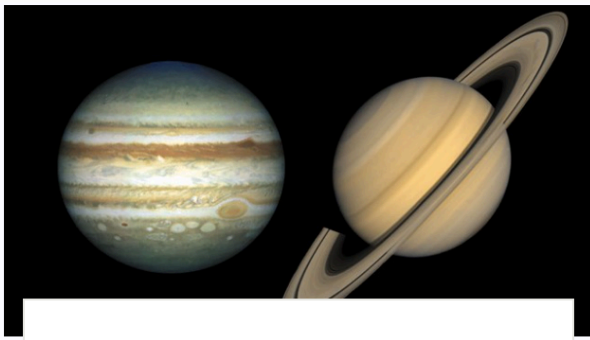
Nov 2026

Laboratory for Planetary and Atmospheric Physics

LPAP is organized into four research themes focusing on different aspects of planetary atmospheres and their interactions with the magnetospheres and oceans.

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Atmosphères et magnétosphères des planètes géantes

Les planètes ne sont pas que des grosses sphères de roche, de glace ou de gaz. Leur zone d'influence se prolonge bien au-delà de leur haute atmosphère, à travers leur attraction gravifique et leur champ magnétique.

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Earth Magnetosphere and Upper atmosphere

When an atom or a molecule collides with another particle, it can gain internal energy which will be lost by the emission of light.

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Atmospheres of Venus and Mars

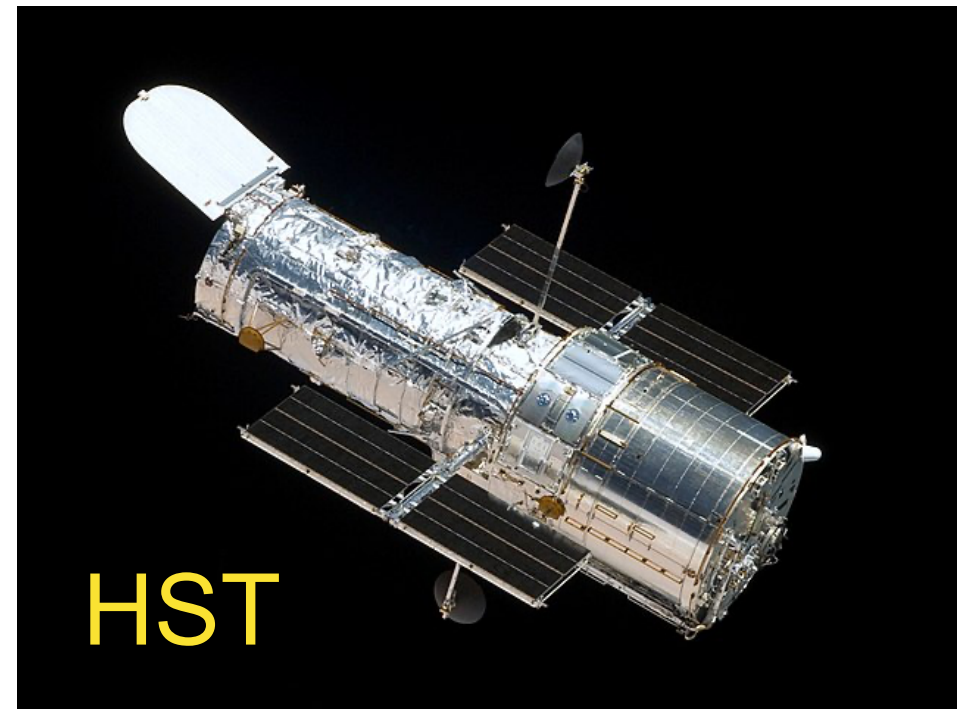
The terrestrial planets possess several common characteristics (e.g. their mass, diameter, density or their distance to the sun), but they also differ in many respects.

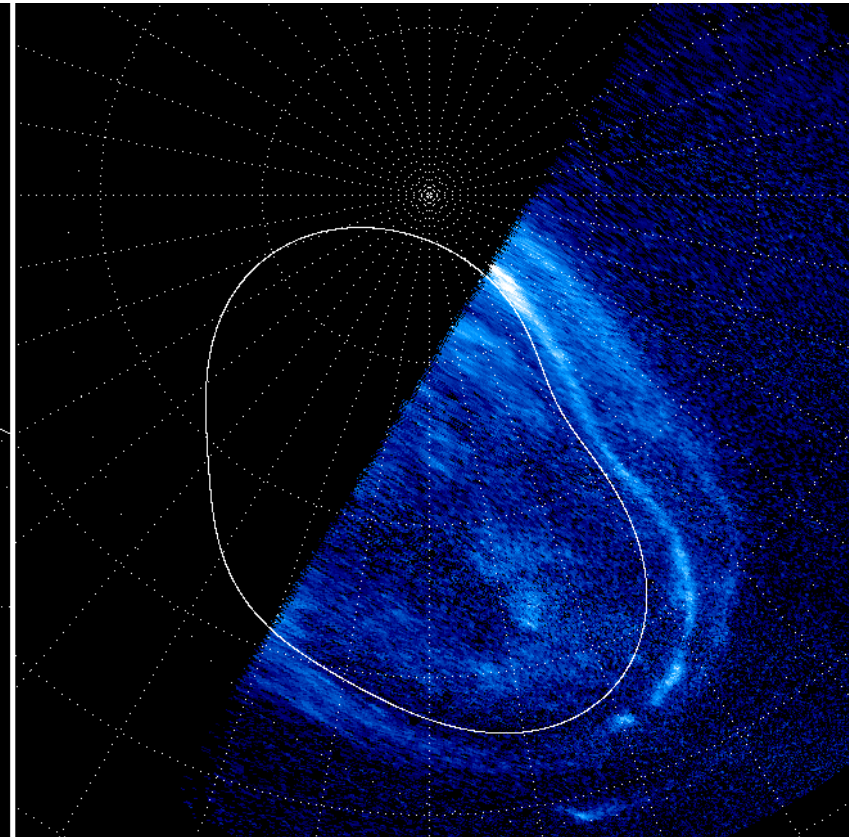
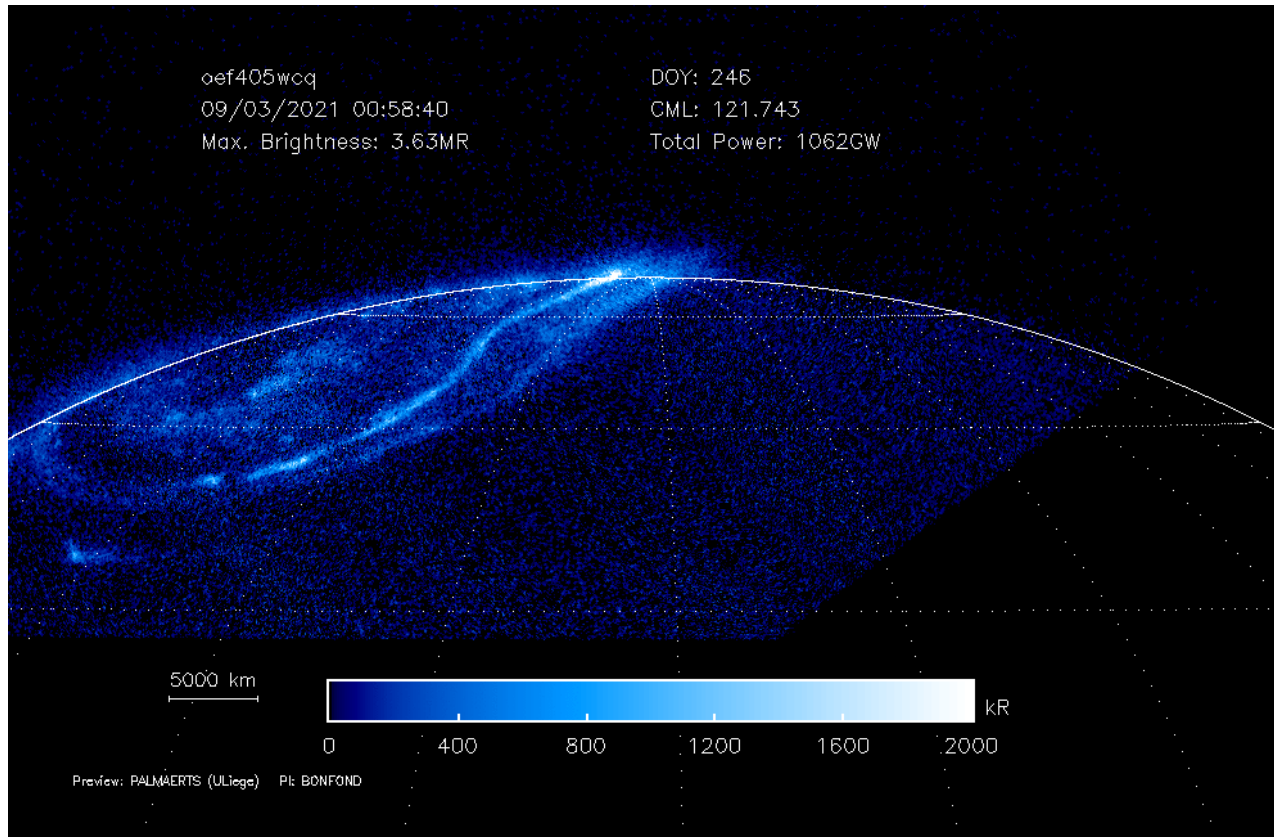
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Earth atmosphere and carbon cycle

Biogeochemical cycles play an important role in the evolution of Earth's climate. This especially holds for the carbon cycle.







AERO0037-1	Space optical instrumentation	
	AERO0037-A-a	40h Th, 12h Pr, 1j T. t.
SPAT0028-2	Planetary magnetospheres and aurorae	
	SPAT0028-A-b	20h Th, 10h Pr
SPAT0048-4	Earth's atmospheric and space environment	
	SPAT0048-C-a	Introduction to atmospheric physics, 37h Th
	SPAT0048-B-a	Space environment, 15h Th
SPAT0048-5	Earth's atmospheric and space environment	
	SPAT0048-B-a	Space environment, 15h Th
	SPAT0048-A-d	Applied space environment, 15h Pr
SPAT0055-1	Atmosphere of the Earth	
	SPAT0055-A-a	45h Th
SPAT0056-1	Planetary and exoplanetary atmospheres	
	SPAT0056-A-a	30h Th, 15h Pr

~ 220 hr

2019-2020 Face-to-face lectures only

2020-2021 Online podcasts only

>700 short videos recorded

2021-2022 "Blended learning"

Mixed face-to-face lectures with recorded podcasts

2022--2026 Mainly face-to-face lectures + podcasts

Every week:

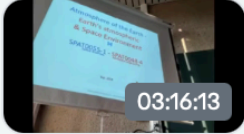
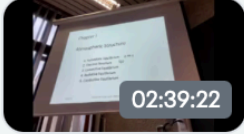
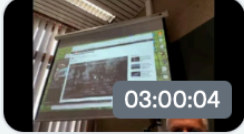
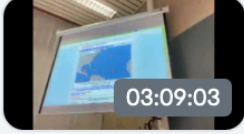
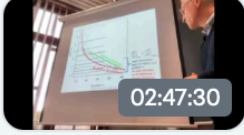
3+-hour lecture

- Watch (ALL) the podcasts
- At your "own" pace

Don't wait for the exam!!!

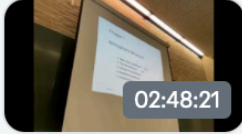
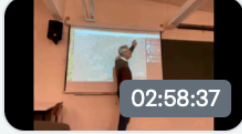
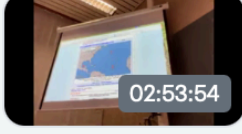
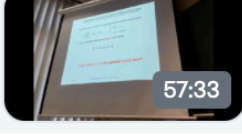
All 2025 lectures
were recorded and
are available on
Vimeo

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Tentative Schedule

Week 1 INT Introduction, the martian

Week 2 EXT, ATM1 Extreme events, Atmospheric structure

Week 3 ATM2, ISA Atmospheric structure

Week 4 SUN1, SUN2 Sun-Earth interactions

Week 5 RT1 RT2 Radiative Transfer 1, 2

Week 6 RT3 Radiative Transfer 3 (06b, 06Buglia)

Week 7 RT4, RT5 Radiative Transfer 4, 5

Week 8 RT6, PH1 Radiative Transfer 6 Photochemistry 1

Week 9 PH2, PH3, PH4 Photochemistry 2, 3, 4

Week 10 TRA0, TRA1, TRA2 Transport 0, 1, 2

Week 11 ION1, ION2 Ionosphere 1, 2

Space Environment

Week 12 SE1 Introduction-Solar wind

Week 13 SE2 B field - Magnetosphere

Week 14 SE3 Particles - Storms

Web Resources

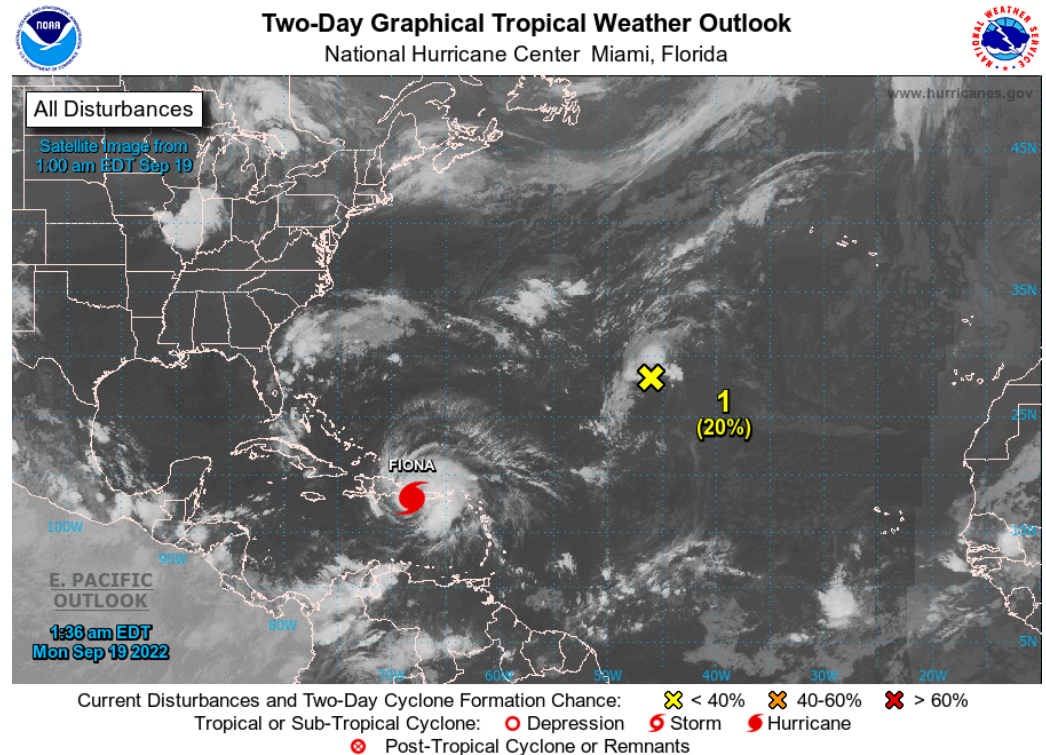
Extreme Events

National Hurricane Center

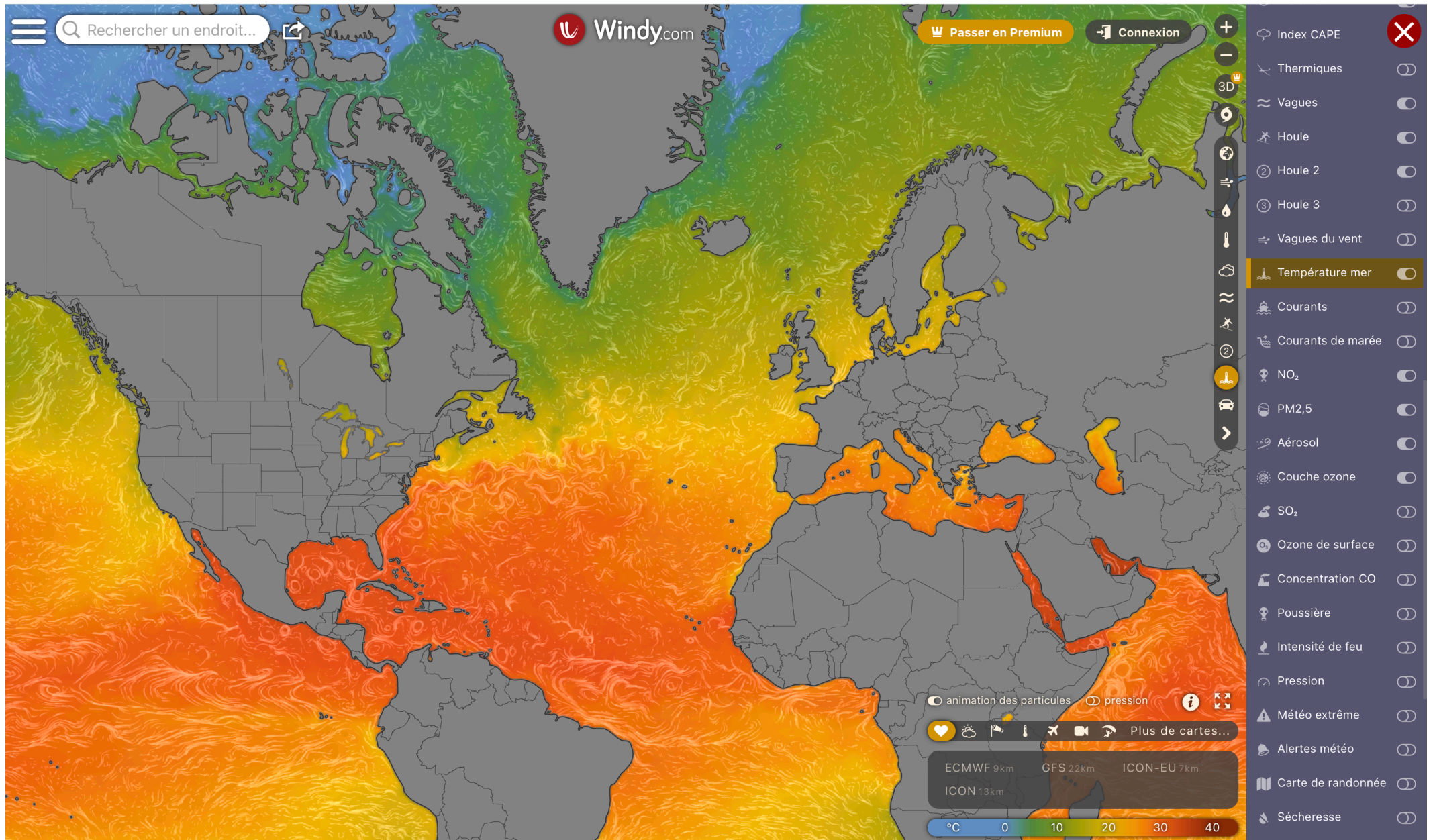
<https://www.nhc.noaa.gov>

Joint Typhoon Warning Center

<https://www.metoc.navy.mil/jtwc/jtwc.html>



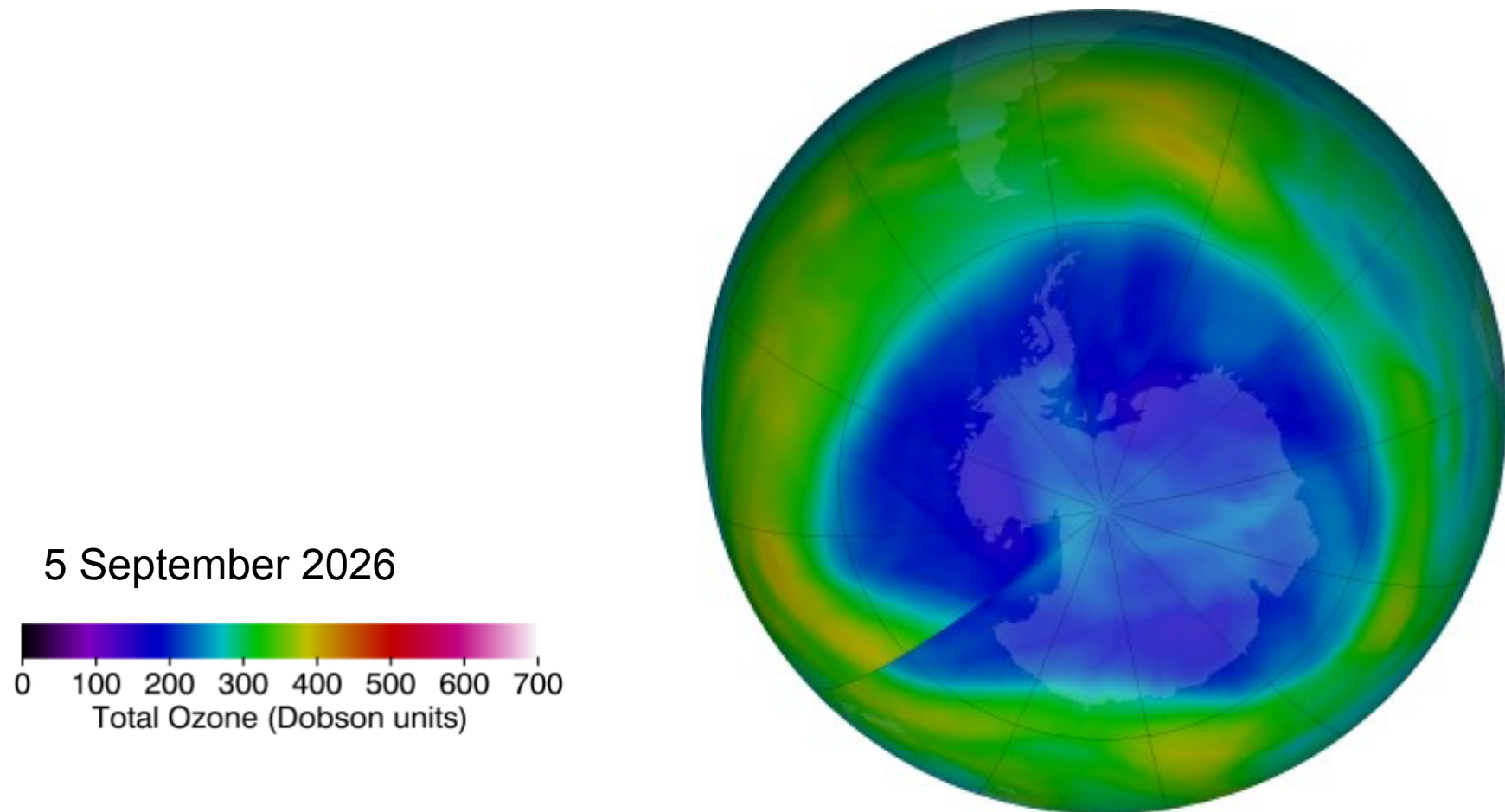
<https://www.windy.com/>



Ozone Hole

NASA Ozone Watch

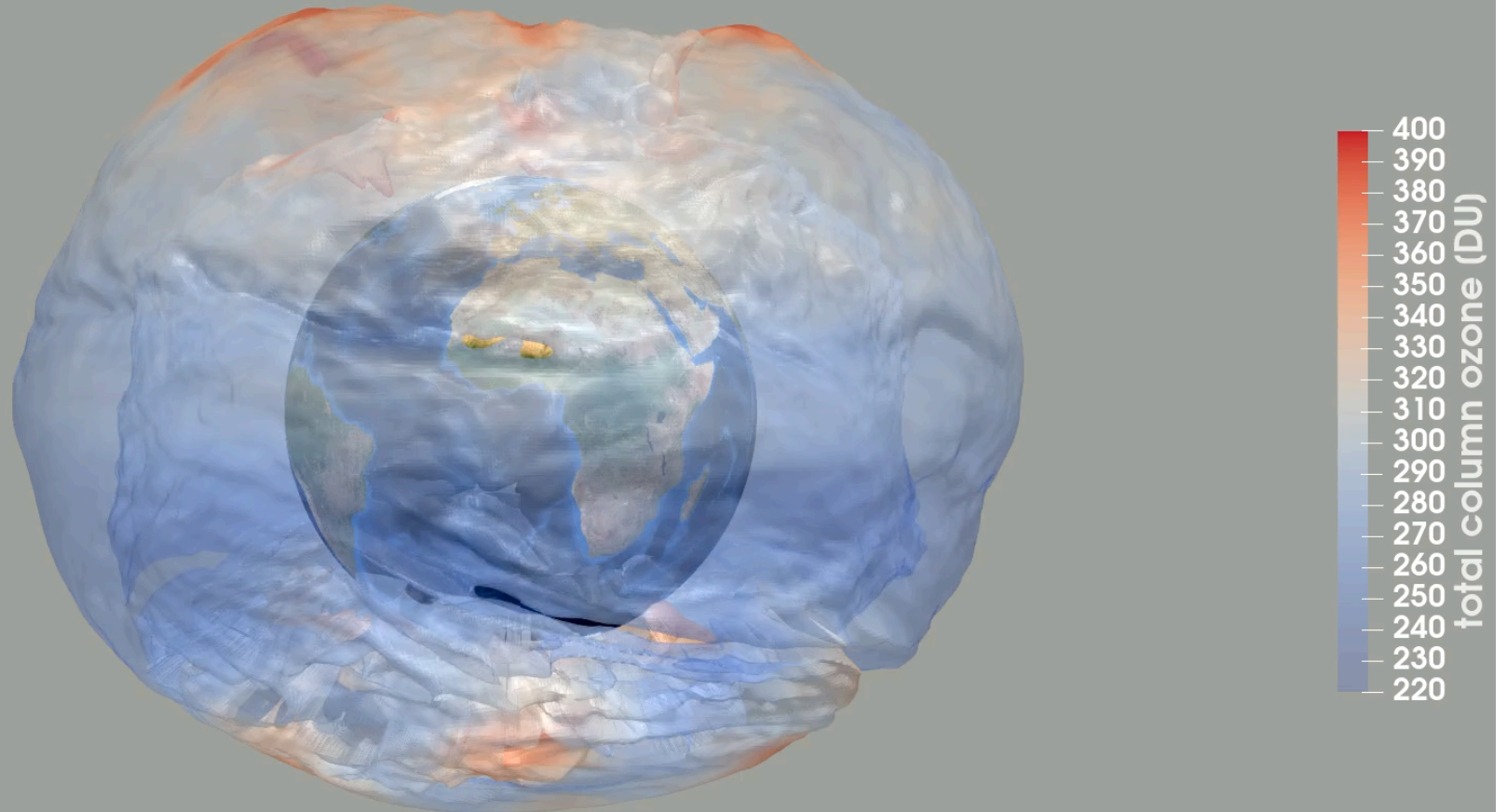
<https://ozonewatch.gsfc.nasa.gov>



Ozone Hole

Ozone hole development 2022

12 mPa ozone partial pressure isosurface coloured by total column ozone



All videos available on *vimeo*

Showcases containing mp4 videos (2-3 minutes)

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SPAT0048_0055_structure1

1 - 12 of 31 Share

Chapter I
Atmospheric Structure

1. Hydrostatic Equilibrium $p \leftrightarrow z$
2. Thermal Structure $T(z)$
3. Convective Equilibrium
4. Radiative Equilibrium

01:10

SPAT0048_0055_0190_structur...

Denis Grodent

Hydrostatic Equilibrium Gas at rest stratified into // layers in $\vec{g}$

03:10

SPAT0048_0055_0200_structur...

Denis Grodent

Hydrostatic Equilibrium Gas at rest stratified into // layers in $\vec{g}$

07:19

SPAT0048_0055_0210_structur...

Denis Grodent

Hydrostatic Equilibrium Gas at rest stratified into // layers in $\vec{g}$

06:05

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Denis Grodent

1. Isothermal atmosphere (constant m and g)
 $T = \text{constant} \Rightarrow H = \text{constant}$

$\frac{dp}{p} = -\frac{dz}{H}$ Integration separable equation $\int_{p_0}^p \frac{dp'}{p'} = -\frac{1}{H} \int_{z_0}^z dz'$

taking exp(): Barometric law
 $p(z) = p(z_0) \exp\left(-\frac{z - z_0}{H}\right)$
 $n(z) = n(z_0) \exp\left(-\frac{z - z_0}{H}\right)$

03:30

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2. Linear variation of T with z: $T(z) = T_0 + \alpha(z - z_0)$
 $T_0 = T(z_0)$

Numerical methods

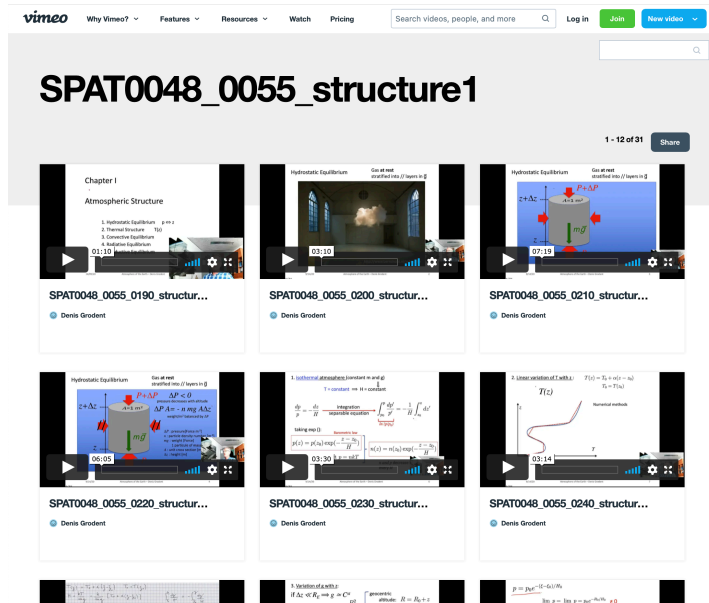
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Denis Grodent

3. Variation of g with z:
if $\Delta z \ll R_E \Rightarrow g \approx C^u$ R^2 geocentric altitude: $R = R_0 + z$

$p = p_0 e^{-(z-z_0)/H_0}$
 $\lim_{z \rightarrow \infty} p = \lim_{z \rightarrow \infty} p = p_0 e^{-R_0/H_0} \neq 0$



<https://vimeo.com/showcase/8808014>

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Links sent by email,
also available on **eCampus**

Course #

Subject

low resolution

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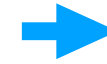
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corresponding PDF slide(s)

All presented slides (+additional material) are available on eCampus

introduction 0-60

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the martian 70-110

<https://vimeo.com/showcase/8807858>

extreme events 120-180

<https://vimeo.com/showcase/8807867>

atmospheric structure 190-720

<https://vimeo.com/showcase/8808014>

<https://vimeo.com/showcase/8809878>

