Summary:

- Earth’s interior and composition
- Probing the interior with seismic waves
- Earth’s surface – imaging it with the Landsat satellites
- The atmosphere and the greenhouse effect
- The magnetosphere, Van Allen Belts, and the aurora

The Earth

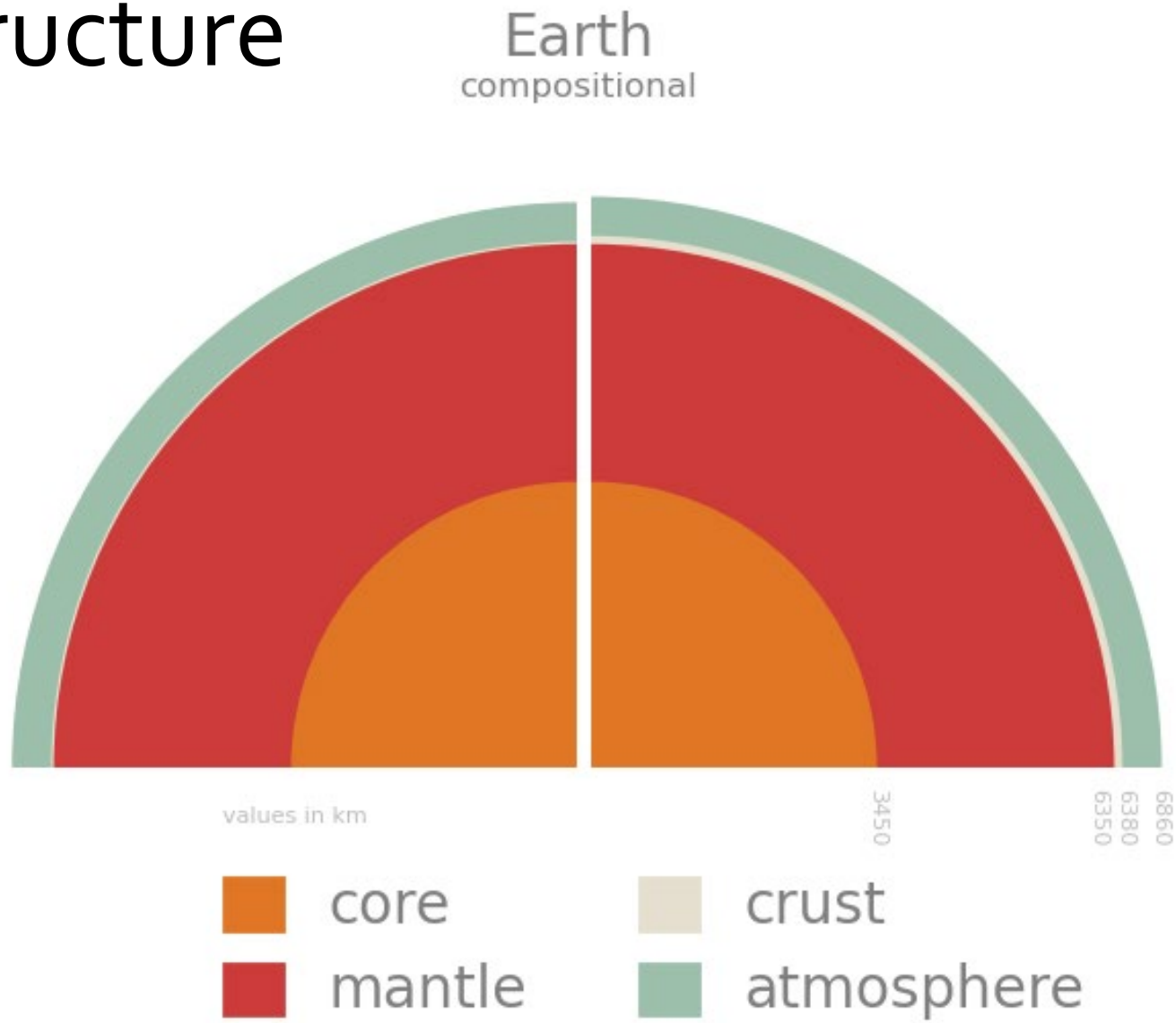
and its wonders

Recap

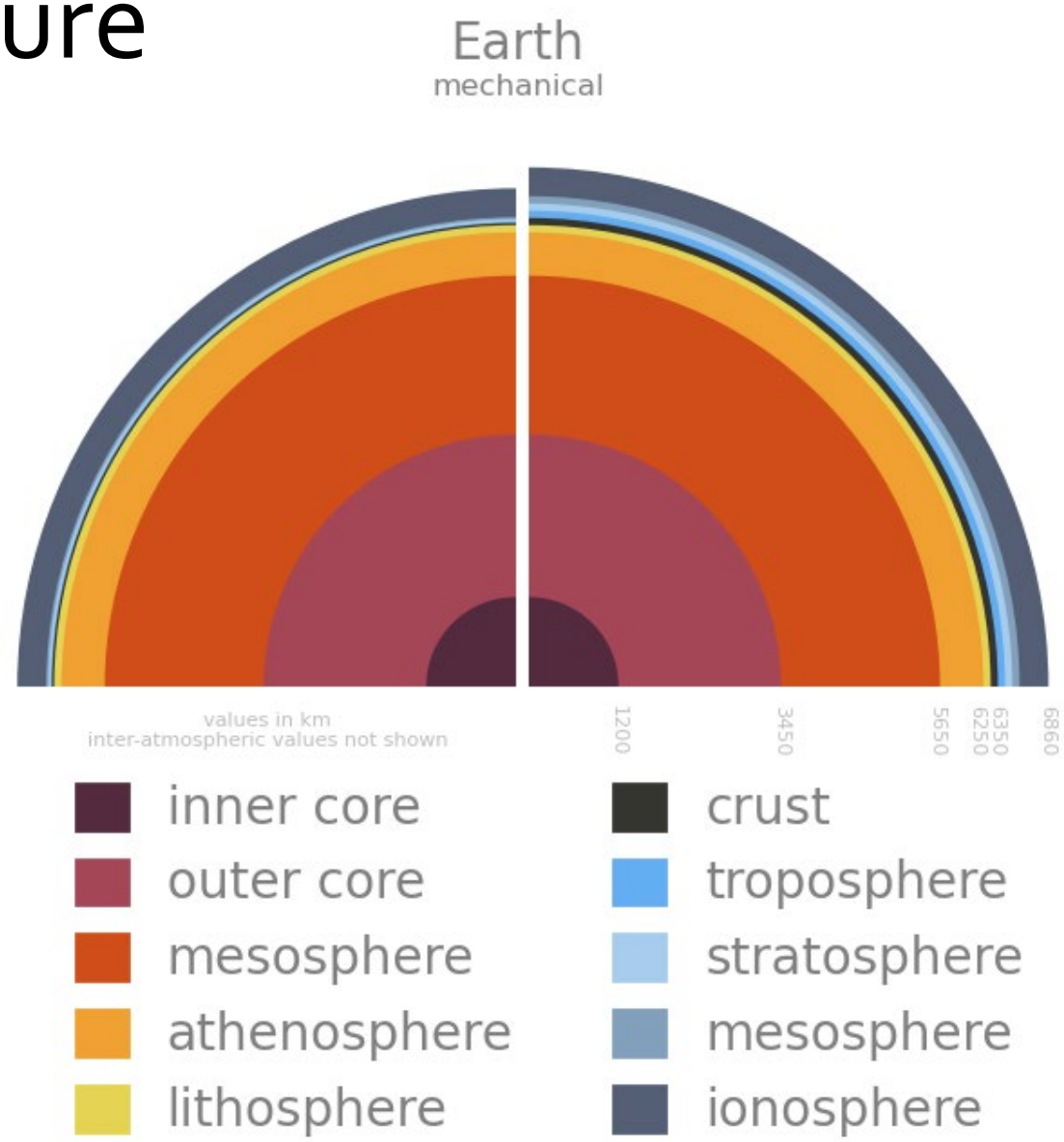
1. Kepler's first law was …
2. Kepler's second law was …
3. Kepler's third law was …
4. What two things affect the gravitational field strength of a planet?

NASA/MODIS

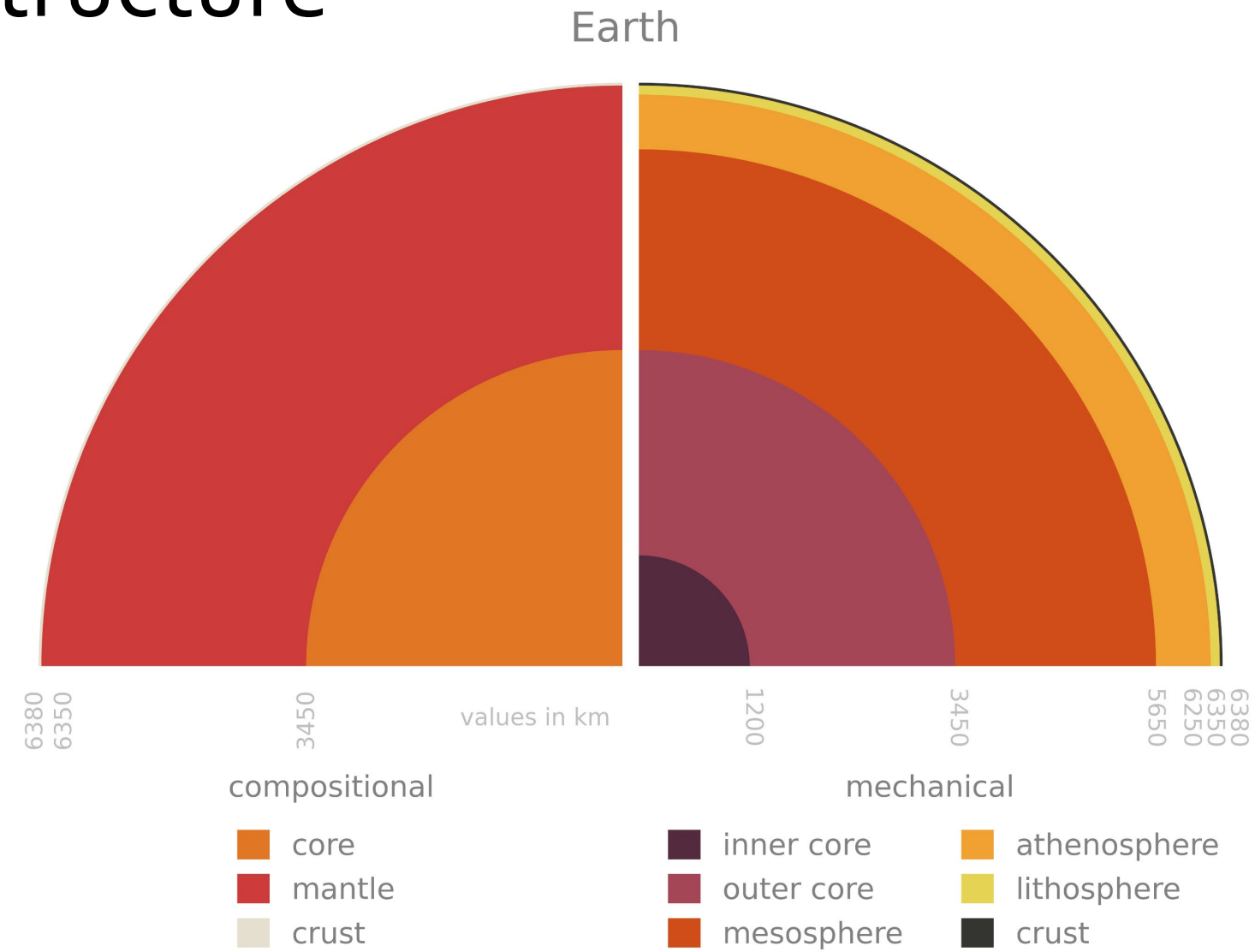
Internal Structure

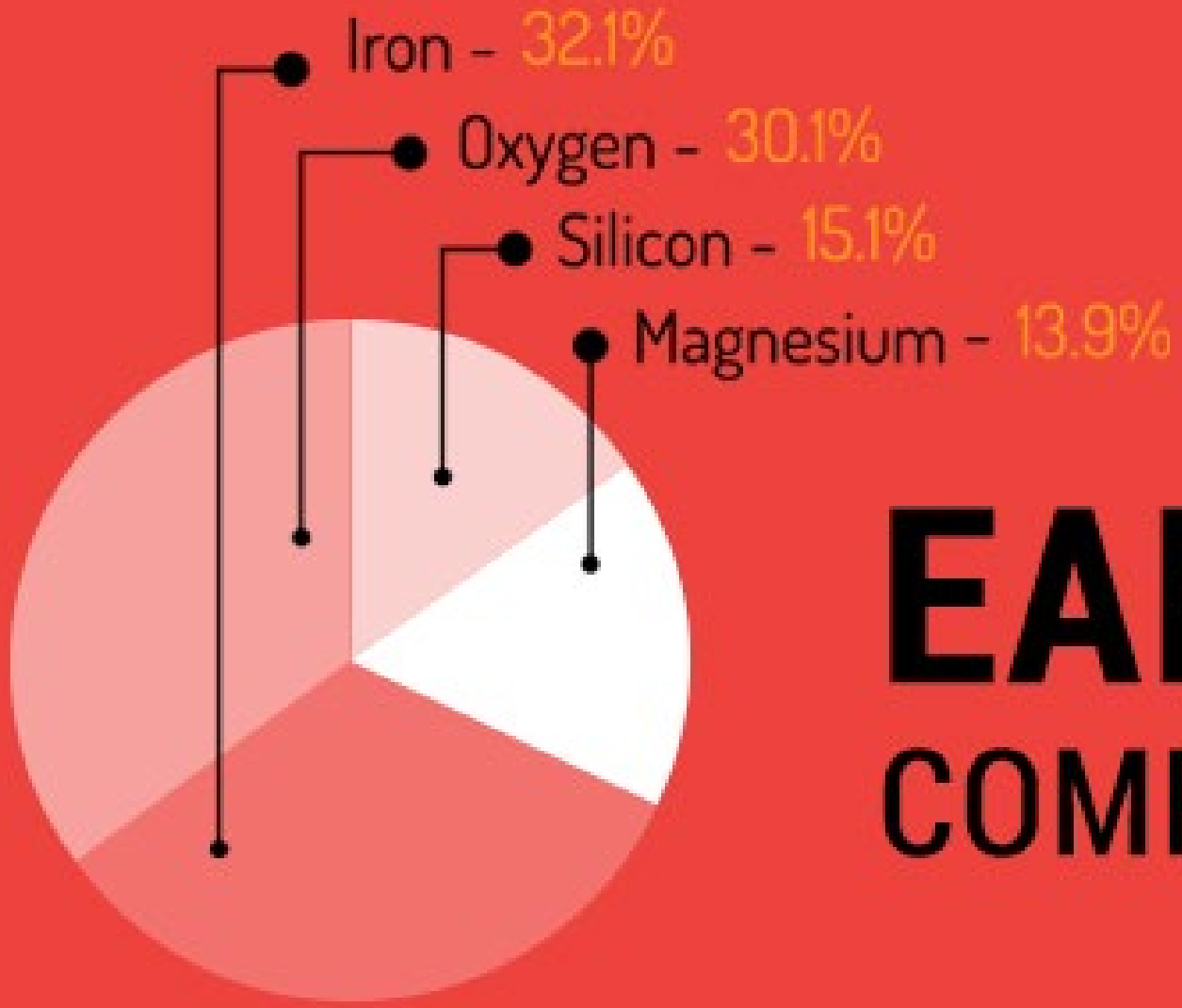


Internal Structure

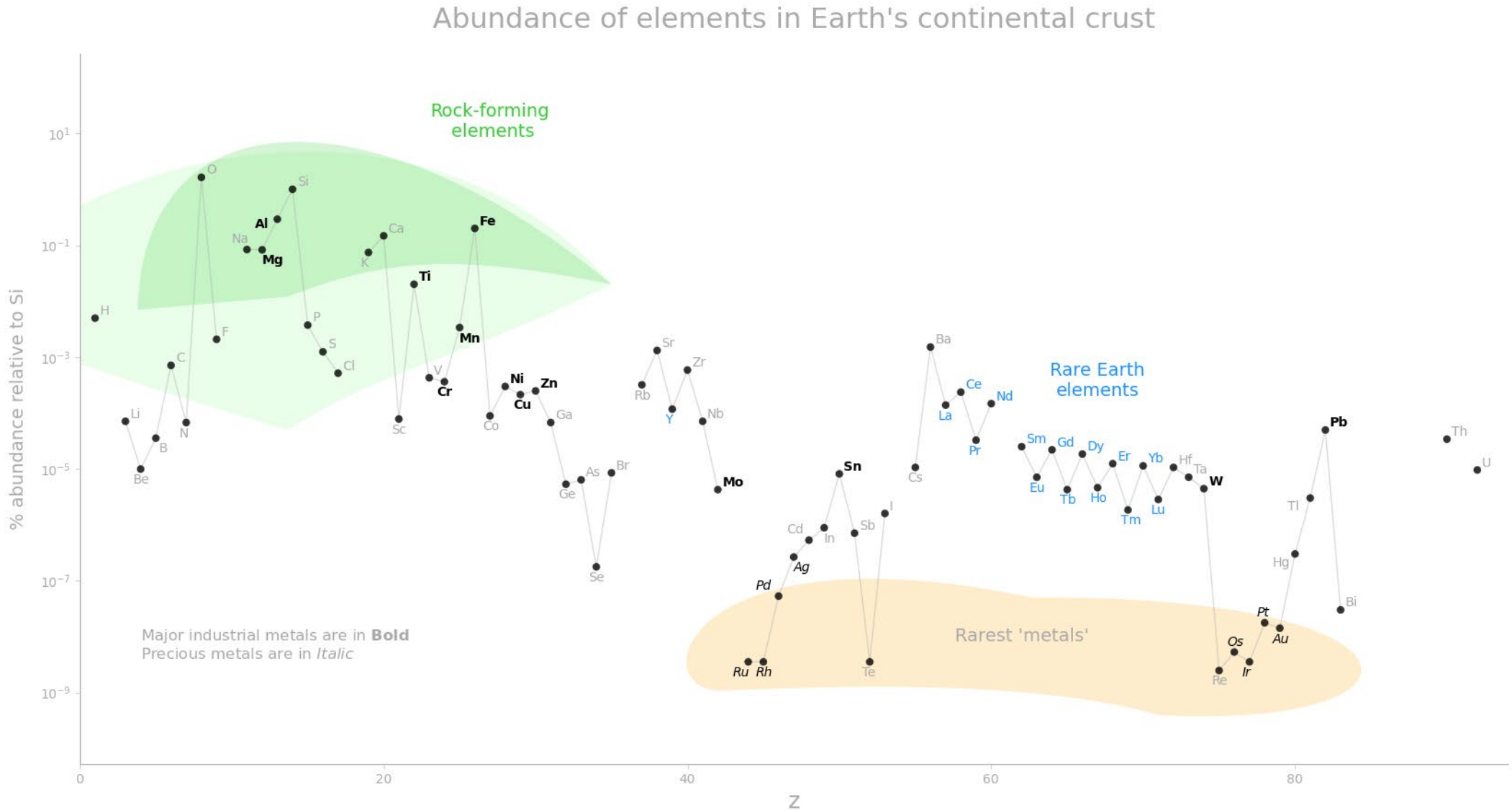


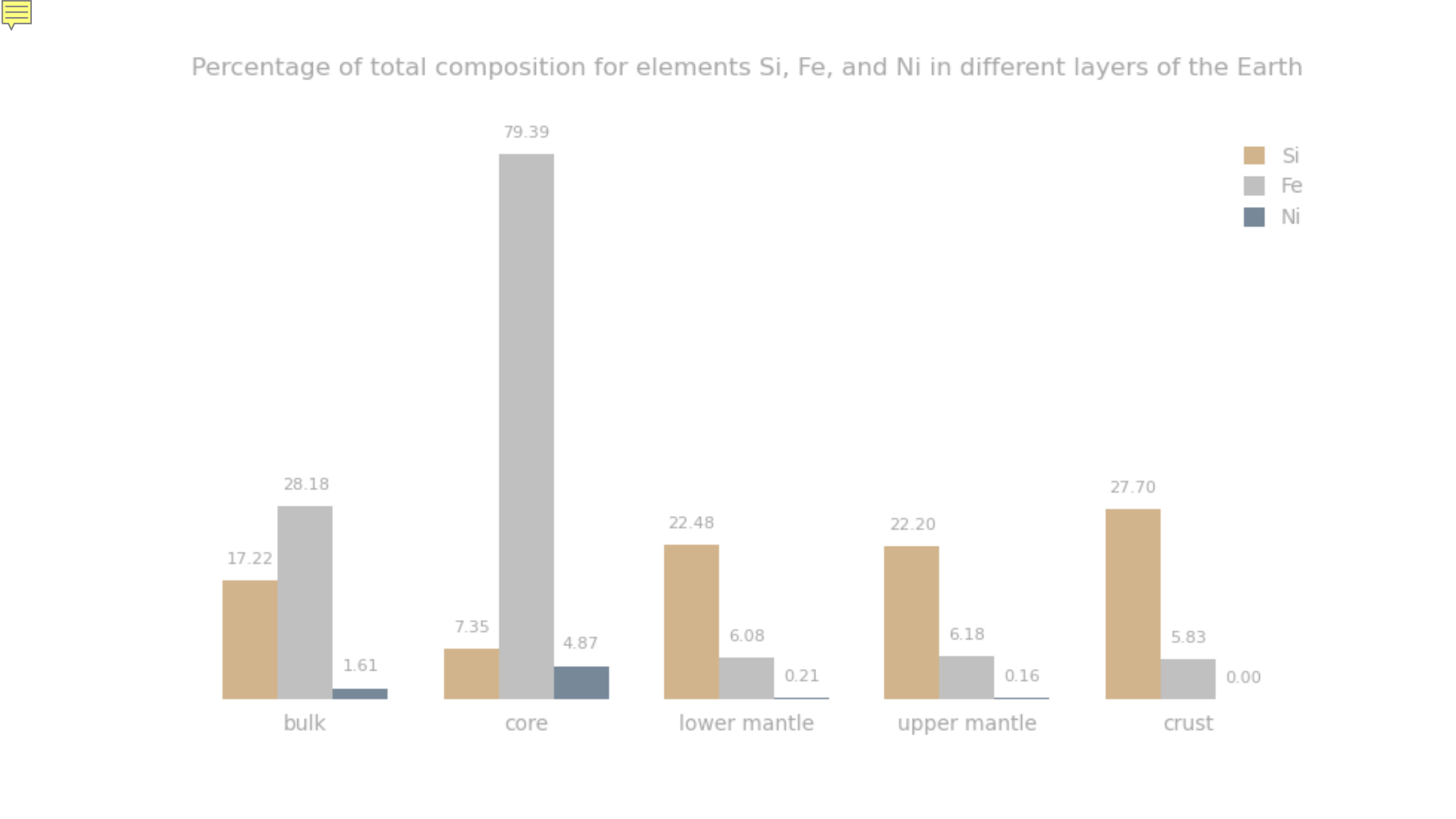
Internal Structure

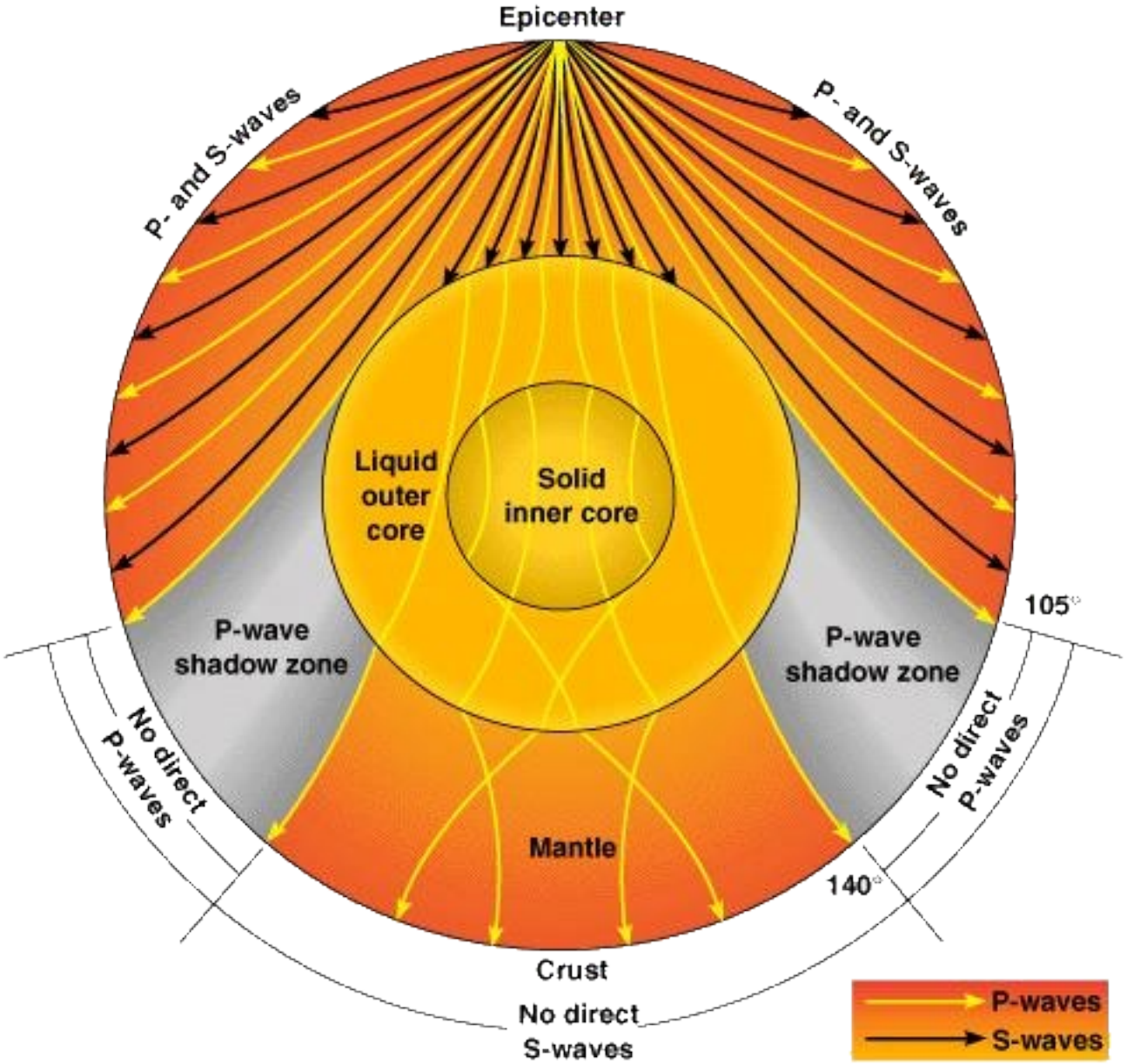


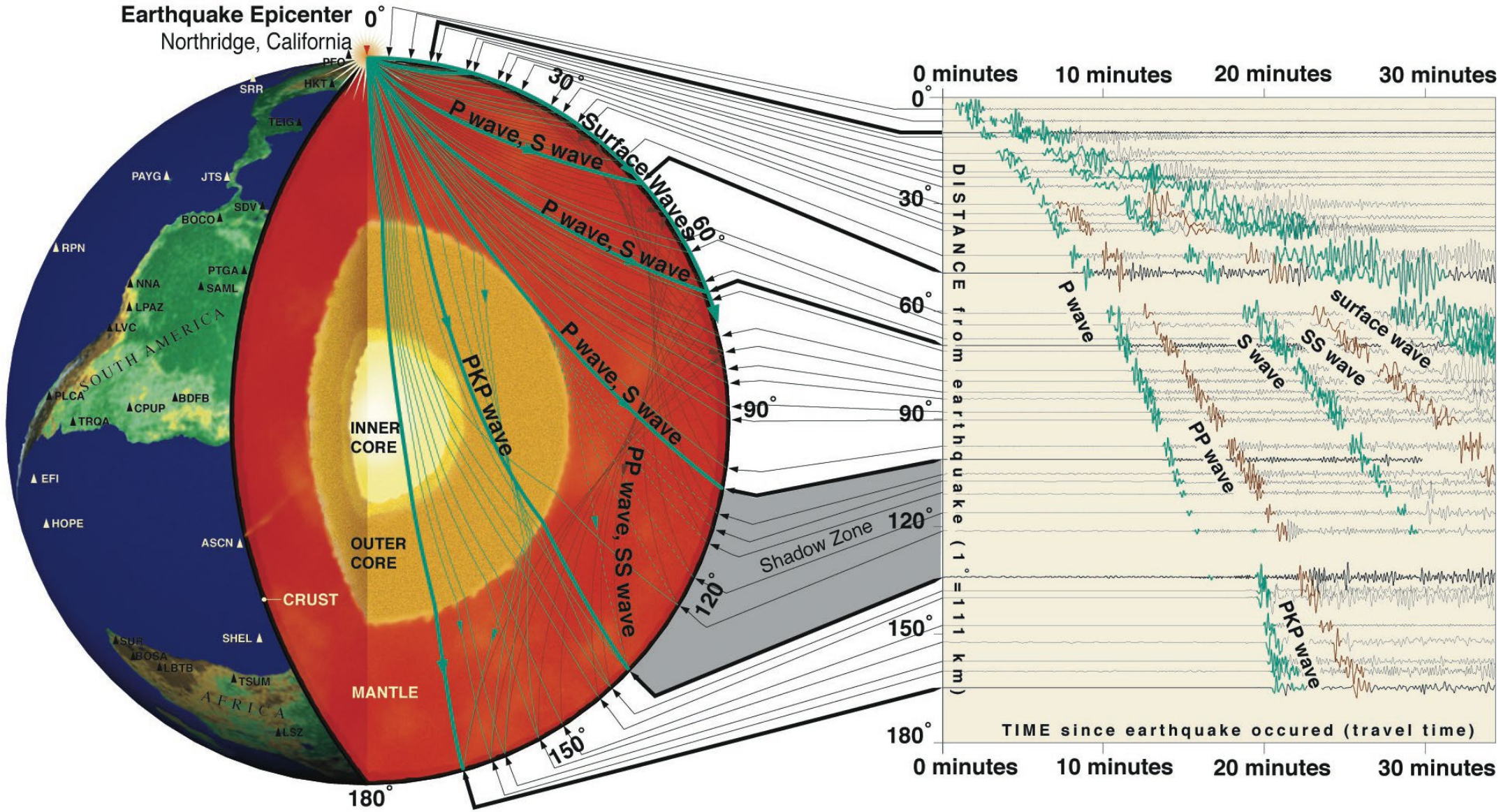


EARTH'S COMPOSITION


Abundance of elements in Earth's continental crust
Rock-forming elements
Rare Earth elements
Rarest 'metals'
Major industrial metals are in Bold
Precious metals are in Italic
% abundance relative to Si
Z
H
Li
Be
B
C
N
O
F
Na
Mg
Al
Si
P
S
Cl
K
Ca
Sc
Ti
V
Cr
Mn
Fe
Co
Ni
Cu
Zn
Ga
Ge
As
Br
Rb
Sr
Y
Zr
Nb
Mo
Ru
Rh
Pd
Ag
Cd
In
Sn
Sb
Te
I
Cs
Ba
La
Ce
Pr
Nd
Sm
Eu
Gd
Tb
Dy
Ho
Er
Tm
Yb
Lu
Hf
Ta
W
Re
Os
Ir
Pt
Au
Hg
Tl
Pb
Bi
Th
U


Percentage of total composition for elements Si, Fe, and Ni in different layers of the Earth
Si
Fe
Ni
17.22
28.18
1.61
7.35
79.39
4.87
22.48
6.08
0.21
22.20
6.18
0.16
27.70
5.83
0.00
bulk
core
lower mantle
upper mantle
crust



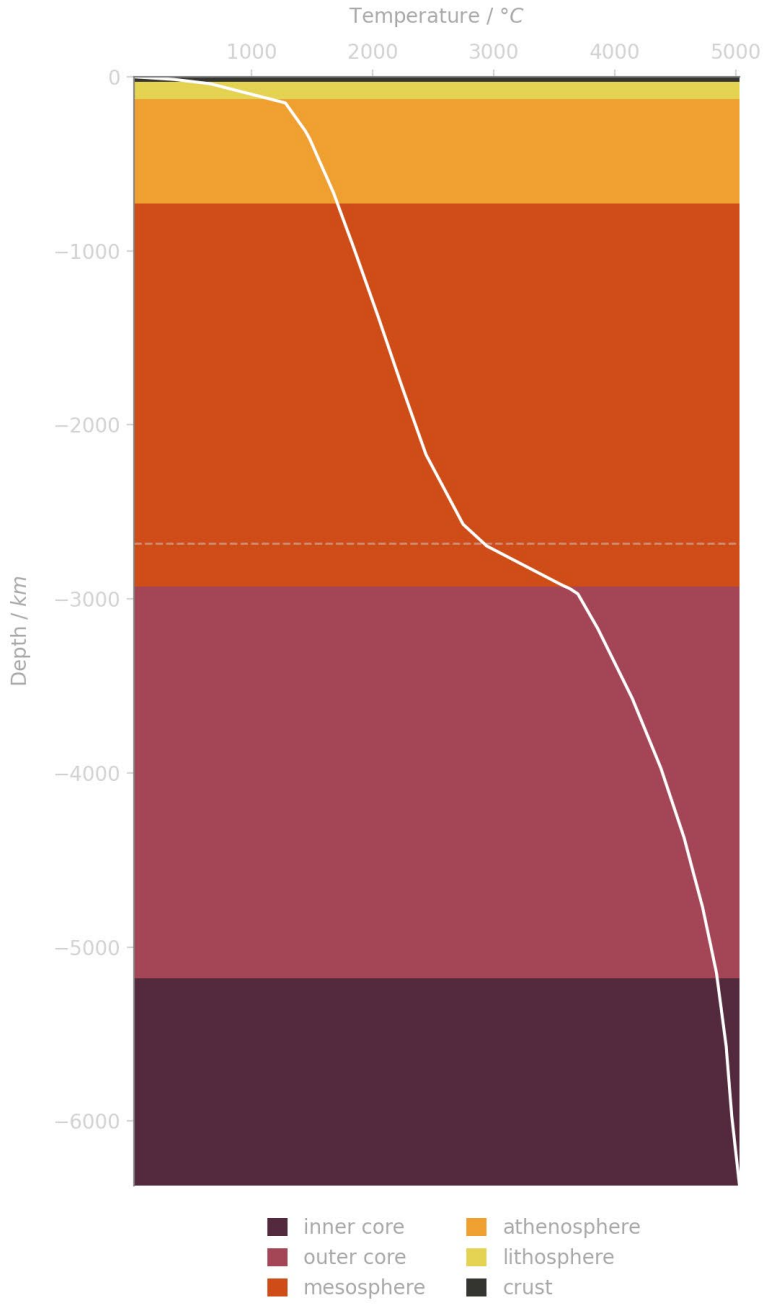

Earthquake Epicenter
Northridge, California
0°
30°
60°
90°
120°
150°
180°
Surface Waves
P wave, S wave
P wave, S wave
P wave, S wave
PKP wave
PP wave, SS wave
INNER CORE
OUTER CORE
MANTLE
CRUST
Shadow Zone
PFO
HKT
SRR
TEIG
PAYG
JTS
SDV
BOCO
RPN
PTGA
SAML
NNA
LPAZ
LVC
SOUTH AMERICA
PLCA
CPUP
BDFB
TRQA
EFI
HOPE
ASCN
SHEL
SUR
BOSA
LBTB
TSUM
AFRICA
LSZ
0 minutes
10 minutes
20 minutes
30 minutes
DISTANCE from earthquake (1°=111 km)
P wave
S wave
surface wave
SS wave
PP wave
PKP wave
TIME since earthquake occured (travel time)

IRIS

Internal Temperature

Based off models and known phase changes of certain materials.

Thought to reach anywhere from 5500 to 6500 degrees Celsius at the centre of the core.



Recap

1. What is the difference between the continental and oceanic crust?
2. What is the difference between a compositional and mechanical layer?
3. What is the inner core made out of?
4. What temperature is the Earth's inner core?

Earth's Surface

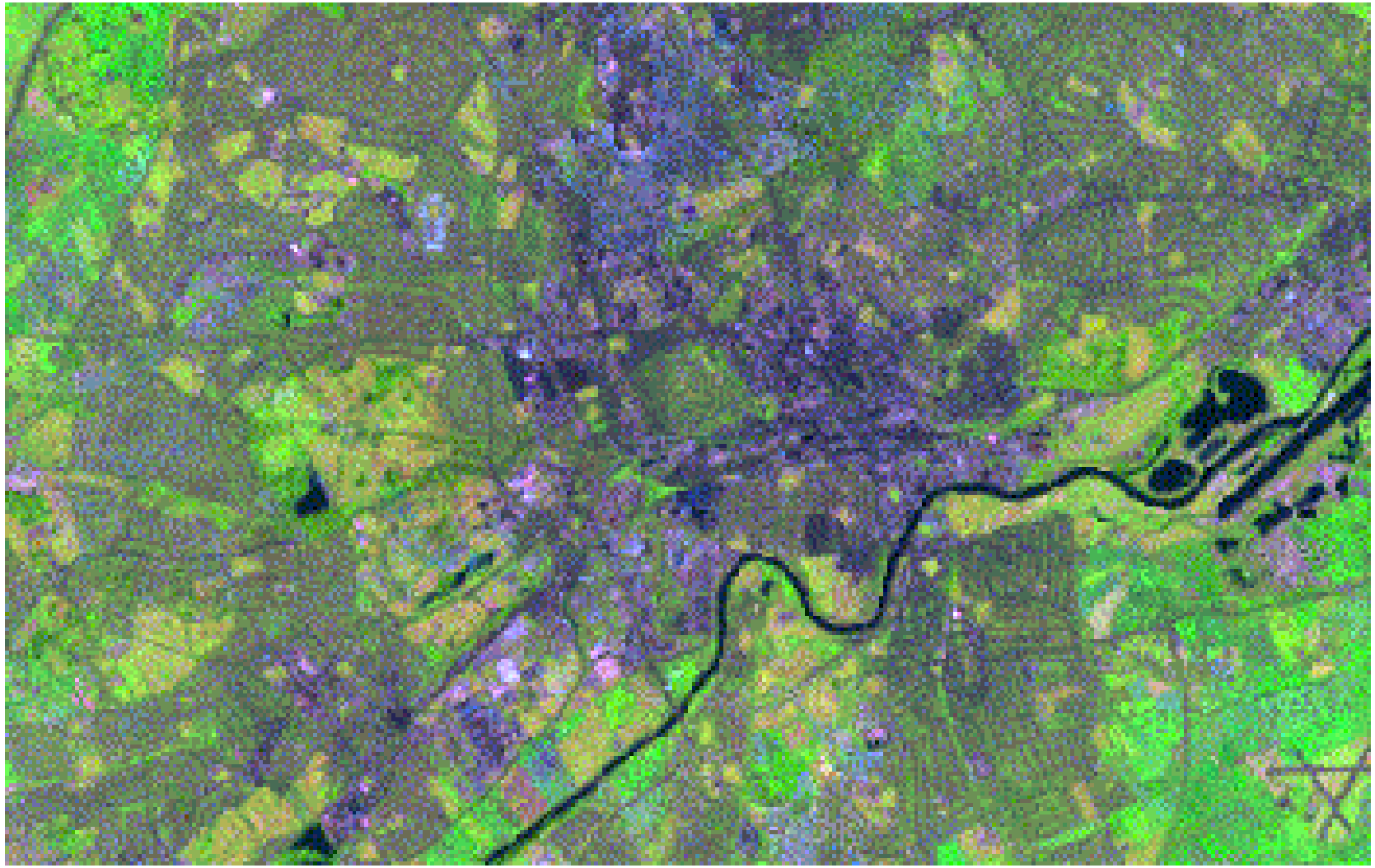
71% water

97% of that is in the ocean
2% is frozen
<1% is fresh water

An even smaller amount is water vapour in the air

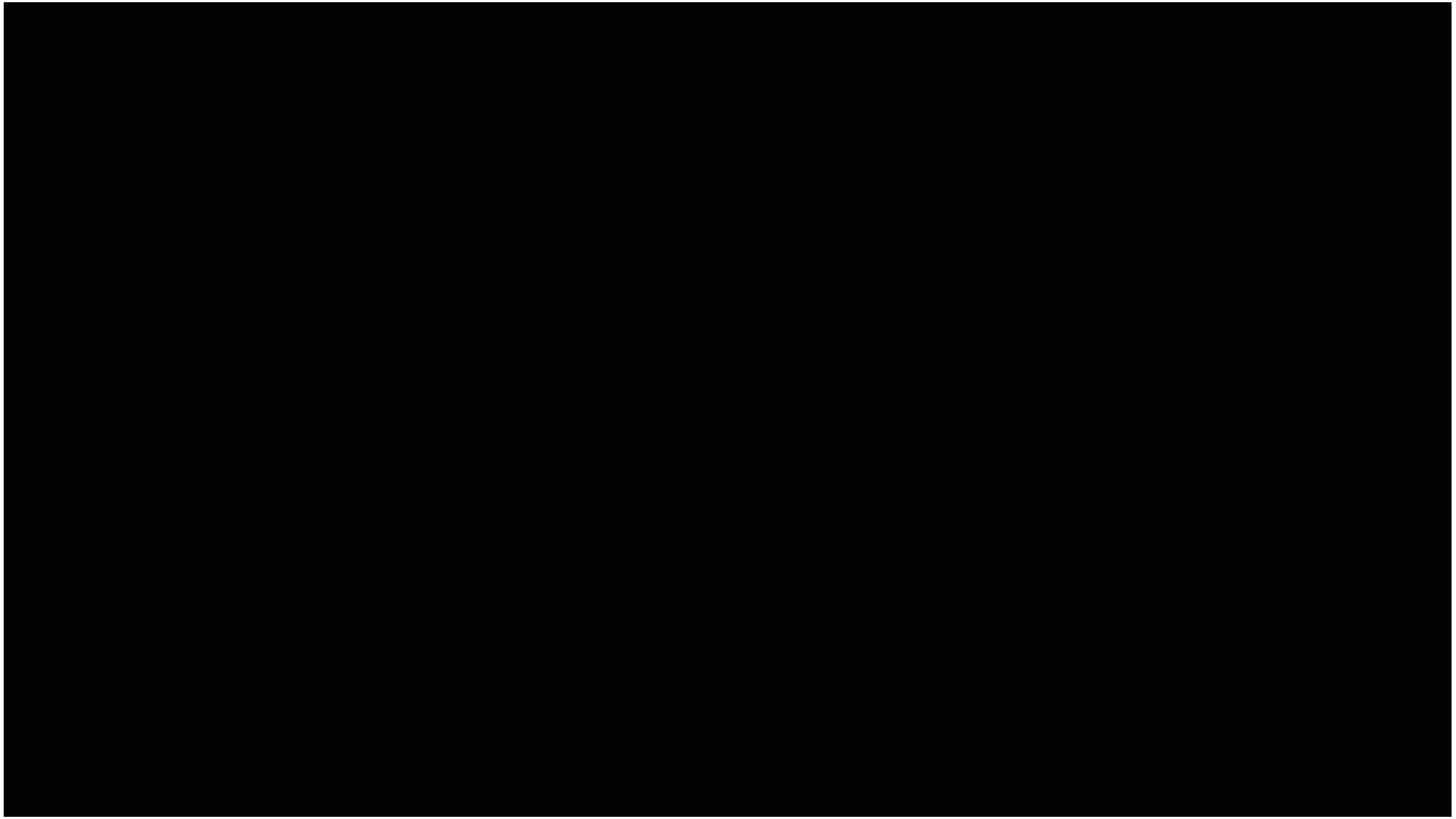
NASA/MODIS

Earth's Surface



NASA/Landsat

Earth's Surface



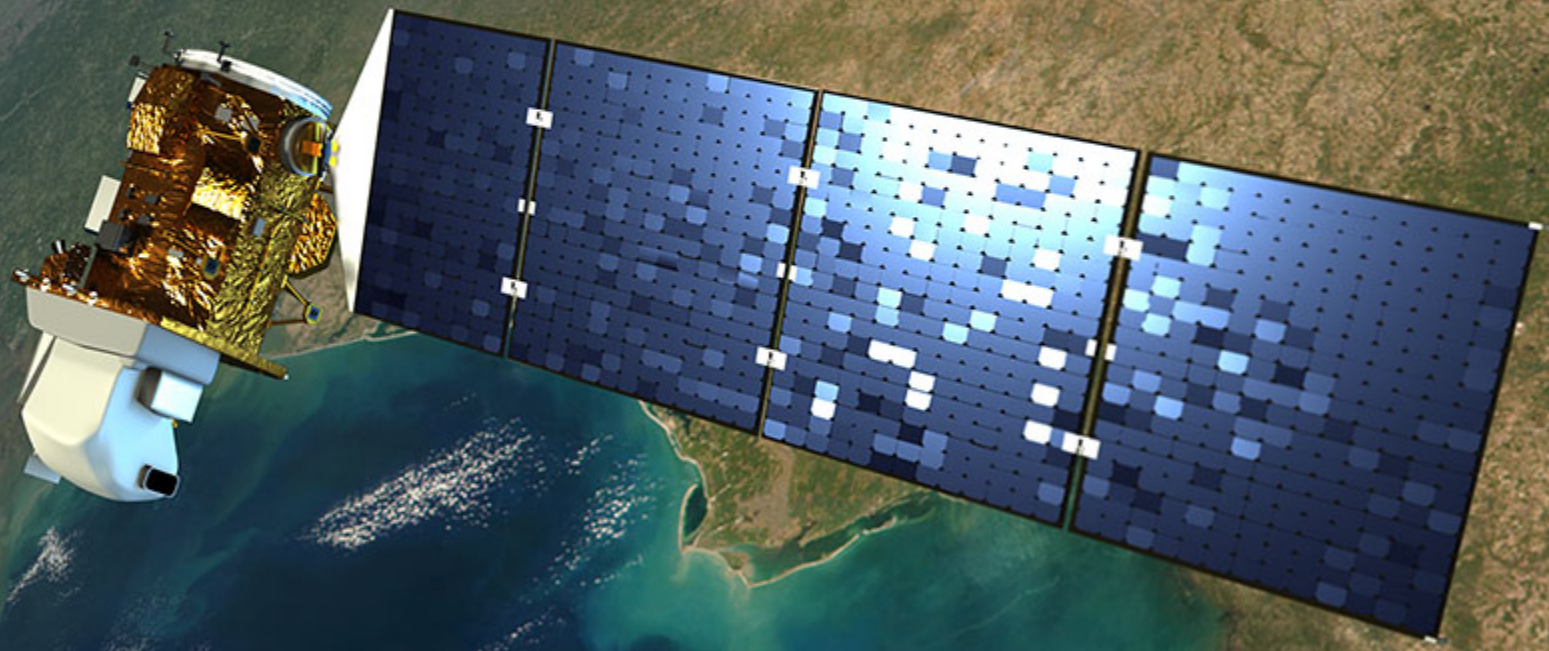
NASA/Landsat

Earth's Surface

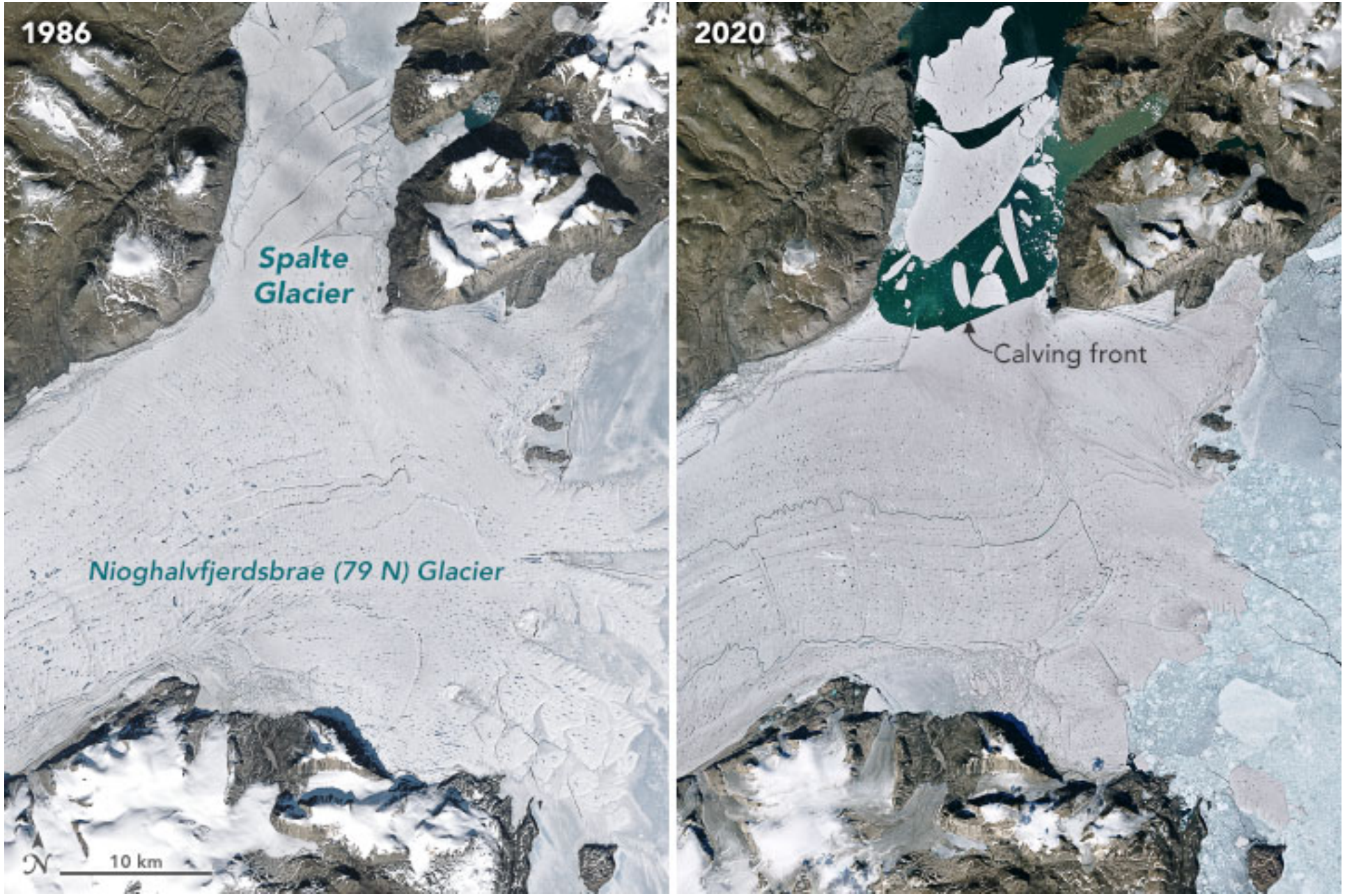
Monitors:

Wildlife
Human Activity
Climate Change
Fires
Weather

Images in visible and
IR wavelengths of light

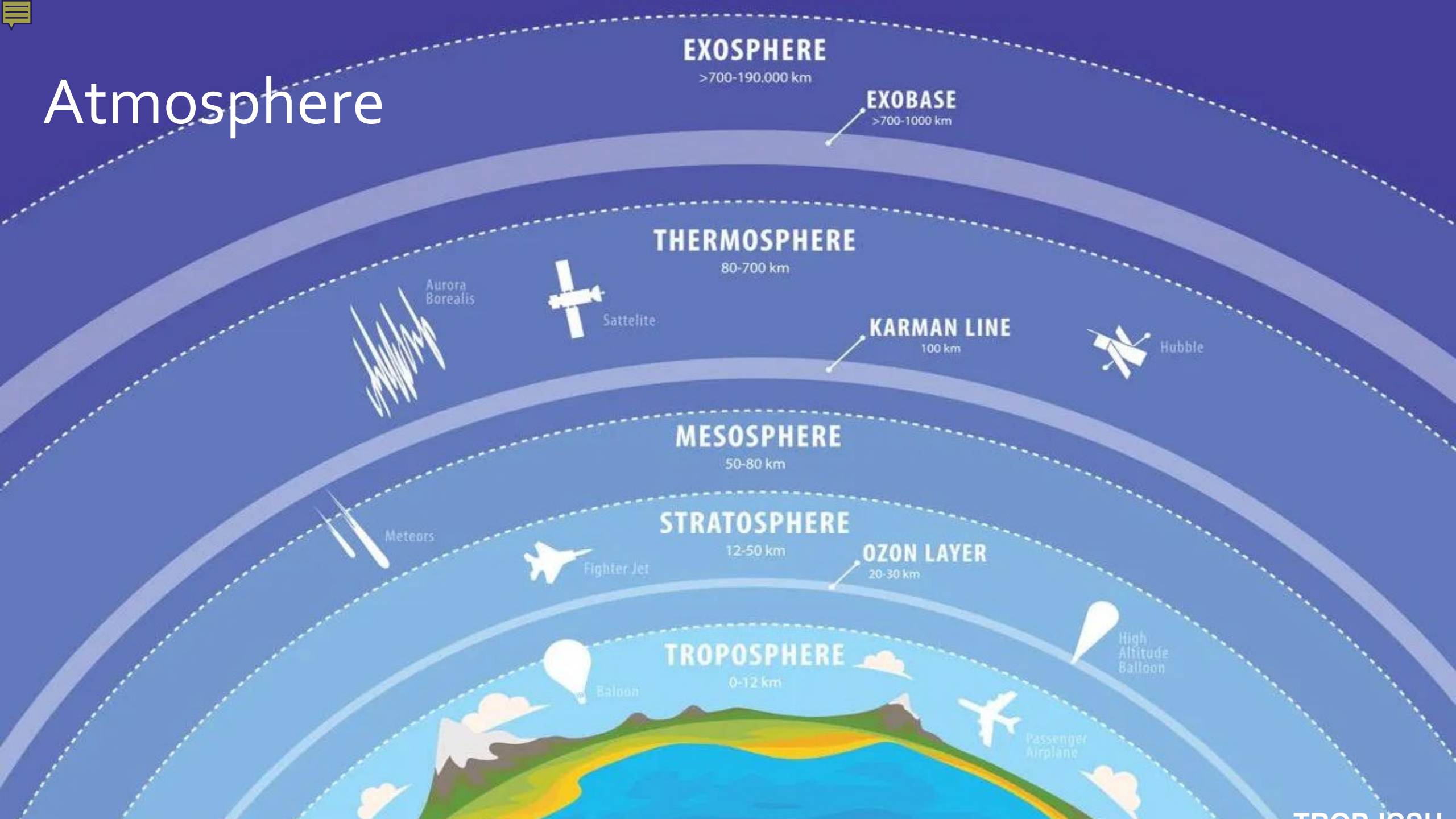


NASA/Landsat



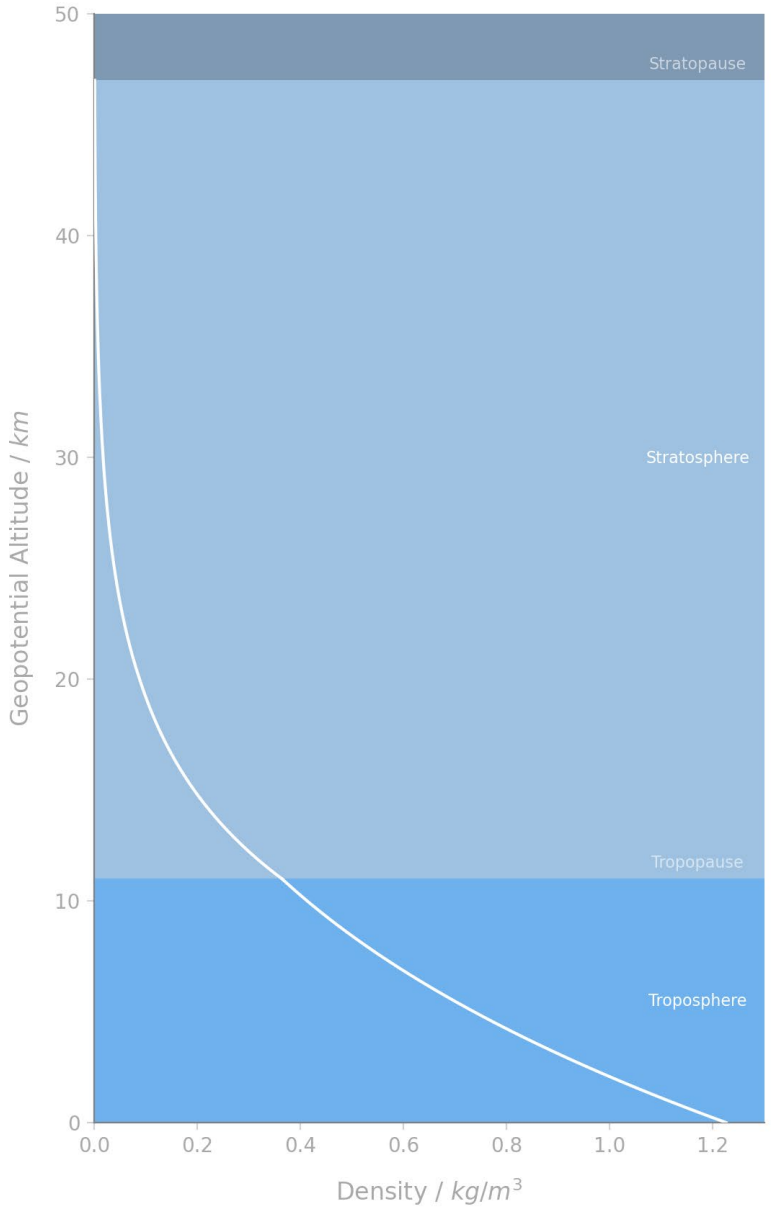
NASA/Landsat

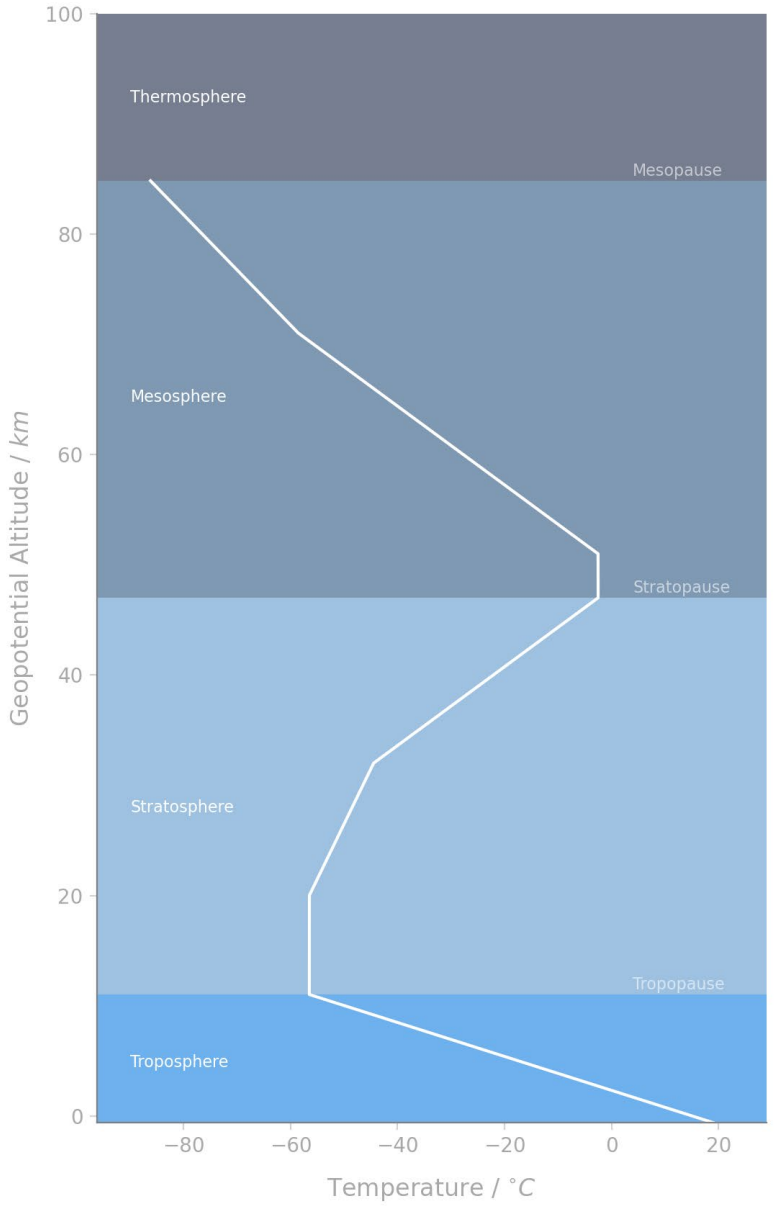
Atmosphere


EXOSPHERE
>700-190.000 km
EXOBASE
>700-1000 km
THERMOSPHERE
80-700 km
Aurora Borealis
Sattelite
KARMAN LINE
100 km
Hubble
MESOSPHERE
50-80 km
Meteors
STRATOSPHERE
12-50 km
Fighter Jet
OZON LAYER
20-30 km
High Altitude Balloon
TROPOSPHERE
0-12 km
Balloon
Passenger Airplane

Atmosphere

Most of the Earth's atmosphere lies in the bottom 10 km.





Atmospheric Composition

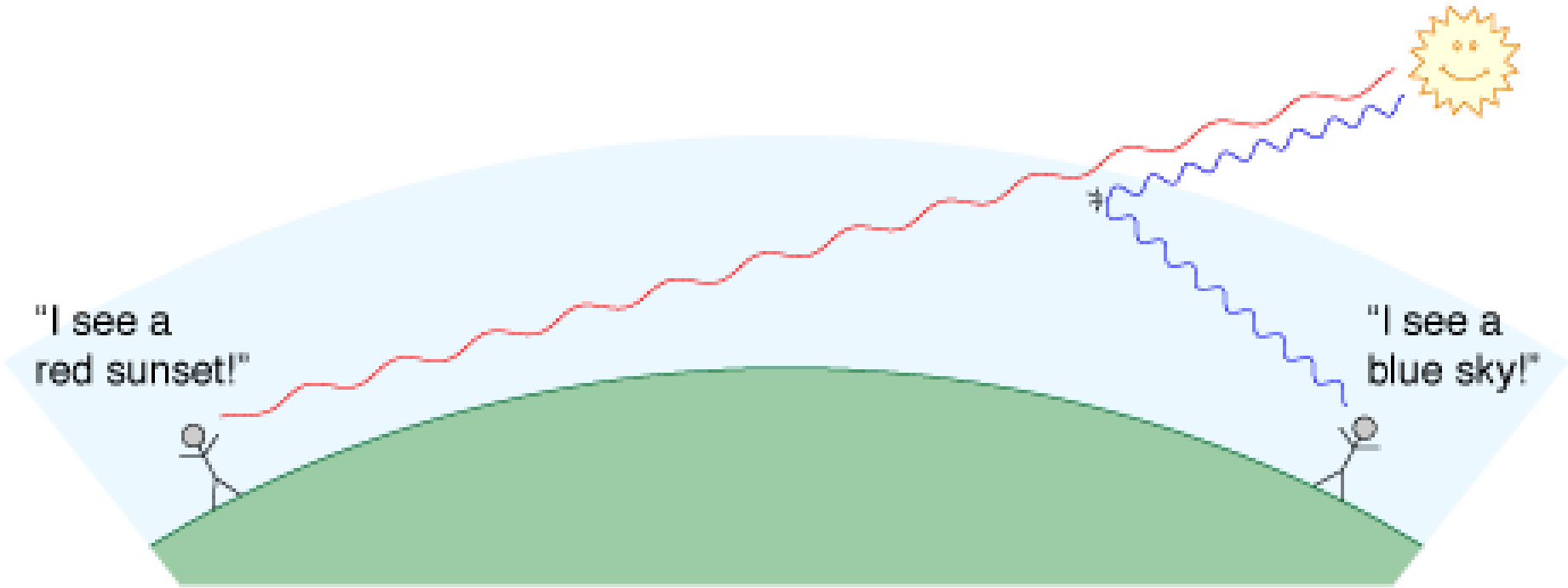
Mostly Nitrogen and Oxygen

Carbon Dioxide is the most abundant greenhouse gas

All other gases such as methane are present in smaller trace amounts

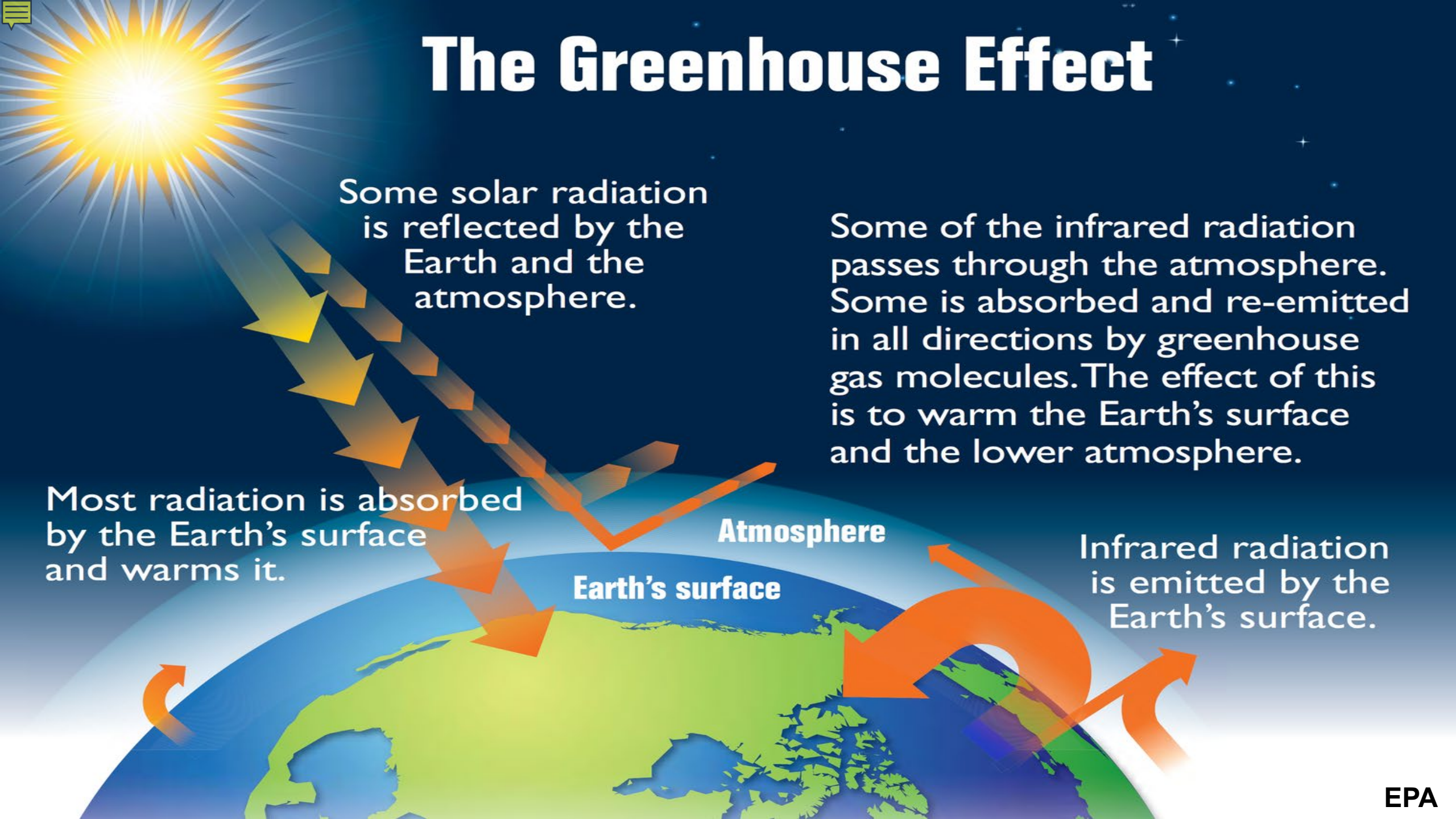
Why is the sky blue?

Shorter blue wavelengths of light are scattered by air particles.



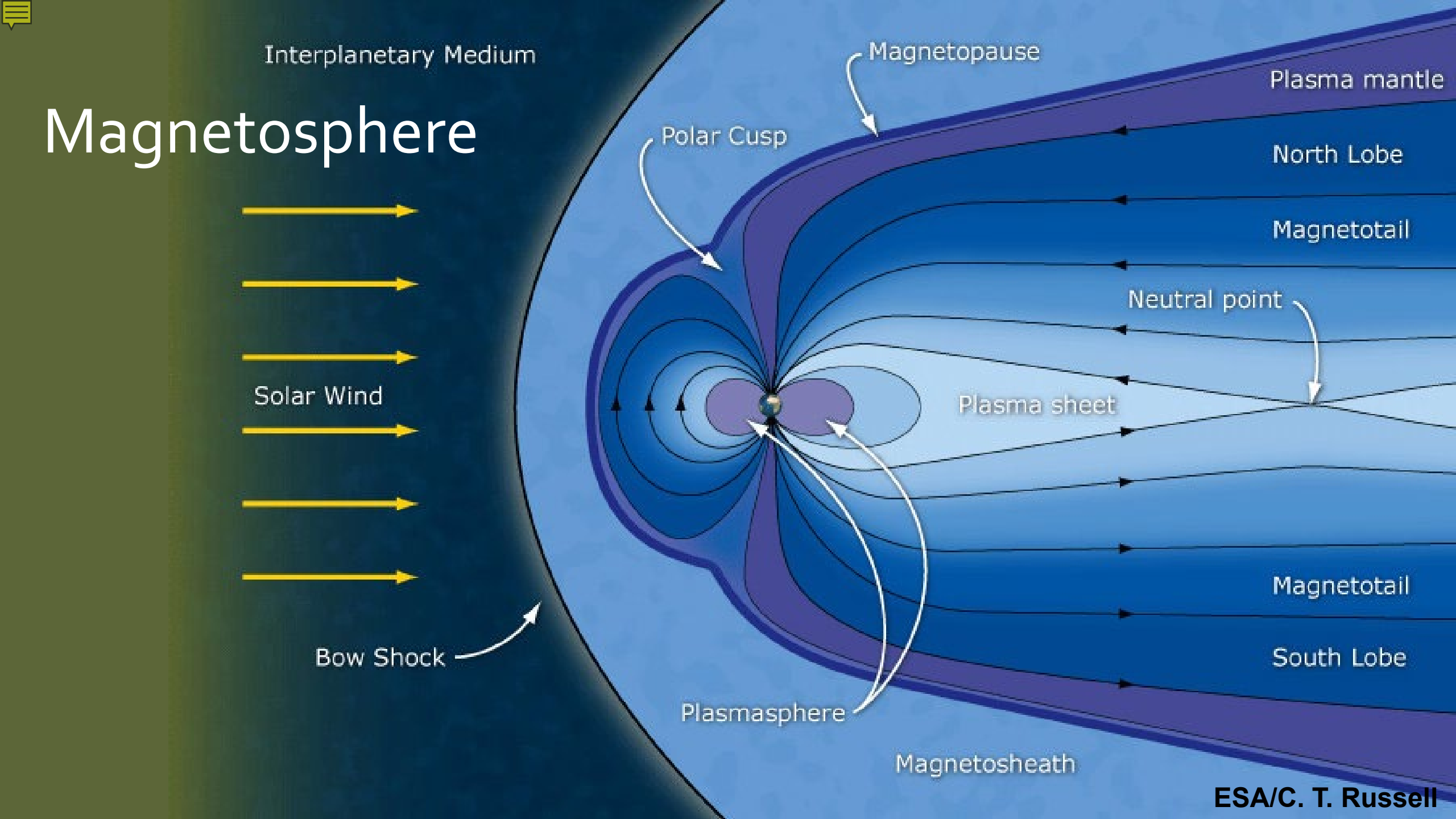
Daniel V. Schroeder

The Greenhouse Effect



EPA

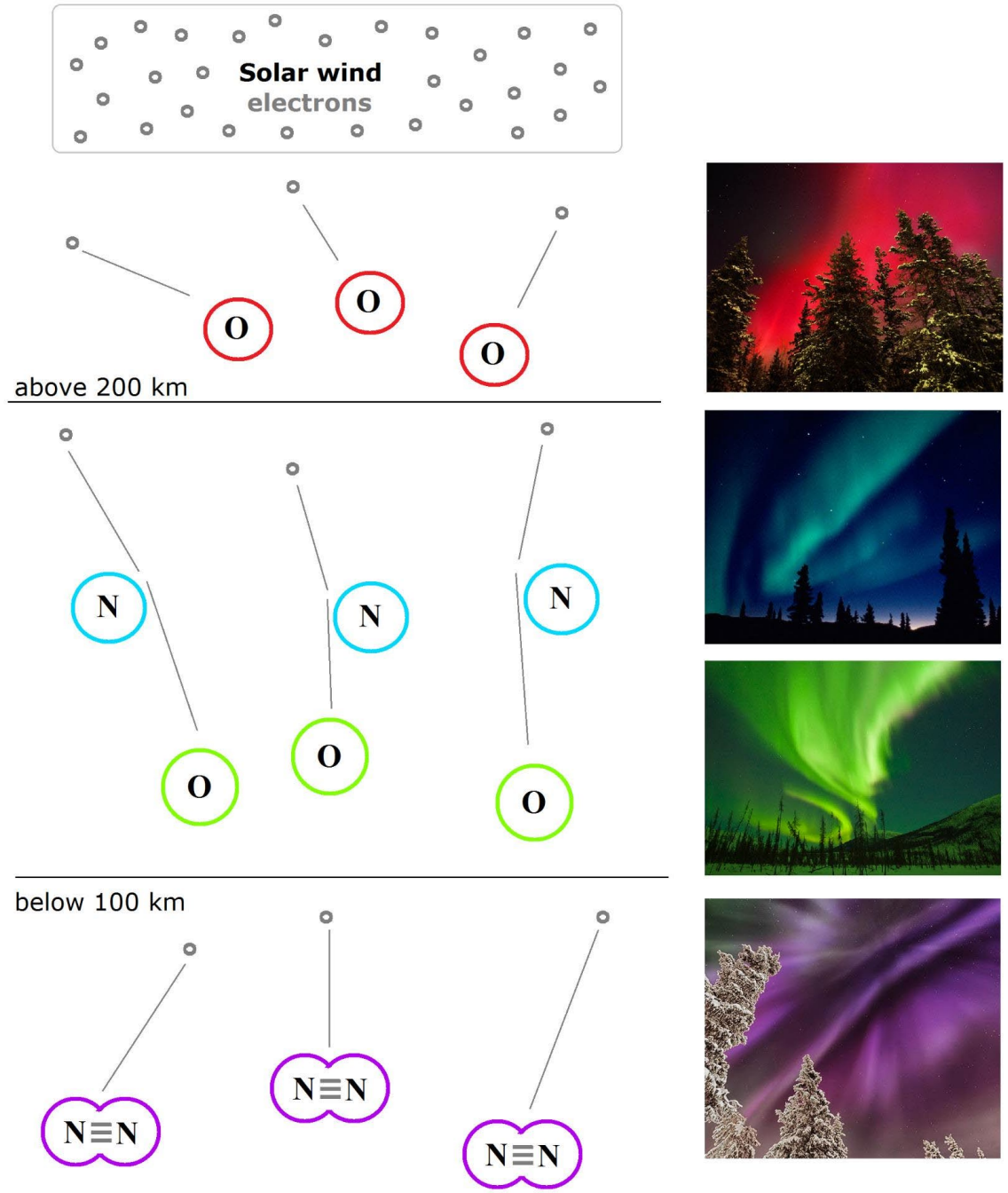
Magnetosphere



ESA/C. T. Russell


ESA/NASA

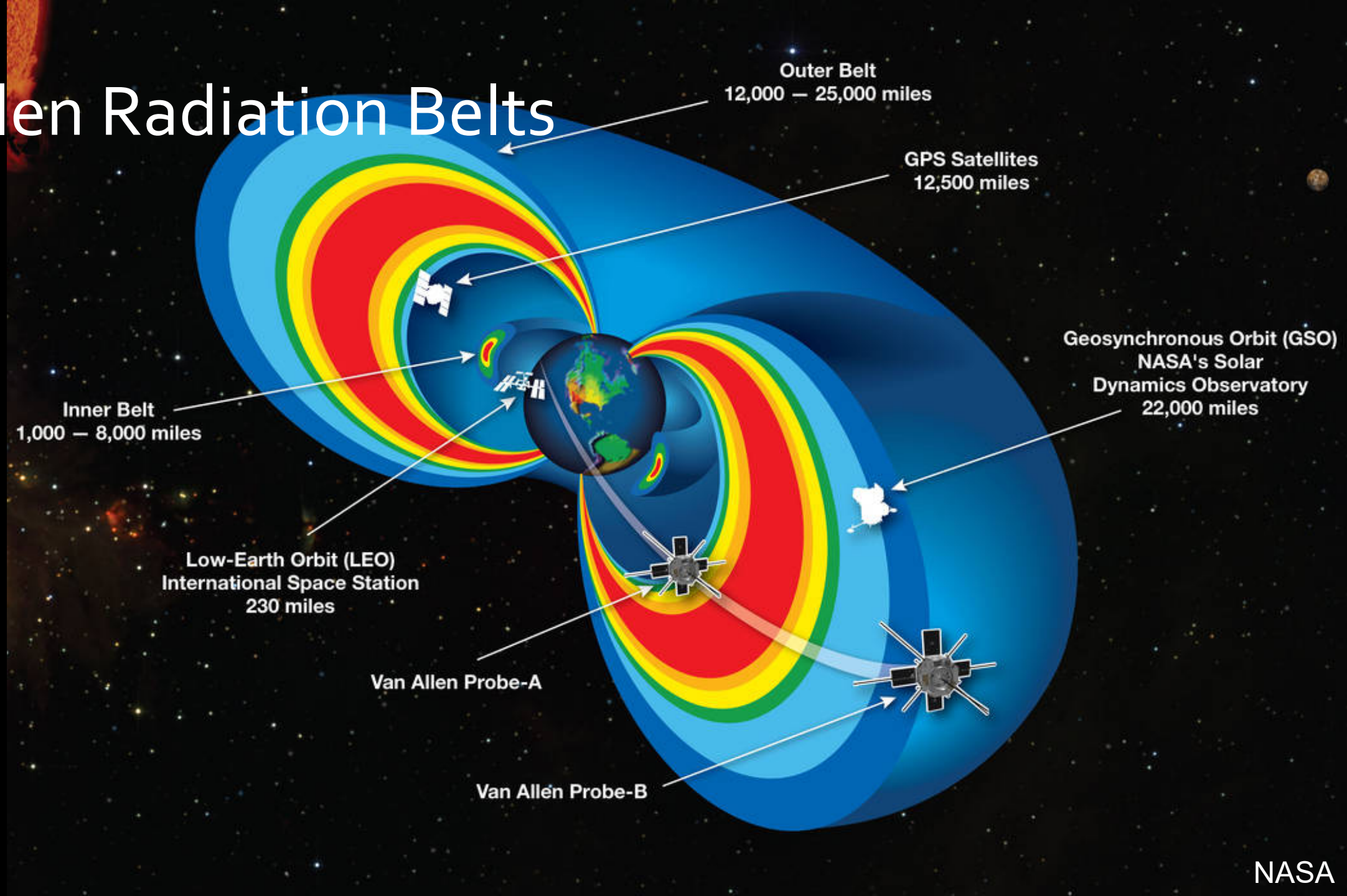
Aurora colors explained



Sun Viewer Twitter

Van Allen Radiation Belts

Electrons and ions are trapped by the Earth's magnetic field in two belts.



Recap

1. How much CO_2 is there in the atmosphere?
2. Why do we observe the Earth in IR wavelengths?
3. What produces the Earth's magnetic field?
4. What makes the different colours of the Aurora?

Up next:

The Moon