

Observing Earth from Space:
Astronaut Photography

Webinar with Earth Science & Remote Sensing (ESRS) Team Members from Astromaterials Research & Exploration Science (ARES) at the NASA Johnson Space Center

Earth Day!

In honor of Earth Day, we are going to talk about

- Astronaut photography of Earth
  - Brief history
  - What makes astronaut photos useful and unique
- Viewing "climate"/weather regions from space
- Changes to Earth’s surface over time
- Resources and tools for public use



AS08-16-2593

Earth Science and Remote Sensing at NASA Johnson Space Center

We're a creative team of Earth scientists, GIS analysts, and computational scientists that work with astronaut photos of Earth

- Support NASA International Space Station (ISS) Program Office
- Payload operations for Crew Earth Observations facility
- Curate and host astronaut photography of Earth online database
  - https://eol.jsc.nasa.gov/

ISS Program Support



Imagery Requests



Disaster Response



Weekly Articles



Machine Learning



Photo Database



Brief History of Astronaut Photography of Earth

- We curate over 4 million photos astronauts have taken of Earth since the 1960s

Apollo missions



AS07-8-1897, 10/1968

Shuttle missions



Space Shuttle Atlantis – 07/10/2011

ISS missions



ISS064-E-49249 – 3/29/2021

Brief History of Astronaut Photography of Earth

- We curate over 4 million photos astronauts have taken of Earth since the 1960s

<u>QUESTION</u>: Out of 4 million photos, about how many have been taken from the ISS?
(put your answers in the chat)

Apollo missions



AS07-8-1897, 10/1968

Shuttle missions



Space Shuttle Atlantis – 07/10/2011

ISS missions



ISS064-E-49249 – 3/29/2021

Brief History of Astronaut Photography of Earth

- We curate over 4 million photos astronauts have taken of Earth since the 1960s

ANSWER: Out of 4 million photos, about 3.5 million have been taken from the ISS!

Apollo missions



AS07-8-1897, 10/1968

Shuttle missions



Space Shuttle Atlantis – 07/10/2011

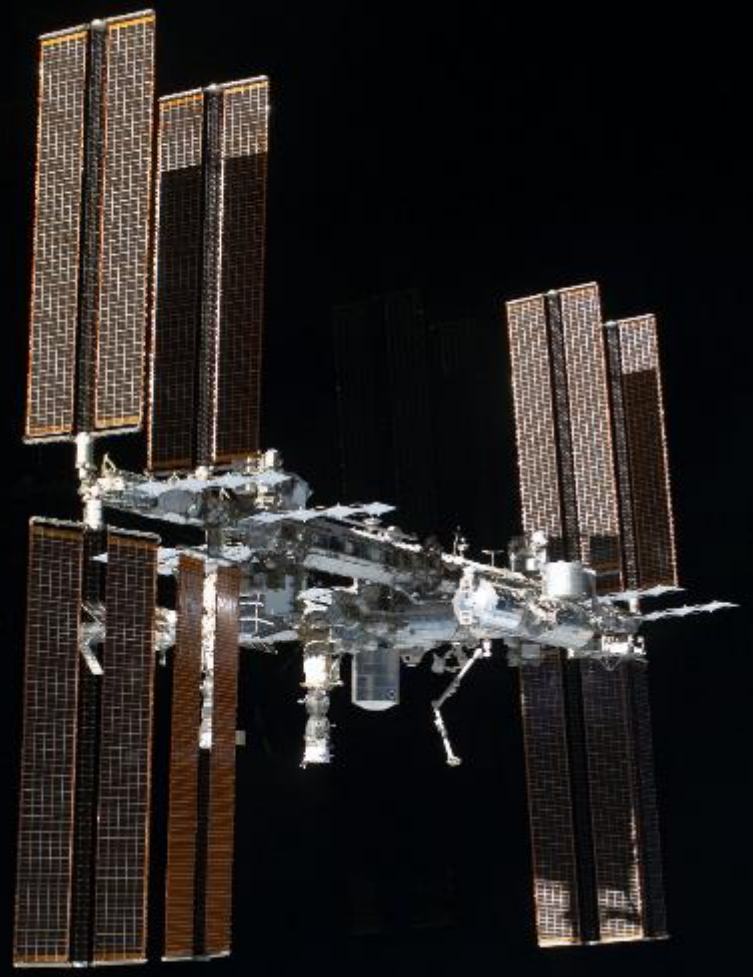
ISS missions



ISS064-E-49249 – 3/29/2021

International Space Station (ISS)

- Astronauts have lived continuously on board since 2000
- Orbits Earth ~16 times every day –that's every 90 minutes!
- Orbits ~250 miles above Earth's surface
- Lots of opportunities for astronauts to take pictures of Earth!



More info: https://www.nasa.gov/mission_pages/station/overview/index.html





There are a lot of camera lenses to choose from!

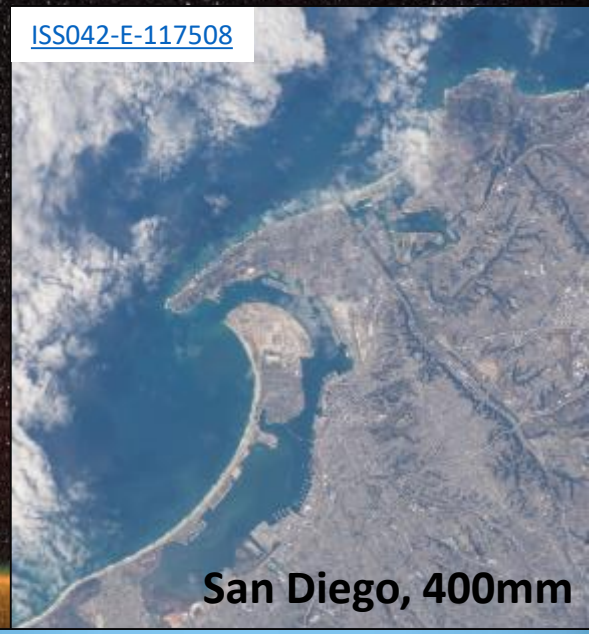


Different Fields of View

- **Shorter camera lens sizes take broad and wide pictures**
- **Longer lens sizes take more zoomed in photos**















- There are a variety of satellites orbiting Earth gathering very useful data and imagery of Earth.
- These satellites pass over the same area of Earth the same time every day.

Video Source: https://svs.gsfc.nasa.gov/4274





QUESTION: What are the benefits of astronaut photography of Earth?

(put your answers in the chat.)









Benefits of Astronaut Photography:

1) Variable Solar Illumination Angles

   - Can see the same locations at any time of night or day

Italy at day and night









Benefits of Astronaut Photography

2) Variable Look Angles

- See the same locations from different directions and orientations



Astronauts can use different camera lens sizes to zoom in on a place

This example shows different photos zooming into Venice, Italy

Crew Earth Observations

- Astronauts on the International Space Station (ISS) photograph Earth from their unique point of view in low Earth orbit

- We provide daily targets on Earth for astronauts to take photos of

- Daily targets are evaluated based on:
  - ISS location
  - Lighting conditions
  - Weather (cloudiness)



NASA astronaut Christina Koch looking out the ISS Cupola windows

Images Help Support:

1. Science

a. Change over time
b. Urban Growth
c. Light Pollution
& more!



Japan at night, ISS064-E-37551, 2/24/2021

2. Disaster Response

a. Fires
b. Hurricane Damage
c. Flood Assessment
& more!



Hurricane in the Caribbean, ISS053-E-4062, 9/9/2017

And so much more! These are just a few examples.

NASA astronaut Christina Koch looking out the ISS Cupola windows →



HOW MIGHT YOU USE THIS ASTRONAUT IMAGE?

A) What would this image help support? *Science? Disaster Response?*
B) What type of information could you obtain from this image or images like this?

(put your answers in the chat.)



1. Science
- a. Change over time
- b. Urban Growth
- c. Light Pollution
- d. Other

2. Disaster Response
- a. Fires
- b. Hurricane Damage
- c. Flood Assessment
- d. Other

Collecting and Delivering Disaster Response Imagery

- **Raw camera files georeferenced**
- **Georeferenced imagery delivered to U.S. Geological Survey**



ISS056-E-129891, 116mm

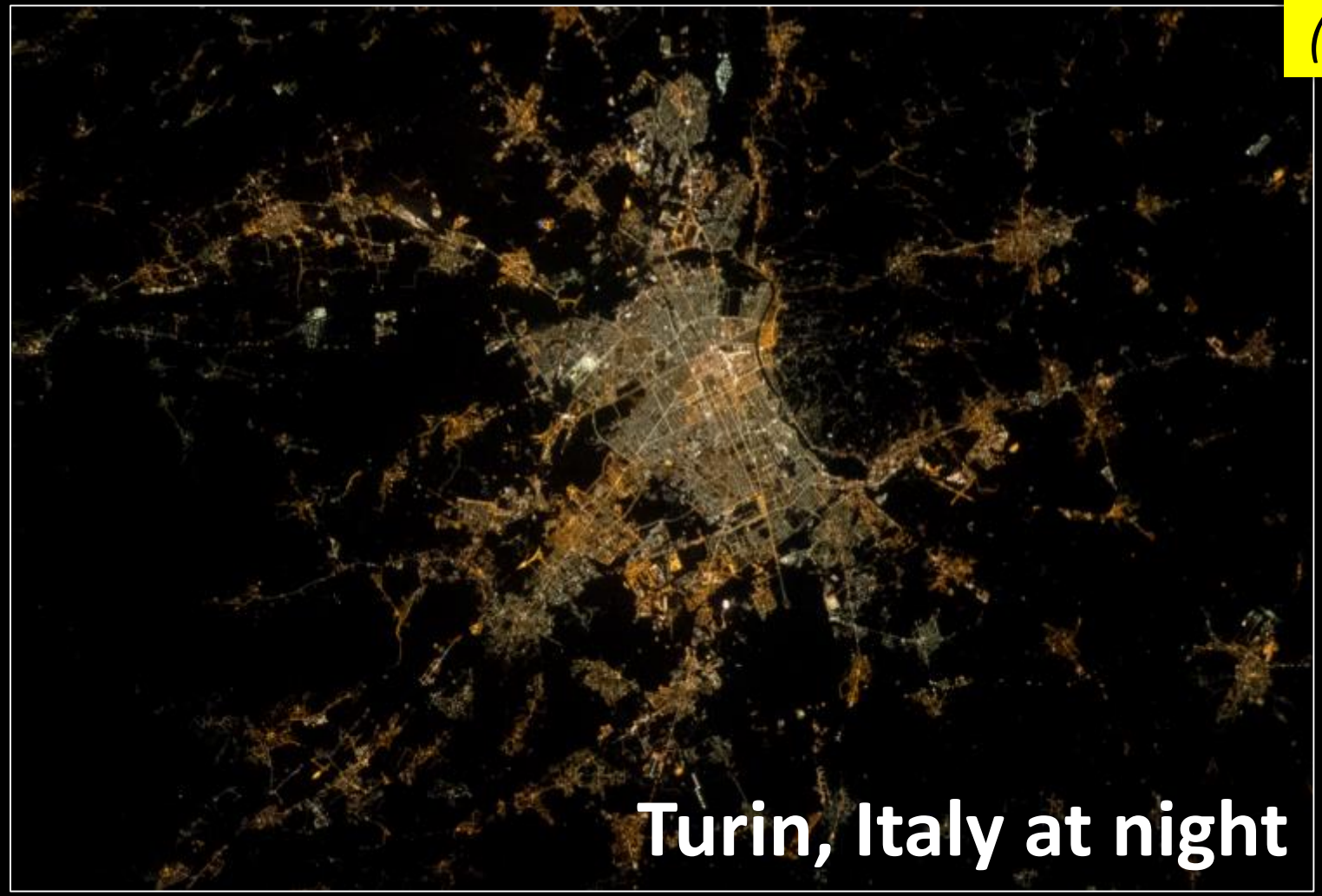


Georeferenced data product

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A) What would this image help support? *Science? Disaster Response?*
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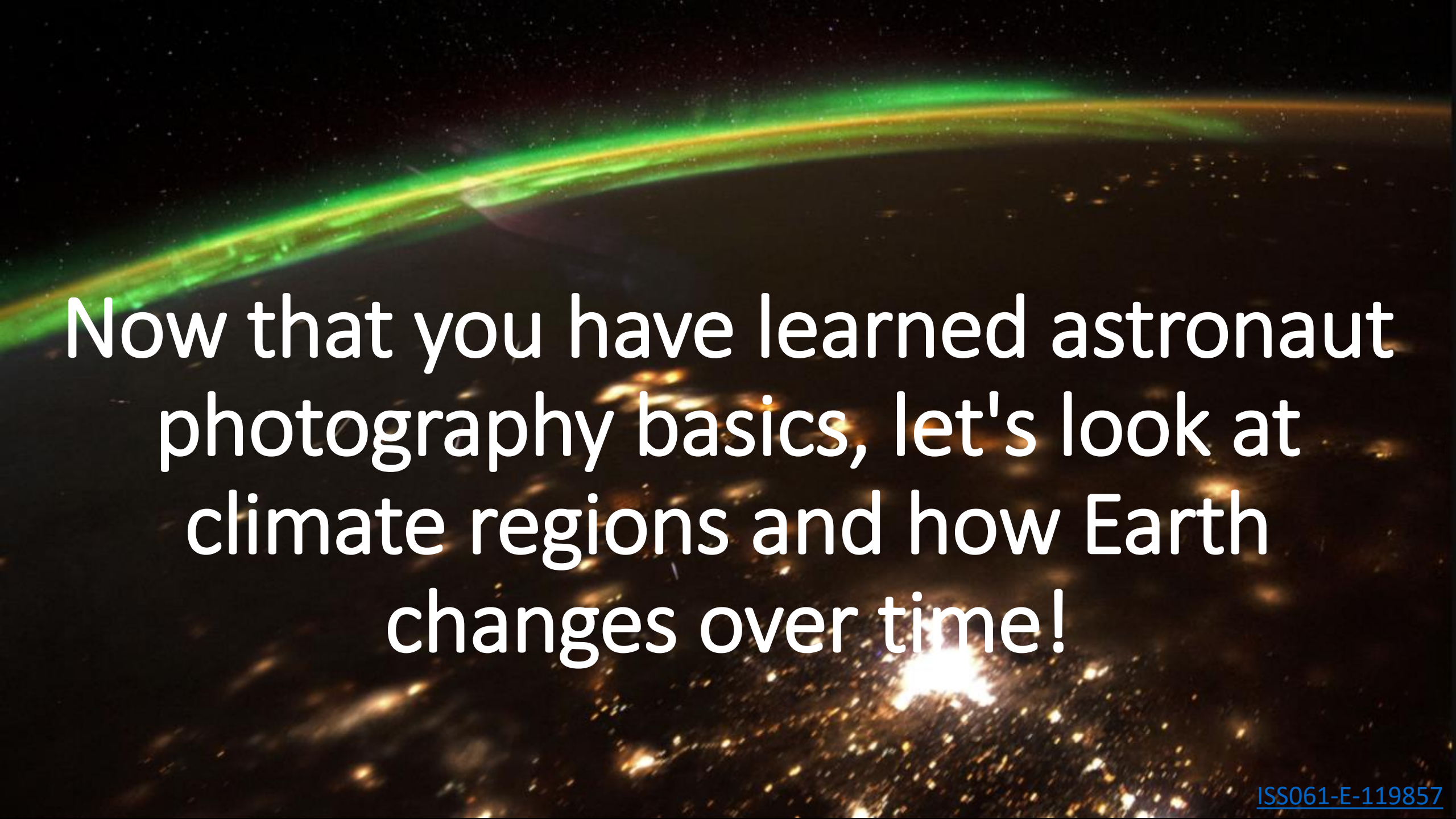
(put your answers in the chat.)



1. Science
- a. Change over time
- b. Urban Growth
- c. Light Pollution
- d. Other

2. Disaster Response
- a. Fires
- b. Hurricane Damage
- c. Flood Assessment
- d. Other

ISS062-E-102588


Now that you have learned astronaut photography basics, let's look at climate regions and how Earth changes over time!
ISS061-E-119857

QUESTION: How many different climate regions can you see in this photo? Support/Describe your observations. *(put answers in the chat)*




ISS041-E-81033
Himalayas
• Block moisture from traveling North
India
• Warm, humid
• Rivers, vegetation
Tibetan Plateau
• Dry, arid
• Lack of vegetation
• Lakes
N

QUESTION: How many different climate regions can you see in this photo? Support/Describe your observations. *(put answers in the chat)*



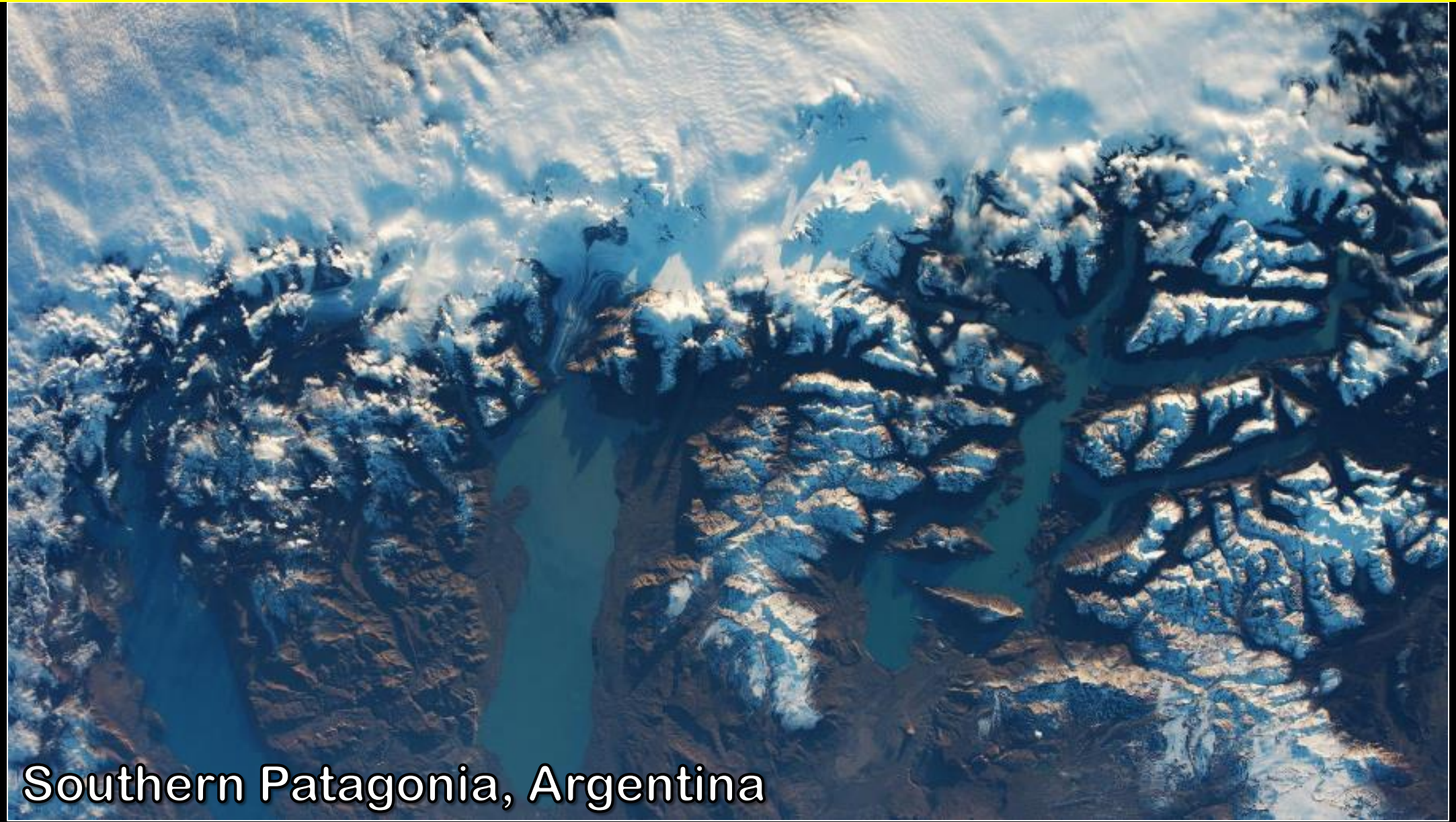
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ISS061-E-21164

QUESTION: What features do you see in this photo?

(put your answers in the chat.)




Southern Patagonia, Argentina
clouds &
snow
glaciers
lakes







Viedma glacier, South Patagonia icefields

Measurable glacial tongue retreat over past decade from astronaut photography

QUESTIONS: 1) List features you see in this photo AND
2) Describe how you might use images of this area for research?

(put your answers in the chat.)



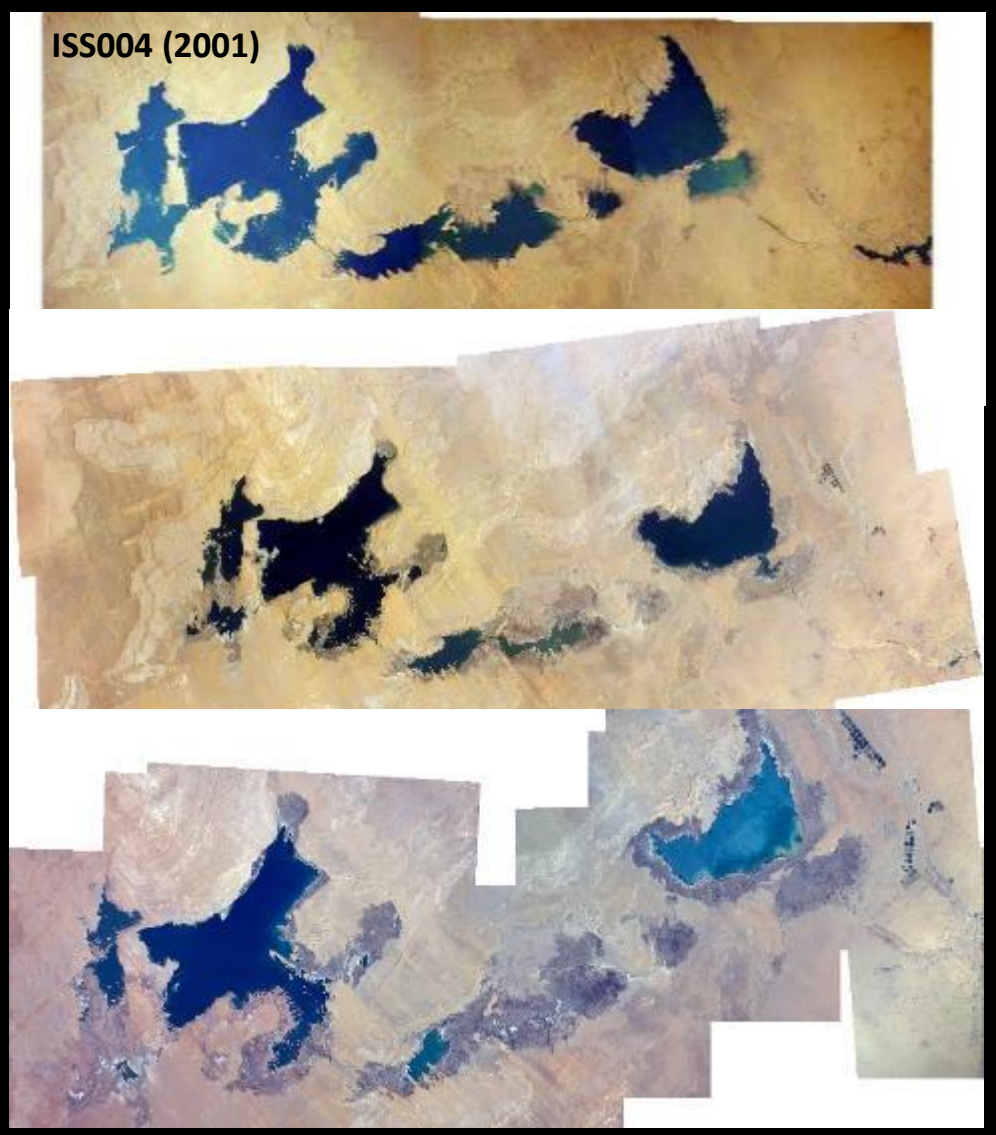
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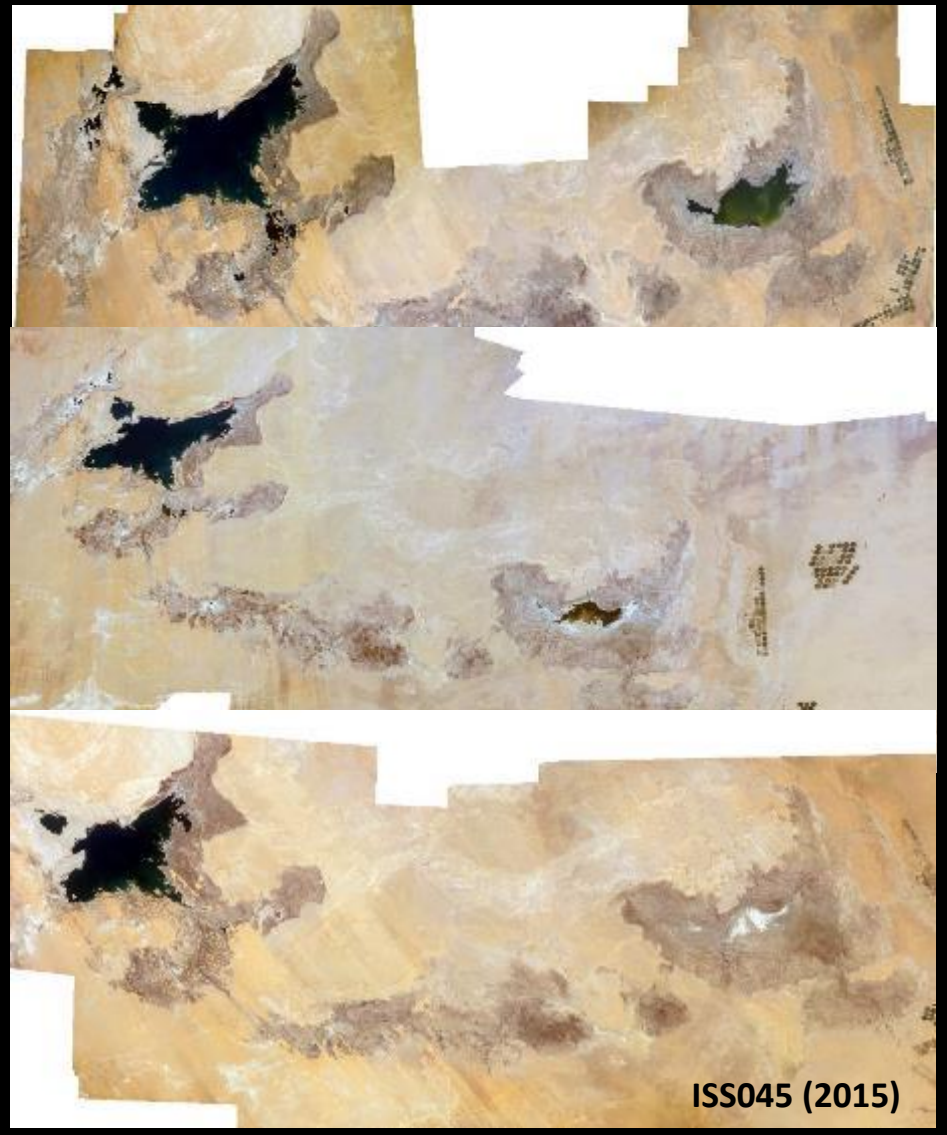


Toshka Lakes, Southern Egypt

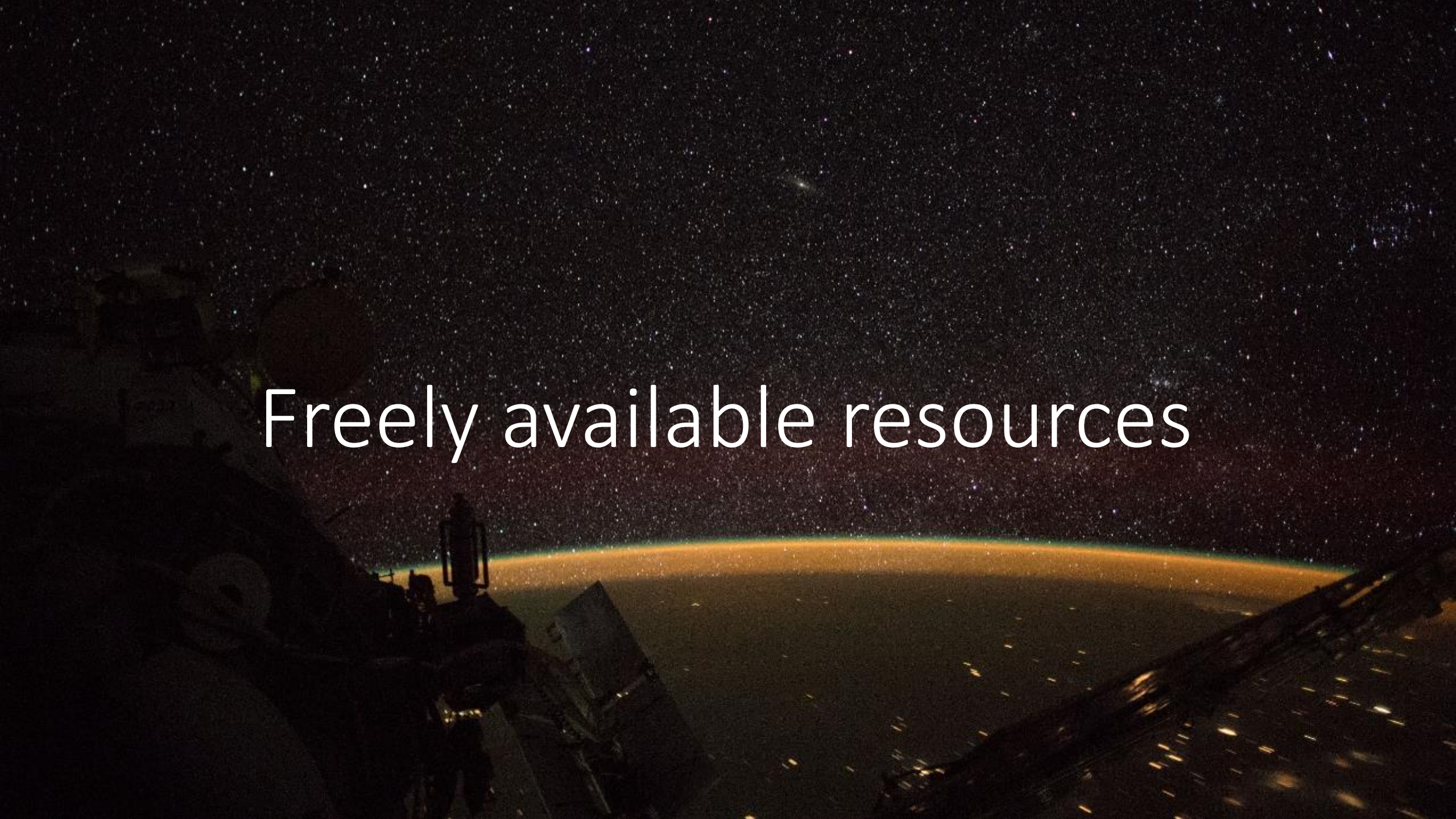
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Astronaut photography over time: shrinking Toshka Lakes, Egypt





Learn more about the Toshka Lakes over time here:
https://earthobservatory.nasa.gov/images/78531/toshka-lakes-southern-egypt



Freely available resources

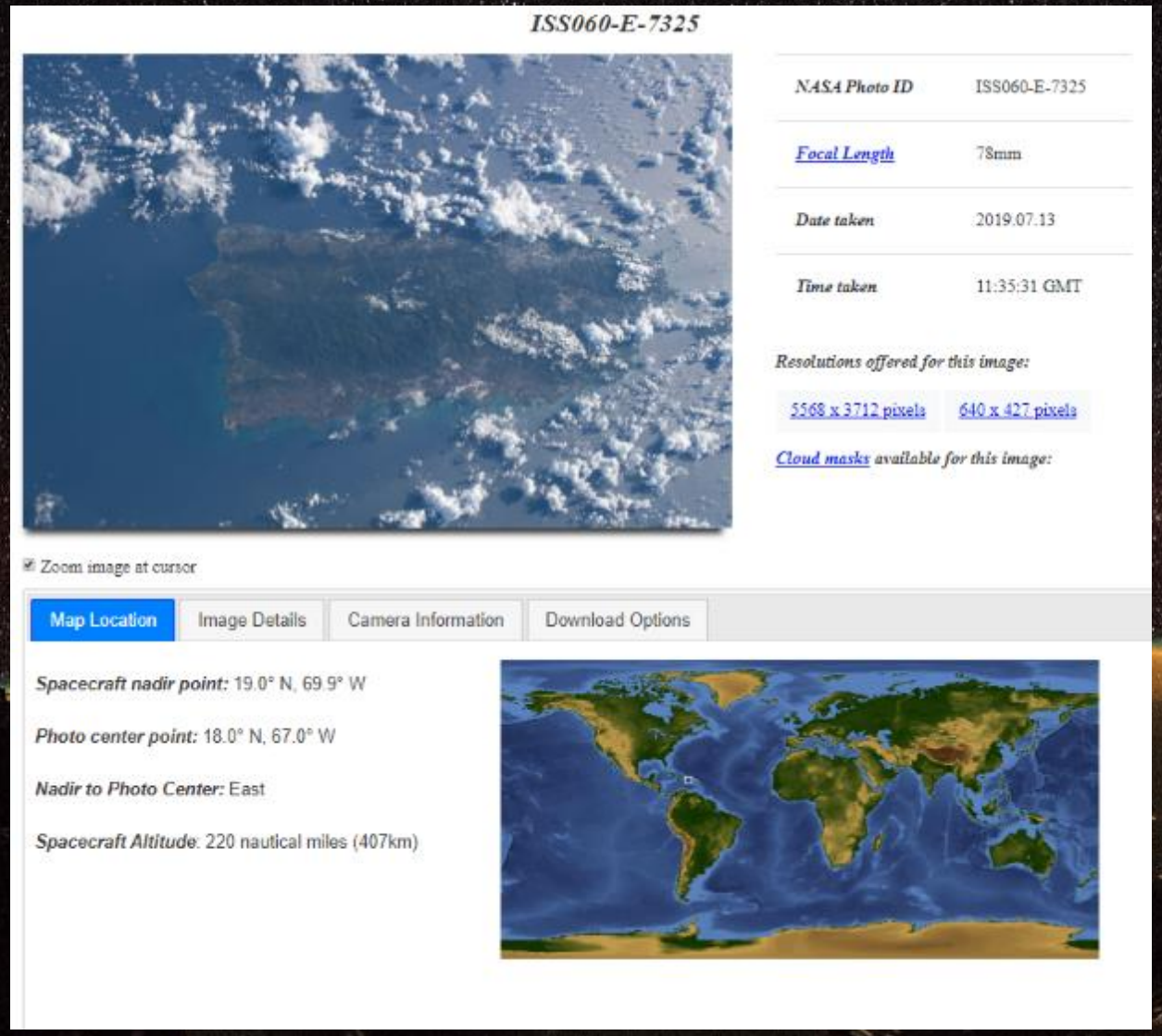
Gateway to Astronaut Photography of Earth

https://eol.jsc.nasa.gov/



Over 3.5 million images of Earth taken by astronauts

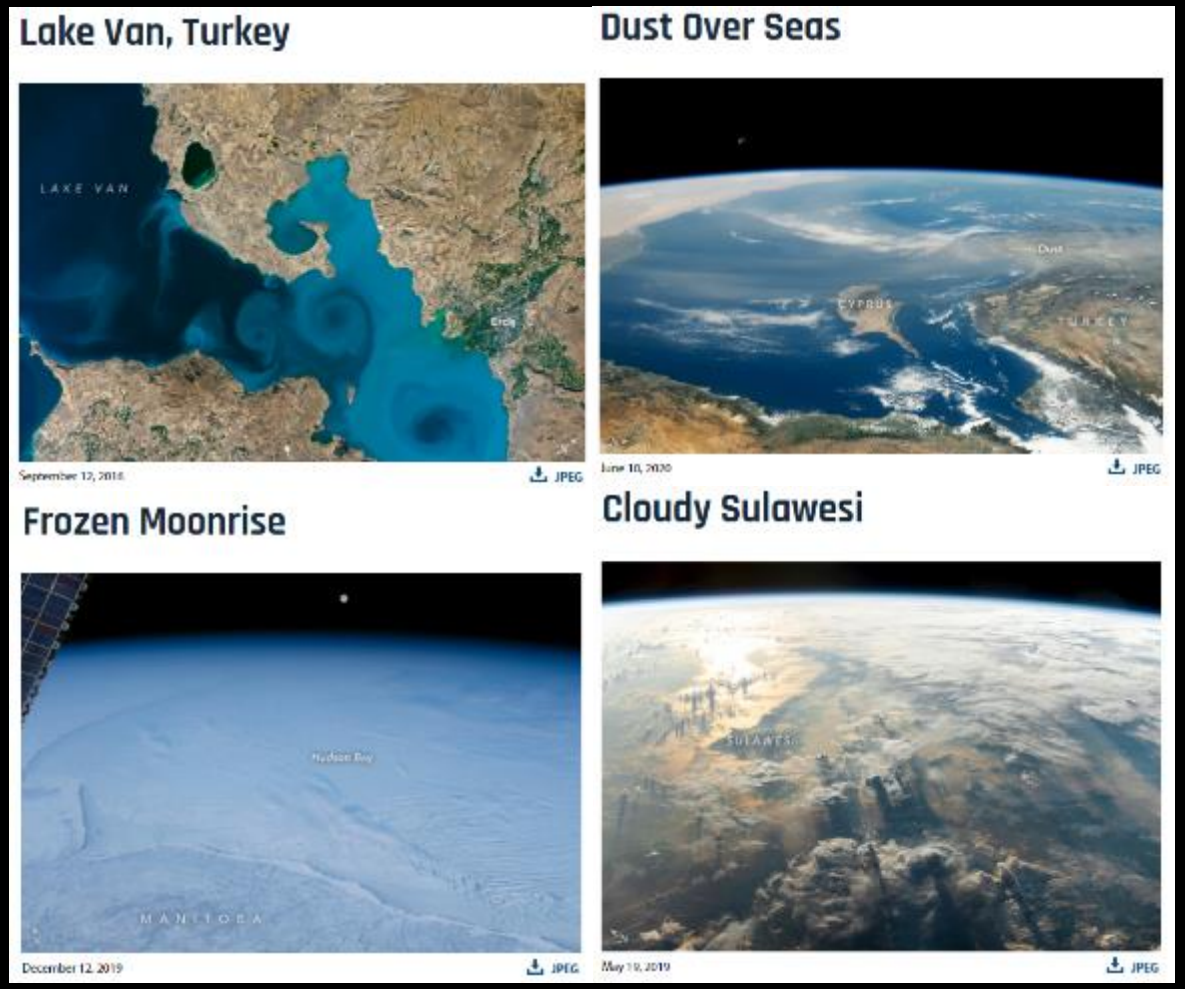
Astronaut photos of Earth are freely available to view & download



https://eol.jsc.nasa.gov/SearchPhotos/photo.pl?mission=ISS060&roll=E&frame=7325

NASA Earth Observatory

- New articles on NASA images published daily
- Once a week on astronaut photos



https://earthobservatory.nasa.gov/




Questions?