

SEA ICE FROM SPACE

Investigating Arctic sea ice and its connection to climate

http://esamultimedia.esa.int/docs/edu/G04_Sea_ice_from_space.pdf



What is sea ice ????

ESA/T. Casal

Instructions

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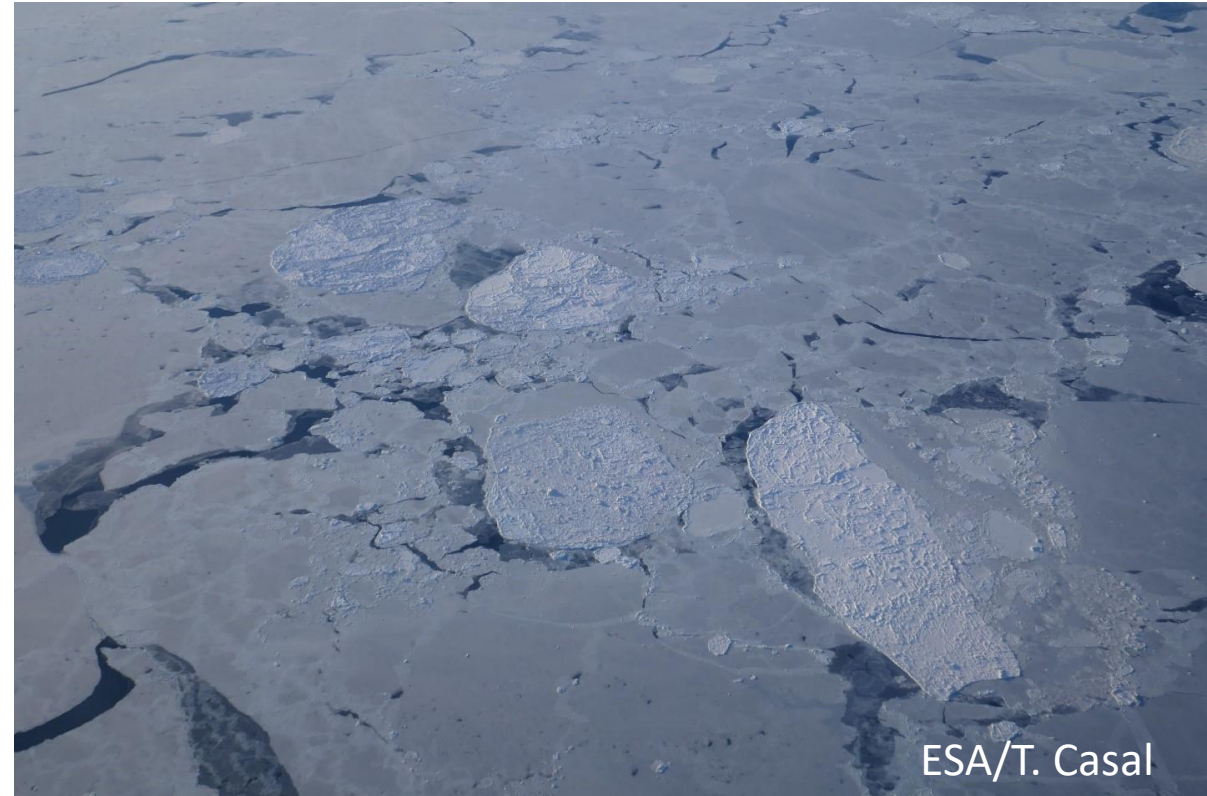
<https://www.menti.com/qcuphvn7eu>

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Sea ice

- Sea ice is simply frozen seawater.
- In contrast to icebergs or glaciers that originate on land, sea ice forms, grows and melts in the ocean.
- The formation of sea ice is a complex process that is influenced by the basic properties of water and ice.
- The salt content of water influences the freezing point: the higher the salt content, the lower the freezing point



Biological importance of sea ice

- Sea ice contains little salt
- The salt that is rejected is either forced out into the surrounding water, or trapped in small pockets or channels between ice crystals. These are called brines.
- The brines trap microscopic plankton
- Different processes wash out of brines that make it possible for photosynthetic algae to grow on the bottom of the sea ice.

Breakout Rooms x 4 (A,B,C,D)

- 15 mins
- Allow to discuss the resource Sea Ice Today



Activity 2 (From Booklet) Sea Ice today

- Where do you see the learning from this activity within the LOs in the specification.
- How would you engage the students in this activity?
- What strategies would you use to implement this activity in the classroom?
- What are the opportunities/challenges to enhance learning in using this activity?

<https://padlet.com/educationatbco/SeaIce1>



Session2 Sea Ice from Space Activity 2: Sea Ice Today

Look at Activity 2: Sea ice today

Resources

Learning Outcomes Poster

science-lo-poster
PDF document
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Activity 2: Sea ice today
(pages 10, 15 &16)

Activity 2 – Sea ice today

In this activity, students will learn about the global distribution of sea ice. They will also analyse up-to-date satellite data about sea ice concentration over the Arctic.

Equipment

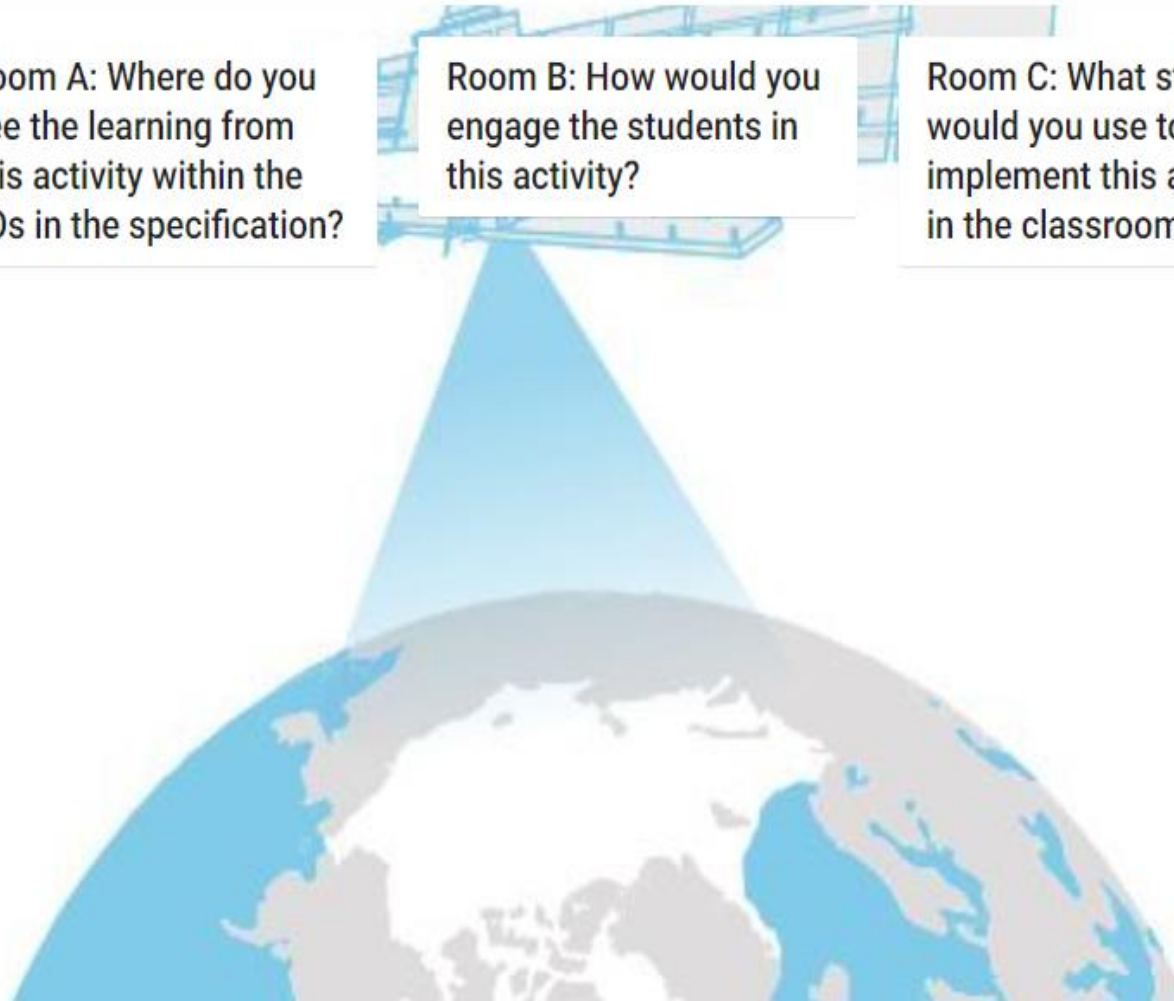


Room A: Where do you see the learning from this activity within the LOs in the specification?

Room B: How would you engage the students in this activity?

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Activity 2 Sea Ice Today

→ Activity 2 – Sea ice today

In this activity, students will learn about the global distribution of sea ice. They will also analyse up-to-date satellite data about sea ice concentration in the Arctic.

Equipment

- PC and internet access
- Student worksheet for each group

Exercise

Before analysing real data, students discuss their expectations regarding where they anticipate to find sea ice in the Northern Hemisphere. For that students analyse a map from the Northern Hemisphere and indicate the areas where they expect to find sea ice (Figure A2 from student worksheet). The locations are 1, 3, 4 and 8. The other areas are influenced by the Gulf Stream, which is an Atlantic ocean current that carries warm water northwards, prevents the water from freezing. Depending on the students' level of knowledge, the "Highways of the Oceans" resource (see links section) can be a good basis for this enquiry. In the Southern Hemisphere, sea ice can be found around Antarctica.

On the University of Bremen (Germany) [website](https://seaice.uni-bremen.de/sea-ice-concentration) (<https://seaice.uni-bremen.de/sea-ice-concentration>), students can find up-to-date data about sea ice concentration in the Arctic. The data is derived from JAXA's (Japan Aerospace Exploration Agency) Advanced Microwave Scanning Radiometer 2 instrument on-board the GCOM-W satellite.

When describing the sea ice concentration, students should understand that a concentration of 0% indicates unfrozen water (open ocean). There is an area around the North Pole that is not imaged by the satellite, and there is no way to know what the actual concentration is within this area, so the area is represented by a dark grey circle. They should point out where on the map sea ice can be found and read from the legend how the concentration of the sea ice is distributed and differs.

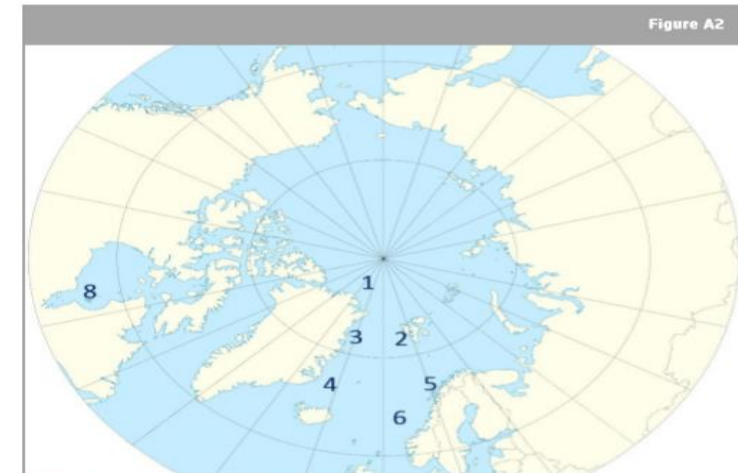
In the links section you can find more links to platforms that provide access to sea ice data, including some from ESA satellites. A new candidate Copernicus Imaging Microwave Radiometer (CIMR) mission is currently being developed to provide future continuity in measurements of sea ice concentration in the Arctic Ocean and in the Southern Ocean around Antarctica.

→ Activity 2 – Sea ice today

In this activity, you will learn where in the world you can find sea ice. You will also analyse up-to-date satellite data about sea ice concentration in the Arctic.

Exercise

1. Figure A2 shows part of the Northern Hemisphere. Indicate the areas (numbers 1 to 8) where you would expect to find sea ice. Explain why.



↑ Select the areas where you expect to find sea ice.

2. Sea ice is frozen ocean water. Would you also expect to find sea ice in the Southern Hemisphere? If so, where?

Pg 15

Anything Interesting

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Session2 Sea Ice from Space Activity 2: Sea Ice Today

Look at Activity 2: Sea ice today

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Activity 2: Sea ice today
(pages 10, 15 &16)

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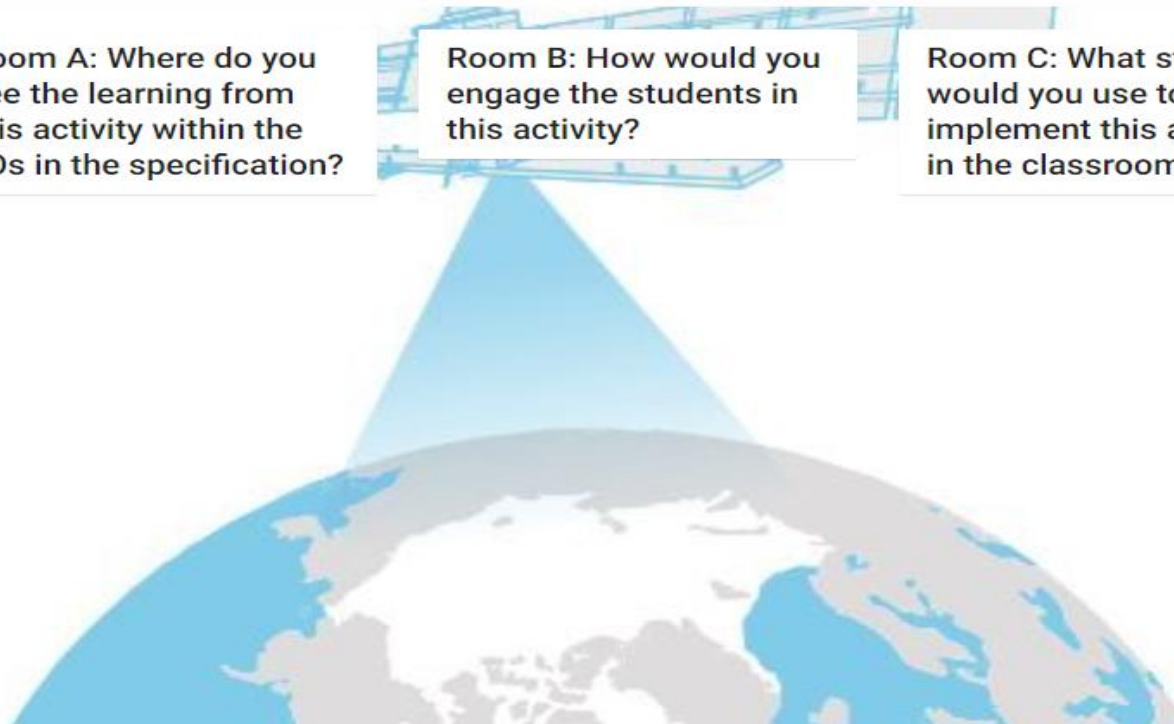


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Room B: How would you engage the students in this activity?

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Room D: What are the opportunities / challenges to enhance learning in using this activity?



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SEA ICE FROM SPACE

What do you think is the connection between the Arctic Ice and the climate?

Menti.com **80 30 28 0**



Connection

- About 12% of the world's oceans are covered by sea ice. Even though sea ice occurs primarily in the polar regions, it influences our global climate.
- Sea ice changes the reflectivity of the ocean and acts as a barrier to the exchange of heat and moisture between the ocean and the atmosphere.
- Sea ice also has a significant role in global ocean circulation.
- Changes in sea ice are one of the biggest challenges for scientists trying to predict Earth's changing climate.

→ Activity 3 – Sea ice through the seasons

In this activity, students will discuss their expectations regarding seasonal changes in sea ice and analyse long-term data about sea ice extent.

Equipment

- Student worksheet for each group

Exercise

Before analysing real data, students discuss their expectations. They should conclude that they expect seasonal changes in sea ice extent and that there might be a decrease of sea ice extent over several years due to rising global temperatures.

After analysing up-to-date data showing sea ice values (activity 2), students will first investigate how the sea ice extent changes in the course of one year and then how it changes over several years. Teachers can find monthly maps of sea ice at <https://climate.copernicus.eu/sea-ice> and download the original image.

The E.U. Copernicus Marine environment monitoring service (<http://marine.copernicus.eu/science-learning/ocean-monitoring-indicators/catalogue/>) also provides graphics and data about the Northern Hemisphere sea ice extent for different years. Teachers are advised to download the most up-to-date data available.

The graphics in the annex, from the E.U. Copernicus Marine Service Information, show the sea ice extent mean and trend in the Northern Hemisphere between 1993 and 2017 and the Northern Hemisphere sea ice mean for 2012, 2014 and for the 1993-2014 period.

By analysing the graphics in the annex students should conclude that Arctic sea ice extent reaches a summer minimum in September and winter maximum in March. Students can also conclude that the long-term trend (annual mean) over the 1993-2017 period indicates that Arctic sea-ice extent has declined at a rate of approximately 6% per decade.

→ Activity 3 – Sea ice through the seasons

Satellites have been observing sea ice for more than three decades. Scientists analyse this data in order to identify short and long-term trends that help to characterise and monitor sea ice. In this activity you will analyse long-term data about sea ice extent and discuss seasonal changes of sea ice.

Exercise

1. Before you start analysing sea ice data, discuss your expectations in small groups:
 - a. Do you expect the sea ice extent to change within the year? Why?

- b. In which month(s) do you expect to find the least and the most sea ice?

- c. Do you expect the sea ice extent to change over the years? Why?

2. You will now analyse and compare sea ice variations in different months during the same year. Describe the change of sea ice extent over the course of one year. In which month(s) do you find the least and the most sea ice?

Breakout Rooms x 4(A,B,C,D)

- 15mins
- Discuss the resource Activity 3



Activity 3: (From Booklet) Sea Ice Through the Seasons

- Where do you see the learning from this activity within the LOs in the specification.
- How would you engage the students in this activity?
- What strategies would you use to implement this activity in the classroom?
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- <https://padlet.com/educationatbco/SeaIce2>



Sea Ice from Space Activity 3: Sea ice through the seasons

Look at Activity 3: Sea ice through the seasons

Resources

Learning Outcomes Poster



science-lo-poster
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Sea Ice from Space: Activity 3 - Sea Ice through the Seasons

Activity 3 – Sea ice through the seasons

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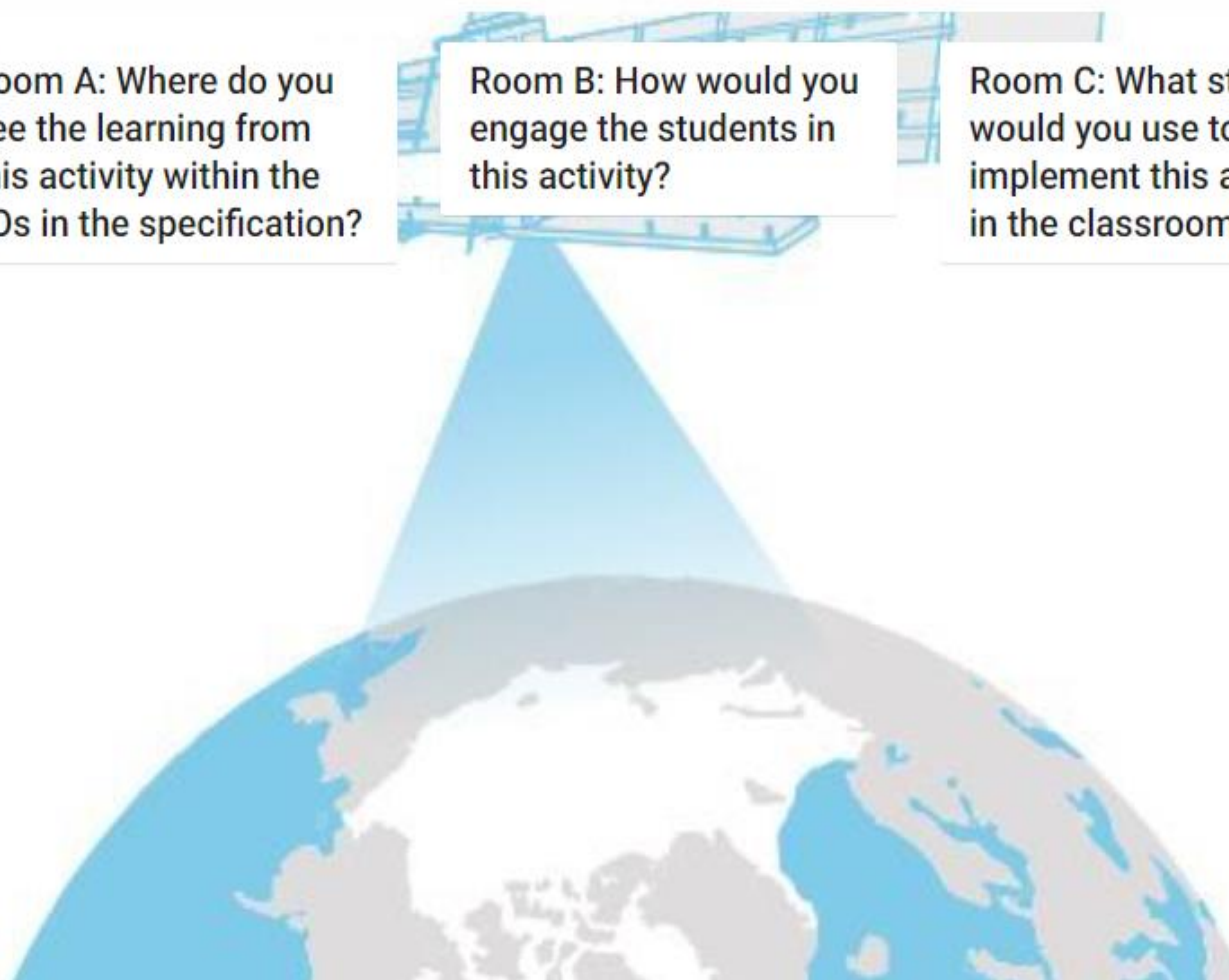


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Anything Interesting from A,B,C,D


Space 5m

Sea Ice from Space Activity 3: Sea ice through the seasons

Look at Activity 3: Sea ice through the seasons

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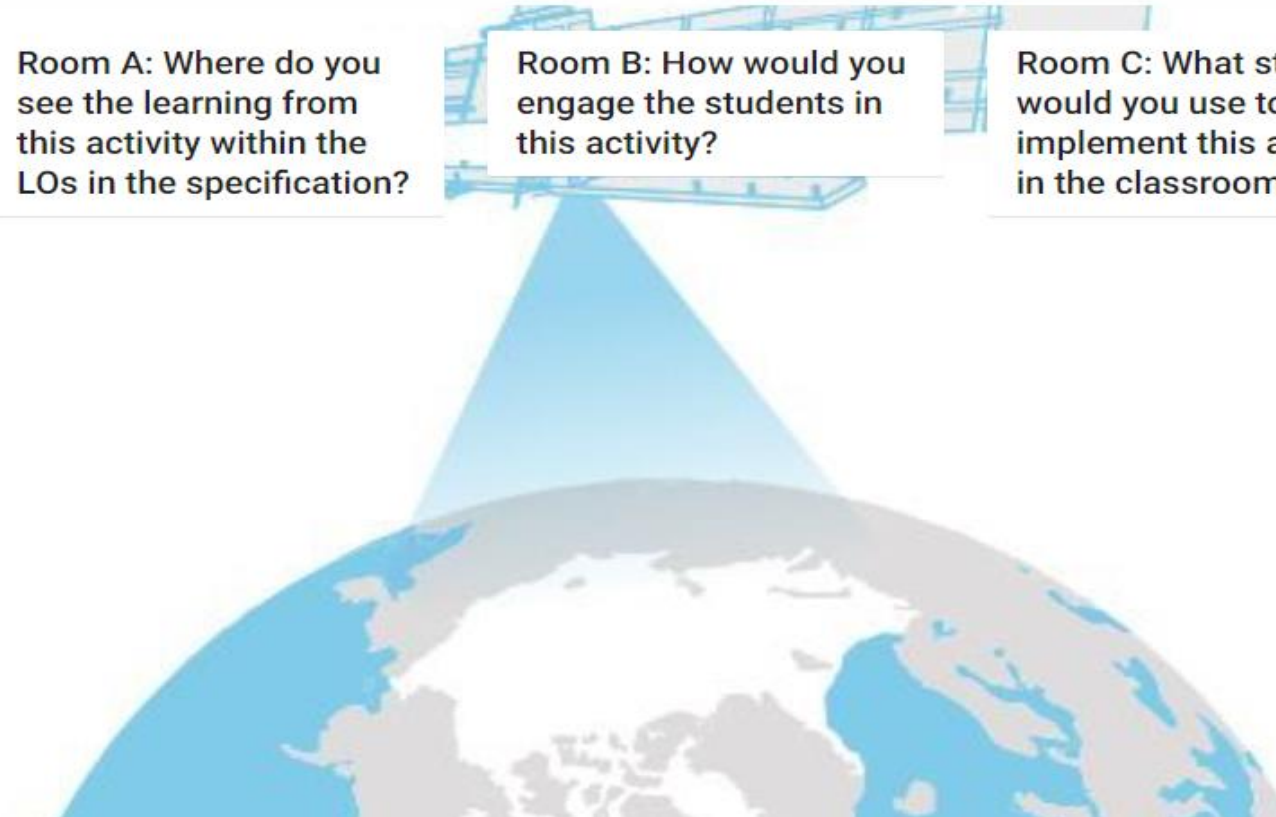
Sea Ice from Space: Activity 3 - Sea Ice through the Seasons

Activity 3 – Sea ice through the seasons

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Equipment

Ireland



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Consequences of an ice-free Arctic

- **I will leave you to ponder over the thought of an ice free Arctic**
- **Consider**
- What the implications are for Earth's climate and for human activities (for example, global shipping routes).
- A possible shipping route through the Arctic leads to quicker transportation of goods between Europe and Southeast Asia.
- However, increased shipping traffic means more ship noise or potential oil spills, which can affect the Arctic environment.
- And while shipping routes are often possible in the summer, they cannot be reliably planned due to annual changes in the Arctic.
- Sea ice changes the reflectivity of the ocean and acts as a barrier to the exchange of heat and moisture between the ocean and the atmosphere.

Resources from ESA

https://www.esa.int/Education/Teachers_Corner/Secondary_classroom_resources



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