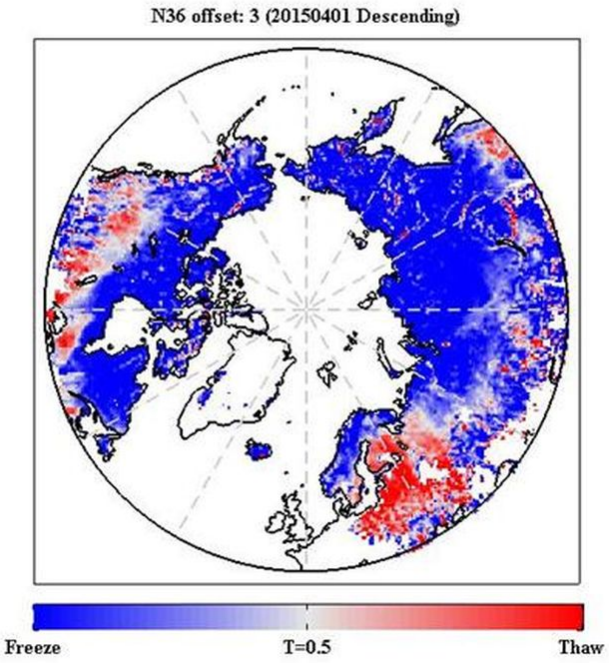
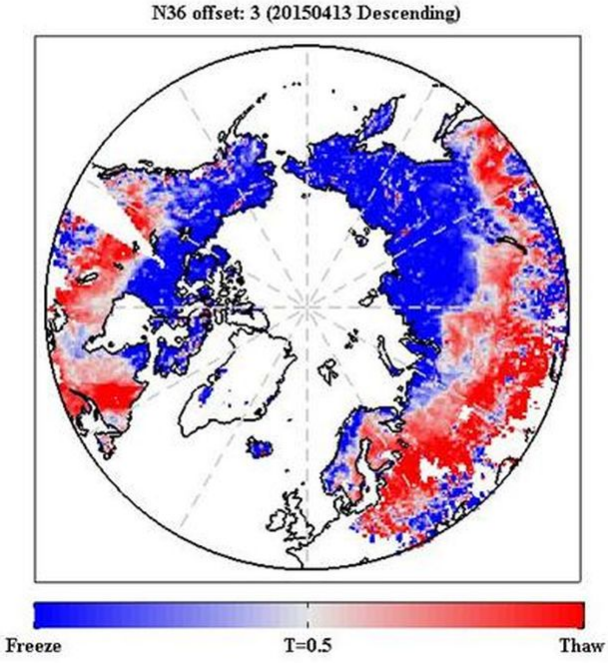
My NASA Data - Mini Lesson/Activity

Exploring Cryosphere Seasonal Thaw and Energy Budget

April 1, 2015



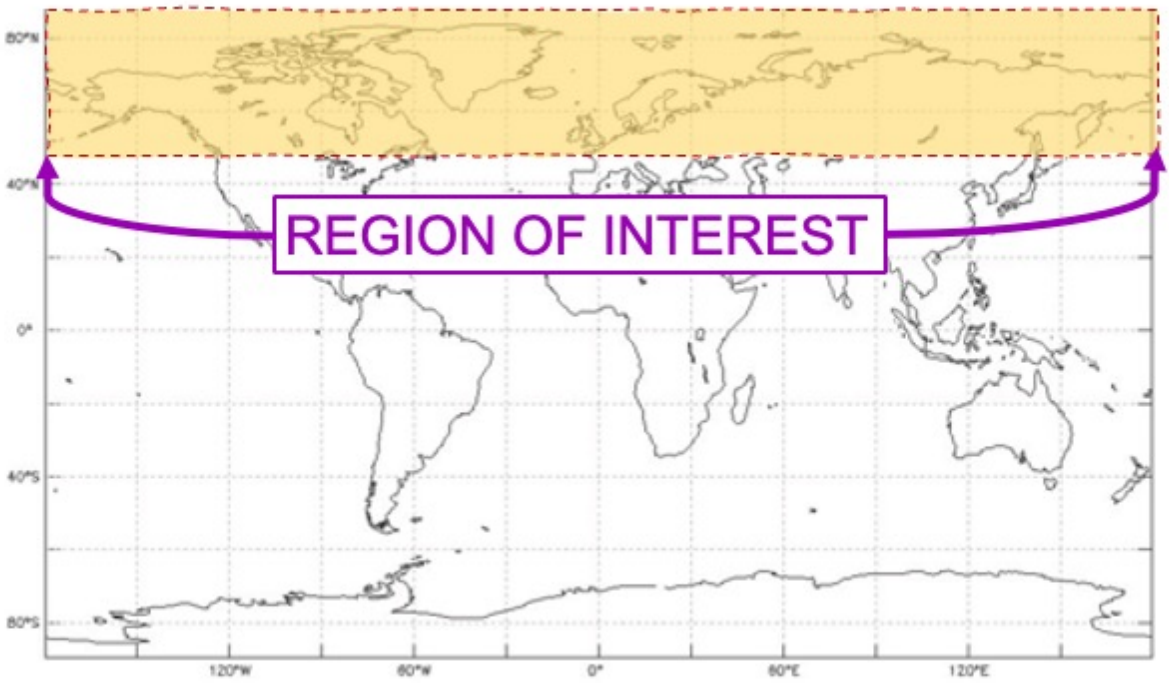
April 13, 2015



Student Directions

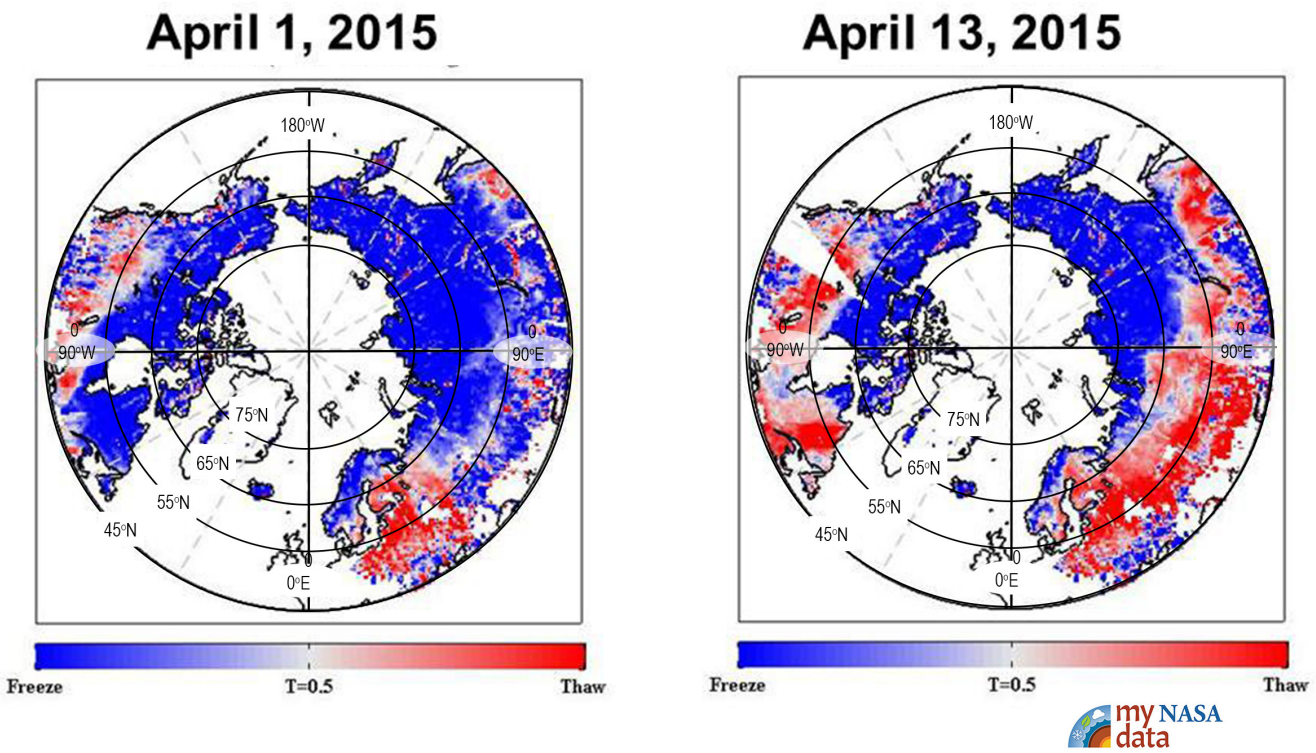
Soil moisture data was evaluated at Earth's most northern region. The data from NASA's Soil Moisture Active Passive (SMAP) observatory is used to classify the Earth's surface as frozen or solid. As liquid water freezes in soil, the water molecules become bound in a crystalline lattice, which changes how the incoming radar energy from SMAP interacts with Earth's surface, compared to soil containing freely oriented liquid water molecules. As a result, these data products reveal the freeze-thaw patterns of surface soils in the region of interest.

Getting Oriented: Use the map projections below to develop the necessary spatial orientation used with this dataset.



A geographic projection world map shows the region of interest above 45 degrees northern latitude. https://mynasadata.larc.nasa.gov/sites/default/files/inline-images/AOI_seaonalthaw_lesson%20world%20map.jpg

Analzing the Dataset: Below are the freeze-thaw data visualizations that have been created from soil moisture data collected from NASA's Soil Moisture Active Passive (SMAP) observatory. Use these data to answer the questions below to explore connections to Earth's energy budget. Check with your instructor on how to submit your answers.



North Pole orthographic projection world map showing freeze-thaw data from April 1, 2015 and April 13, 2015.
Credit: Image adapted for educational purposes. Original data presentation from NASA/JPL-CalTech
https://www.jpl.nasa.gov/images/pia11399-nasa-smap-images-show-progression-of-spring-thaw-in-northern-hemisphere
https://mynasadata.larc.nasa.gov/sites/default/files/inline-images/FreezeThawDATA_lesson%20color%20polar%20view.jpg

1. **Describe patterns and trends in data.**
    1. Identify the range of latitudes (between ____°N and ___°N) that have experienced the greatest amount of change in land surface conditions during the time of study.
    2. On one of the lines of latitudes you identified above find the following:
        1. The land surface conditions at (____°N and ___°E/W) changed from being frozen to thawed between April 1, 2015 and April 15, 2015.
        2. The land surface conditions at (____°N and ___°E/W) remains frozen between April 1, 2015 and April 15, 2015.
2. **Explain patterns and trends that connect the data to Earth's energy budget.**
    1. Explain why there is a relationship between the latitudinal trend of thawing surface soils and the seasonal change in the solar radiation received at the Earth's surface.
    2. The Arctic region has a vast amount of mountainous terrain. Explain why the northern side of a mountain thaws later in the season than the southern side in these northernmost regions.
3. **Make predictions about Earth's energy budget:**
    1. Predict how the dataset will change if the freeze-thaw data was retrieved between May 1st and May 15th of the same year. Explain your reasoning.

2. Predict how an extended thawing season in the Arctic may impact Earth’s energy budget. Explain your prediction.

Data Clarifications:

- As liquid water freezes in soil, the water molecules become bound in a crystalline lattice, which changes how the incoming radar energy from SMAP interacts with Earth's surface, compared to soil containing freely oriented liquid water molecules.
- Note that permanently ice covered land surfaces such as Greenland are not part of this dataset.
- As noted by NASA/JPL, that the original data interpretation acknowledged The SMAP radar measurements indicate frozen soil conditions for some regions near the southern edge of the maps (in the United States and Eurasia), even though these regions are now thawed. This is a result of the influence of other characteristics of the land surface, such as soil moisture, on the radar signal.

My NASA Data Visualization Tool

- Earth System Data Explorer