DATASHEET: Greenland and Anarctica Ice Sheet Mass (2002-2022) Dataset

INTRODUCTION

Dataset Names
Greenland and Antarctica Ice Sheet Mass (2002-2022)
Datasheet Author
NASA Office of STEM Engagement Note: This datasheet follows the format of the Educator-Facing Datasheet for Derivative Datasets.
Date Datasheet Created
1/24/2023
Context
These two datasets show changes in the mass of the Greenland and Antarctic icesheets from 2002 to 2022, relative to 2002. Data is expressed in units of gigatons (Gt). How much is a gigaton? Find out here. Glaciers are made up of fallen snow that, over many years, compresses into large, thickened ice masses. An ice sheet is a dome-shaped glacier mass exceeding 50,000 square kilometers. The world's ice sheets are confined to Greenland and Antarctica. These white, bright ice sheets help cool our planet by reflecting solar radiation back into space. Ice sheets also contain vast stores of freshwater. Between 2002 and 2017, the twin satellites of the Gravity Recovery and Climate Experiment (GRACE) have provided a complete map of Earth's gravitational field every 30 days. The GRACE Follow-On (GRACE-FO) mission continued mapping Earth's gravitational field in 2018 and continues operating today. While most of the planet's mass — its land and core — doesn't move much in 30 days, its water and ice do, causing Earth's gravity to shift. By tracking these changes, GRACE and GRACE-FO can identify how much ice sheets and glaciers are shrinking. Data from these satellites show that both ice sheets have been losing mass since at least 2002, and the speed at which they're losing mass is accelerating. NASA's IceSat, IceSat-2 and Operation IceBridge missions also contribute to the study of ice sheets by measuring the elevation of the ice sheets and more. Vital Signs of the Planet: Ice Sheets Ice Sheets & Glaciers The Anatomy of Glacial Ice Loss

1. ORIGIN

Where can the original dataset be found?
Jet Propulsion Laboratory (JPL) Physical Oceanography Distribution Active Archive Center (PODAAC) Antarctica Ice Sheet Mass Variation **Citation:** Wiese, D. N., D.-N. Yuan, C. Boening, F. W. Landerer, and M. M. Watkins (2022) JPL GRACE and GRACE-FO Mascon Ocean, Ice, and Hydrology Equivalent Water Height RL06.1M CRI Filtered Version 3.0, Ver. 3.0, PO.DAAC, CA, USA. Dataset accessed [2023-01-24] at http://dx.doi.org/10.5067/TEMSC-3MJ62. Greenland Ice Sheet Mass Variation **Citation:** Wiese, D. N., D.-N. Yuan, C. Boening, F. W. Landerer, and M. M. Watkins (2022) JPL GRACE and GRACE-FO Mascon Ocean, Ice, and Hydrology Equivalent Water Height RL06.1M CRI Filtered Version 3.0, Ver. 3.0, PO.DAAC, CA, USA. Dataset accessed [2023-01-24] at http://dx.doi.org/10.5067/TEMSC-3MJ62. Users are referred back to the original dataset for the most recent values. The original datasets for this datasheet are duplicated as a tabs in "Greenland and Antarctica Ice Sheet Mass.xlsx"

2. METADATA

Column	Description
Col A: Year	Date formatted as **year.fraction-of-year**. The first four-digit number is the year. The following two decimal places represent a percentage of the year that has passed in days. For example, 2002.29=April 16. (2002.29-2002)*365=105.85 or approx. day-of-year 106 Reference Ordinal Day Calendar for day-of-year.
Col B: Greenland Ice Mass Variation (Gt)	Change in Greenland ice sheet mass (Gigatons) relative April 16, 2002.
Col C: Greenland Uncertainty (Gt)	Greenland mass uncertainty (+/- Gigatons)
Col D: Antarctica Ice Mass Variation (Gt)	Change in Antarctica ice sheet mass (Gigatons) relative April 16, 2002.
Col E: Antarctica Uncertainty (Gt)	Antarctic mass uncertainty (+/- Gigatons).

3. MOTIVATION

For what purpose was the **original** dataset created?
To create a climate data record and monitor how the Greenland and Antarctic ice sheets are changing over time.
For what purpose was the **derived** dataset created?
To simply the dataset to serve as an entry point for data analysis of Earth system datasets for the K-12 classroom.
Who created the **original** dataset?
National Aeronautics and Space Administration (NASA)
Who created the **derived** dataset?
National Aeronautics and Space Administration (NASA)
Who funded the creation of the **original** dataset?
National Aeronautics and Space Administration (NASA)
Who funded the creation of the **derived** dataset?
National Aeronautics and Space Administration (NASA)

4. COMPOSITION

What does a row in the dataset represent?
Change in Greenland and Antarctic ice sheet mass variation with estimated uncertainty values relative to April 16, 2002.
How many rows are in the dataset, in total?
214 rows for the 2002-2022 record. Original dataset is updated as more data becomes available.
Does the dataset contain all possible rows or is it a sample of rows from a larger dataset?
All possible rows. Note, lack of data between June 2017 and June 2018, between the end of the GRACE mission and start of the GRACE-FO data collection.
If it's a sample, describe your sampling process (random, weighted, etc). Is the sample representative of the larger set (e.g., geographic coverage)?
n/a

5. DERIVATION PROCESS

Who was involved in the data derivation process and how were they compensated?
NASA Office of STEM Engagement
What processes (e.g. cleaning, filtering, labeling) did the derivation process perform?
Removed header information, parsed data into columns, and put Greenland data and Antarctica data into the same file.
If software was used to perform the derivation, is it available? If so, please point to a link or other access point.
n/a
What information was removed or transformed during derivation that might influence the findings of an analysis (e.g., deleting rows due to missing data, a sampling mechanism that over-samples from a particular group, etc.)?
n/a

6. USES

Are there real-world applications of the dataset that an educator should be aware of?
• Ice sheet mass is an essential metric for understanding climate change, the influx of fresh water into the ocean, and sea level rise. For every 360 Gt of ice lost, the ocean rises by 1 millimeter. Reference: Sea Level Change: Observations from Space. Since 1993, meltwater from Greenland and Antarctic ice sheets is responsible for about one-third of the global average rise is sea level. Reference: Vital Signs of the Planet: Ice Sheets • Coastal community planning. Sea level rise increases coastal flooding. • Modeling ocean circulation and global wind patterns. • Ice sheets contain a valuable climate record. Ice sheets contain annual layers. Analysis of air bubbles in the layers allows scientists to reconstruct climate records for the past hundreds of thousands of years. Reference: Core questions: An introduction to ice cores

7. EDUCATOR'S GUIDE

Are there recommended subsets to be explored?
NASA studies long term trends, interannual and seasonal variability of ice sheets. All data points are needed to compile a comprehensive time series to better understand these phenomena.
Are there outliers or unusual observations to be pointed out?
Greenland, Antarctica Melting Six Times Faster Than in the 1990s
Are there any correlations in the derivative dataset to be pointed out?
n/a

Does the data embody any computing or statistical learning goals (e.g., columns have a particular skew, correlations demonstrate Simpson's Paradox, etc.)?
n/a
What potential threats to validity would be worth discussing?
n/a
Suggestions for student activities
• Calculate the rate of decadal rates of change for both Greenland and Antarctica. • Calculate interannual variability for both ice sheets.