DATASHEET: Global Mean Sea Level Variation (1993-2022) Dataset

INTRODUCTION

Dataset Name
Global Mean Sea Level Variation in millimeters (1993-2022)
Datasheet Author
NASA Office of STEM Engagement Note: This datasheet follows the format of the Educator-Facing Datasheet for Derivative Datasets.
Date Datasheet Created
1/20/2023
Context
This dataset records global mean sea level (GMSL) change since 1993, as observed by satellites. GMSL is the average height of the entire ocean surface and is an important climate indicator. GMSL rise is caused primarily by two factors: added water from melting land-based ice sheets and glaciers, and the thermal expansion of seawater as it warms. Global sea levels have been rising for decades in response to a warming climate, and that rise appears to be accelerating. Scientists monitor the change in global sea level height using satellite altimeters. Satellite altimeters measure the altitude of a surface from orbit with reflected radar pulses to centimeter or millimeter accuracy when averaged over the globe. This dataset combines sea surface height from the TOPEX/Poseidon, Jason-1, OSTM/Jason-2, Jason-3, and Sentinel-6 Michael Freilich missions to form a single sea surface height climate data record. Sea Level Change Observations from Space Vital Signs of the Planet: Sea Level Why is Sea Level Rising? We Asked a NASA Scientist: Episode 33

1. **ORIGIN**

Where can the original dataset be found?
Global Mean Sea Level Data **Reference:** GSFC. 2021. Global Mean Sea Level Trend from Integrated Multi-Mission Ocean Altimeters TOPEX/Poseidon, Jason-1, OSTM/Jason-2, and Jason-3 Dataset accessed [2023-01-20] at https://doi.org/10.5067/GMSLM-TJ151. Users are referred back to the original dataset for the most recent values. The original dataset for this derived datasheet is duplicated as a tab in "GMSL_SatelliteRecord.xlsx"

2. METADATA

Column Name	Description
Col A Date	Date formatted as **year.fraction-of-year**. The first four-digit number is the year. The following six decimal places represent a percentage of the year that has passed in days. For example, 1993.01115= Jan 4, 1993 (365 days X .01115 = 4.2 days = Jan. 4) 1996.406182 = May 27, 1996 (366 days X .406182 = 148.6 days = May 27) *Note 1996 is a leap year.* 2005.961562 = Dec. 16, 2005 (365 days X .961562 = 350.97 days = Dec. 16) Reference Ordinal Day Calendar for day-of-year.
Col B GMSL	Global Mean Sea Level variation in millimeters (mm) +/- 4 mm, since 1993. +/- 4 mm is the "uncertainty margin," or the range from the mean (average) within which there is a high probability that the true number resides. For example, when we say global sea level has risen 101 mm +/- 4 mm, the true value has a high probability of being between 97 and 105 mm. The uncertainty margin exists both because of sea level variability in the ocean and the accuracy with which we measure the individual values. (https://climate.nasa.gov/vital-signs/sea-level/) GMSL value in Col B is the value after data processing. Data processing techniques include a correction for glacial isostatic adjustment, application of a 60-day Gaussian type filter to smooth the data, and removal of the semiannual and annual signals in sea surface height.

3. MOTIVATION

For what purpose was the **original** dataset created?
To create a record of how the GMSL is changing over time.
For what purpose was the **derived** dataset created?
To simplify 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?
NASA Goddard Space Flight Center under the auspices of the NASA Sea Level Change program.
Who created the **derived** dataset?
NASA Office of STEM Engagement
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?
Global mean sea level variation since 1993, expressed in mm.
How many rows are in the dataset, in total?
1093 rows covering Jan. 4, 1993 to Sept. 7, 2022. Original dataset is updated as data becomes available, with a 4-5 month delay for processing.
Does the dataset contain all possible rows or is it a sample of rows from a larger dataset?
All possible rows as of date of datasheet creation.
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?
- Parse data into columns into individual values for each field.   - Removed columns to only show date and fully processed GMLS (column 12). (The original dataset includes various stages of data processing.)   - GMSL values in the original dataset presented as relative to a 20-year TOPEX/Jason collinear mean which results in positive and negative values of GMSL.   - Applied a vertical offset of 38.56 mm was applied in the derived dataset to make the starting GMSL value 0 and show change in GMSL since the beginning of the satellite record.
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?

- Scientific studies to monitor GMSL variability over time.
- Advance scientific understanding of the Earth's climate system.
- Improved predictions of sea level rise.
- Sea level rise affects people in different ways, depending on where they lives. Concerns of sea level rise include coastal flooding, coastal erosion, and saltwater intrusion into marshes, wetlands, agricultural lands and groundwater, among others.

7. EDUCATOR'S GUIDE

Are there recommended subsets to be explored?
NASA studies long term trends. 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?
n/a
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

- [Sea Level Rise Classroom Activities](#)
- [My NASA Data: Hydrosphere Lesson Plans](#)

Additional Datasets

- [Key Indicators: Global Mean Sea Level](#)