Lecture 01
Content Goals

• Rising Sea Level
• Scientific Notation
• Temperature Scales
Glacier Recession

Pine Island Glacier, Antarctica

NASA Image
Thermal Expansion
Rise in Mean Sea Levels

Fig 1 Sea level curves calculated by different research groups with various methods. The curves show the sea level relative to the satellite era (since 1992). Graph: Klaus Bittermann.
Rise in Mean Sea Levels

• Increase in Ocean Mass (Fresh Water from Land)
• Melting Glaciers and Ice Sheets
• Expansion of Water due to Increasing Temperature
ICLICKER QUESTION

Which of the following are believed to contribute to the rise in Global Mean Sea Levels:

a) Thermal Expansion of Water due to Increasing Average Temperature
b) Melting Glaciers and Ice Sheets
c) Increase of Ocean Mass due to Addition of Water from Land
d) All of the above
e) Just a) and c)
Scientific Notation

Method for expressing and working with very large and very small numbers
Powers of 10 (Large Numbers)

<table>
<thead>
<tr>
<th>Term</th>
<th>Short-hand notation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ten</td>
<td>$10^1$</td>
</tr>
<tr>
<td>A hundred</td>
<td>$10^2$</td>
</tr>
<tr>
<td>A thousand</td>
<td>$10^3$</td>
</tr>
<tr>
<td>A million</td>
<td>$10^6$</td>
</tr>
<tr>
<td>A billion</td>
<td>$10^9$</td>
</tr>
<tr>
<td>A trillion</td>
<td>$10^{12}$</td>
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</tbody>
</table>

power of 10 = number of zeros
Powers of 10 (Small Numbers)

For numbers that have many zeroes after the decimal point, we use negative powers of ten and count to the right of the decimal point INCLUDING THE 1:

\[0.01 = 10^{-2}\quad 0.001 = 10^{-3}\quad 0.000001 = 10^{-6}\]

Property: Numbers with negative powers of 10 are reciprocals of numbers with the same positive powers of 10.
Example: \(\frac{1}{10^2} = 10^{-2}\)
Scientific Notation

• Write a number as the product of a number between 1 and 10 and a power of ten (positive or negative).

  • Examples:
    • $12000 = 1.2 \times 10^4$
    • $0.000033 = 3.3 \times 10^{-5}$

• To write a number in scientific notation:
  1) Move the decimal point to the first non-zero digit
  2) Count the number of positions you moved the decimal point if to the left, the power of 10 is positive if to the right, the power of 10 is negative.
Multipliers

- $n = 10^{-9}$ (nano)
- $\mu = 10^{-6}$ (micro)
- $m = 10^{-3}$ (mili)
- $1$
- $k = 10^{3}$ (kilo)
- $M = 10^{6}$ (mega)
- $G = 10^{9}$ (giga)
- $T = 10^{12}$ (tera)
One million can be written as:

a) 100,000

\[ b) \frac{10^8}{10^2} \]

\[ c) 1,000,000,000 \]

\[ d) 10^4 \times 10^8 \]

\[ e) 10^3 \times 10^4 \]
Temperature Scales

• What is the freezing temperature of water in both Fahrenheit and Celsius?
• boiling temperature?

• Celsius-to-Fahrenheit
  
  $$T_F = \left(\frac{9}{5}\right) T_C + 32$$

• Fahrenheit-to-Celsius:
  
  $$T_C = (T_F - 32) \left(\frac{5}{9}\right)$$