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Midpoint Progress Report

Ocean currents exert a significant influence on sea levels, often resulting in elevated sea levels at the center of the currents compared to surrounding areas. Over the past 15 years, there has been a consistent upward trend in the average sea levels along the coasts of the eastern and southern United States.

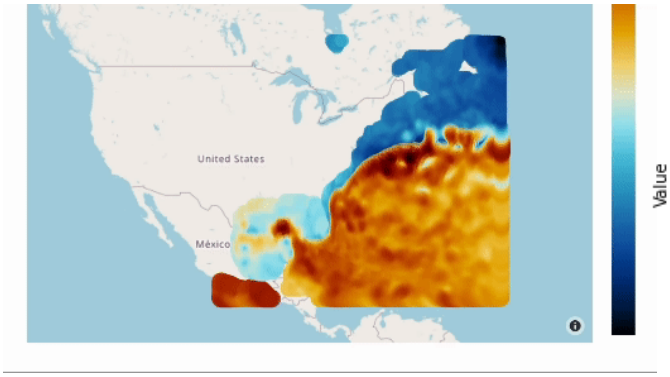

Figure 1: ADT by Geo 1993-2023

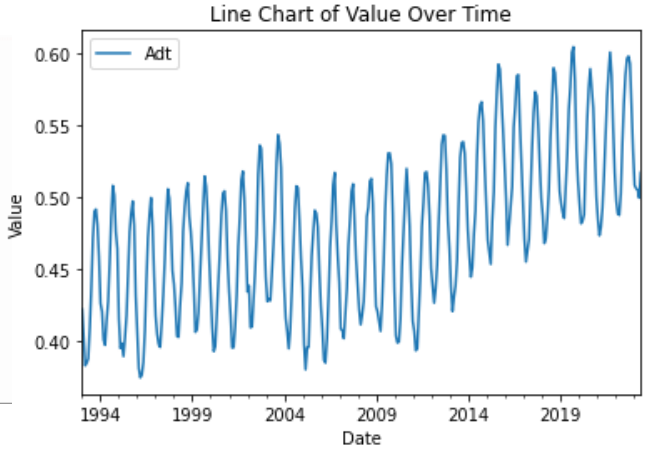

Figure 2: Average ADT by Month

Our team generated the above two graphs for the Midpoint Summary. *Figure 1* is an animation of Absolute Dynamic Topography (ADT) of **all places in the bounding box area of longitude -102 – -49 and latitude 16 – 52** for the **time period 1993 – 2023**. There are two colors – orange and blue – shown in the animation. The orange color indicates high adt and the blue color indicates low adt; **the lighter the color – towards orange scale – the higher adt; the darker the color – towards blue scale – the lower the adt**. *Figure 2* shows the average ADT of **all places in the bounding box area of longitude -102 – -49 and latitude 16 – 52** for the **time period 1993 – 2023**. We say "**by month**" for *Figure 2* because the points that form lines on this figure are averaged over days of specific months of specific years; for example, for 1999, there are 12 points (1 average ADT per ~30 days) calculated and graphed. **ADT** represents how much higher or lower the sea surface is compared to marine geoid. It's calculated by subtracting geoid data (Earth's gravity field) from satellite-measured sea surface height. **Average ADT** is simply the average of these measurements over a period of time. **High ADT is an indicator of high sea level**.

Figure 2 shows that the average ADT has an increasing trend across years, indicating that the sea level is rising steadily, along with some fluctuations from year to year. The rising sea level is most likely due to additional water being added to the sea due to glaciers and ice sheets melting [1]. Sea level rise fluctuates monthly, with highs and lows possibly influenced by seasonal tides and other factors.

Figure 1 is a bit interesting, in the sense that far from the coasts, sea levels are high and near the coasts, sea levels are low (see the light blue color in the Texas coasts area). Another interesting thing to note is that sea levels are affected by temperature. It is evident that the ADT is progressively lower in northern latitudes and higher towards the south. One possible explanation is water expansion due to heat in the

south that contributes to high ADT [2]. The comparatively high sea level in the deep oceans could also be due to tidal forces causing sea levels to be higher due to the position of the moon [3].

Our possible future directions: 1) find the reasons behind average ADT fluctuating throughout the years. 2) Find the reasons behind why the increasing trend stagnates between 2004 - 2011. 3) consider the impacts of Greenhouse gasses on SLR.

[1]
https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level#:~:text=The%20rising%20water%20level%20is,record%20(1993-present).

[2]
https://sealevel.nasa.gov/understanding-sea-level/global-sea-level/thermal-expansion

[3]
https://science.nasa.gov/resource/tides/