Sea level rise prior to 1990 found to be slower than other estimates suggesting modern rise significantly faster

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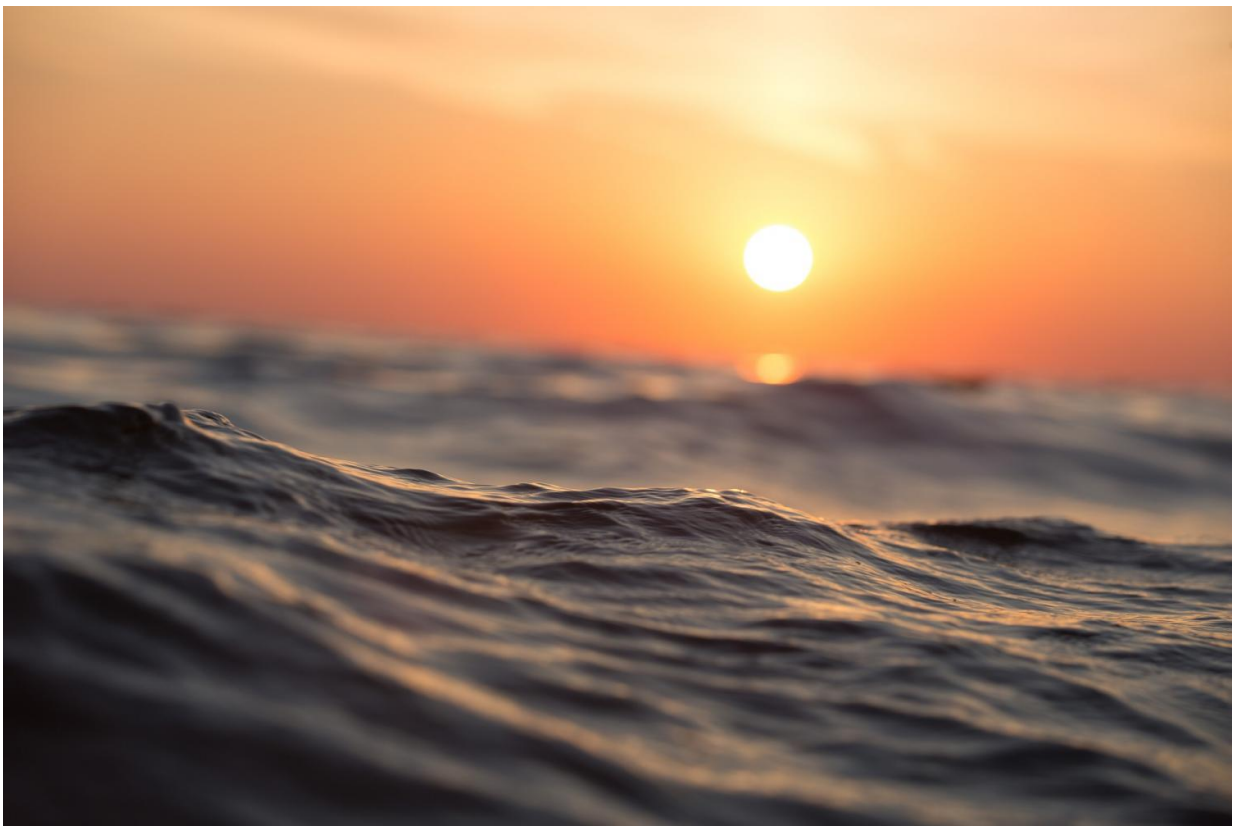

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(Phys.org)—A team of researchers from across Europe has found evidence that suggests the rate of rise in sea levels from approximately

1902 until 1990 was less than other models have shown. This indicates, the team reports in their paper published in *Proceedings of the National Academy of Sciences*, that modern sea levels are rising faster than suspected.

Since approximately 1990, it has been relatively easy to measure sea level height across the planet because of advances in satellite technology. Prior to that time, as the researchers note, it was much more difficult due to a variety of factors such as gravity, land rising and sinking, wind patterns, etc., using tide gauges placed at sites around the world. In this new effort, the researchers have attempted to gain a better understanding of sea level changes during the 20th century prior to the use of satellite technology.

To create a better record, the researchers collected tide data and combined it with factors that are known to have caused changes in sea levels, such as shifts in land masses, regional events such as weather changes and, of course, runoff due to melting of glaciers and northern ice. They used all the data they had collected to create a model depicting sea levels in various parts of the world over the past 100 years, and then used the model to calculate the rate at which sea levels were rising on average over the same time frame. As expected, the model showed a rate of 3.1 millimeters per year since 1990, which agrees with satellite reports. But the model also showed that before 1990, the average rate was just 1.1 millimeter a year, which is significantly less than other models have shown. These numbers suggest that sea levels have been rising much faster since 1990 than other models have shown, in some cases up to three time faster.

The accelerated rise is believed to be due to more runoff from mountain glaciers, expansion of ocean waters due to warmer water temperatures, and melting of ice in the northern and southern parts of the planet—all due to global warming.

More information: Sönke Dangendorf et al. Reassessment of 20th century global mean sea level rise, *Proceedings of the National Academy of Sciences* (2017). DOI: 10.1073/pnas.1616007114

Abstract

The rate at which global mean sea level (GMSL) rose during the 20th century is uncertain, with little consensus between various reconstructions that indicate rates of rise ranging from 1.3 to 2 mm·y−1. Here we present a 20th-century GMSL reconstruction computed using an area-weighting technique for averaging tide gauge records that both incorporates up-to-date observations of vertical land motion (VLM) and corrections for local geoid changes resulting from ice melting and terrestrial freshwater storage and allows for the identification of possible differences compared with earlier attempts. Our reconstructed GMSL trend of 1.1 ± 0.3 mm·y−1 (1σ) before 1990 falls below previous estimates, whereas our estimate of 3.1 ± 1.4 mm·y−1 from 1993 to 2012 is consistent with independent estimates from satellite altimetry, leading to overall acceleration larger than previously suggested. This feature is geographically dominated by the Indian Ocean–Southern Pacific region, marking a transition from lower-than-average rates before 1990 toward unprecedented high rates in recent decades. We demonstrate that VLM corrections, area weighting, and our use of a common reference datum for tide gauges may explain the lower rates compared with earlier GMSL estimates in approximately equal proportion. The trends and multidecadal variability of our GMSL curve also compare well to the sum of individual contributions obtained from historical outputs of the Coupled Model Intercomparison Project Phase 5. This, in turn, increases our confidence in process-based projections presented in the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.