

Days become slightly longer as land ice melts

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Rising sea levels are affected by many factors, most of which researchers can now effectively explain. Delft University of Technology researcher Thomas Frederikse has established that the average rise in sea levels worldwide is accelerating. Moreover, he says, the days on Earth are becoming slightly longer.

The increase in sea levels is not the same across the world. There are significant regional differences. Frederikse has conducted a thorough study of the data from 1958 to 2014. He says, "All kinds of factors play a role. For example, the melting of land ice, the expansion of seawater caused by increasing temperatures, but also the use of groundwater and the storage of large quantities of fresh water in inland reservoirs. Another factor is what is known as [glacial isostatic adjustment](#) (GIA). This is the 'rebounding' of the land after the ice ages.

"Because of all these factors, there is no single place on earth where the sea level exactly matches the global average. In order to understand regional patterns and to be able to develop regional future scenarios, a good understanding is needed of the relevant underlying processes and associated regional patterns. It is now possible to estimate local and global changes in sea levels accurately with the help of satellites. Before satellites, we only had local sea-level measurements in a limited number of places at our disposal. In this dissertation, I have been able to confirm that the sea-level rises measured in the decades before satellites can be effectively explained by the sum of all relevant [physical processes](#)."

He continues: "The rise in sea levels was studied for two coastal regions

and on a global scale. The physical processes that we took into account were the loss of mass in glaciers and ice caps, the depletion of groundwater reservoirs, the retention of water by dams, GIAs, changes in the specific volume of seawater, local wind effects and changes in air pressure. We were able to unravel and precisely model all of these different influences for the North Sea, for example. In the period 1958-2014, the rise in sea levels in the North Sea amounted to 'just' around 8 cm. This is comparable to the average worldwide increase over the same period, which is approximately 1.5 mm per year, but the underlying causes are different: the melting of glaciers and Greenland have hardly any effect here, but when it comes to Antarctica, we get the full blast. This is not good news for us, because the ice cap in Antarctica could lose a lot of mass in a future warmer world.

"We are now able to explain [sea-level](#) rises in almost all oceans. Although the issue of rising sea levels is complex, we now have a good understanding of most factors at play. As a result, the models and predictions are better, which is good news. The picture emerging is of rising sea levels and a significant acceleration in that process (with considerable regional differences). This is not only based on modeling; the measurements demonstrate that it is already happening. That is the bad news."

Frederikse's research also reveals something else: Days on earth are becoming slightly longer (around 0.2 milliseconds in the last 25 years) as a result of the melting land ice. This is causing mass (in the form of ice) to disappear, primarily in Greenland and Antarctica, which moves in the direction of the equator as liquid water. This results in slight changes in the distribution of the Earth's mass. "Just like a figure skater who stretches out their arms during a pirouette, it makes the earth turn slightly more slowly, and the days therefore last slightly longer now."

More information: Sea-level changes on multiple spatial scales:

estimates and contributing processes. [repository.tudelft.nl/islandor ...
6b-8831-db5ec2603cb8](https://repository.tudelft.nl/islandor/6b-8831-db5ec2603cb8)

Provided by Delft University of Technology

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