

Auditing the Earth's sea-level and energy budgets

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An international research team has balanced the sea-level rise budget by showing that the total amount of contributions to sea level rise explains the measured rise over recent decades.

Scientists have accounted for all the contributions to global sea-level [rise](#) in a study that balances the sea-level rise 'budget' and explains the observed rise over recent decades.

In work led by CSIRO Wealth from Oceans Flagship [scientists](#) Drs John Church and Neil White and published in mid-September in the American Geophysical Union's Geophysical Research Letters, the researchers also reviewed the related Earth's energy budget – confirming that 90% of the energy stored in the climate system resides in the ocean and this warming drives one component of sea-level rise.

The international research team found that the two largest contributions to observed sea-level rise since 1972 came from ocean thermal expansion (about 40%) and glacier melting (another 35%). The remainder is from changes in the ice sheets and terrestrial storage in reservoirs and extraction of groundwater from aquifers.

The new research resolves an issue evident in past IPCC Assessments in which the actual observed rise over recent decades was larger than the sum of contributions to sea-level rise, raising concern that the IPCC may have underestimated future rise.

“There are many factors contributing to sea-level rise, including changing groundwater storage, thermal expansion of the oceans, and melting glaciers and ice sheets,” says Dr Church.

“Closing the sea-level budget required accurate estimates of ocean warming, by far the largest storage of heat in the Earth’s climate system

“The sum of contributions has been less than the observed rise. To resolve this, we revisited the Earth’s sea-level and energy budgets together using new and updated estimates of all contributing factors for the past few decades, and including a new estimate of groundwater depletion. This allowed us to balance the sea-level budget from 1972 to the present,” Dr Church said.

He said that [sea-level rise](#) and ocean warming had continued to increase up to the present time, in concert with increasing greenhouse gas concentrations. However, aerosols have the potential to partially mask the effects on global temperature of balancing the Earth’s energy [budget](#) . An increase in aerosol emissions, probably from developing countries, and moderate volcanic activity are inferred from the result.

More information: Geophysical Research Letters,
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