

Sea-level study shows signs of things to come

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Our greenhouse gas emissions up to now have triggered an irreversible warming of the Earth that will cause sea-levels to rise for thousands of years to come, new research has shown.

The results come from a study, published today in the journal *Environmental Research Letters*, which sought to model sea-level changes over millennial timescales, taking into account all of the Earth's land ice and the warming of the oceans—something which has not been done before.

The research showed that we have already committed ourselves to a sea-level rise of 1.1 meters by the year 3000 as a result of our [greenhouse gas emissions](#) up to now. This irreversible damage could be worse, depending on the route we take to mitigating our emissions.

If we were to follow the high A2 emissions scenario adopted by the [Intergovernmental Panel on Climate Change](#) (IPCC), a sea-level rise of 6.8 meters could be expected in the next thousand years. The two other IPCC scenarios analysed by the researchers, the B1 and A1B scenarios, yielded sea-level rises of 2.1 and 4.1 meters respectively.

"Ice sheets are very slow components in the [climate system](#); they respond on time scales of thousands of years," said co-author of the study Professor Philippe Huybrechts.

"Together with the long life-time of greenhouse gases in the atmosphere, this inertia is the real poison on the climate system: anything we do now

that changes the forcing in the climate system will necessarily have long consequences for the ice sheets and sea level."

In all of the scenarios that the researchers analysed, the [Greenland ice sheet](#) was responsible for more than half of the sea level rises; [thermal expansion](#) of the oceans was the second highest contributor, and the contribution of glaciers and ice was only small.

The researchers believe this is the first study to include glaciers, ice caps, the Greenland and [Antarctic ice sheets](#) and the thermal expansion of the oceans into a projection of sea-level rises. They did so by using a climate modelling system called LOVECLIM, which includes components from a number of different subsystems.

The polar ice sheets are not normally included into projections due to computational constraints, whilst researchers often find it difficult to account for the 200 000 individual glaciers that are found all over the world in very different climatic settings.

Professor Huybrechts continued: "Ultimately the current polar ice sheets store about 65 meters of equivalent sea level and if climatic warming will be severe and long-lasting all ice will eventually melt.

"Mankind should limit the concentration of [greenhouse gases](#) at the lowest possible level as soon as possible. The only realistic option is a drastic reduction of the emissions. The lower the ultimate warming will be, the less severe the ultimate consequences will be."

More information: Millennial total sea-level commitments projected with the Earth system model of intermediate LOVECLIM, H Goelzer, P Huybrechts, S C B Raper, M-F Loutre, H Goosse and T Fichefet 2012 *Environ. Res. Lett.* 7 045401.

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