

Thinning of West Antarctic Ice Sheet demands improved monitoring to reduce uncertainty over potential sea-level rise

Surprisingly rapid changes are occurring in the Amundsen Sea Embayment, a Texas-size region of the Antarctic Ice Sheet facing the southern Pacific Ocean. Experts across a wide range of scientific disciplines from the United States and United Kingdom met in Austin, Texas, to identify barriers to improved predictions of future sea-level rise resulting from these changes.

The United Nations Intergovernmental Panel on Climate Change (IPCC) reported in February that the scientific community could not provide a best estimate or an upper limit on the rate of sea-level rise in coming centuries because of a lack of understanding of the flow of the large ice sheets.

All of the ice on Earth contains enough water to raise sea level over 200 feet, with about 20 feet from Greenland and almost all of the rest from Antarctica. Although complete loss of the Antarctic Ice Sheet is not expected, even a small change would matter to coastal populations.

Background:

The two-mile thick pile of ice and snow that is the Antarctic Ice Sheet spreads under its own weight, flowing down to the sea where the ice begins to float as ice shelves, with icebergs breaking off from the edges of the ice shelves. The ice shelves often run aground on islands, providing friction that slows the flow of the ice behind.

The consensus view of the workshop:

Satellite observations show that both the grounded ice sheet and the floating ice shelves of the Amundsen Sea Embayment have thinned over the last decades. Ongoing thinning in the grounded ice sheet is already contributing to sea-level rise.

The thinning of the ice has occurred because melting beneath the ice shelves has increased, reducing the friction holding back the grounded ice sheet and causing faster flow.

Oceanic changes have caused the increased ice-shelf melting. The observed average warming of the global ocean has not yet notably affected the waters reaching the base of the ice shelves. However, recent changes in winds around Antarctica caused by human influence and/or natural variability may be changing ocean currents, moving warmer waters under the ice shelves.

Our understanding of ice-sheet flow suggests the possibility that too much melting beneath ice shelves will lead to “runaway” thinning of the grounded ice sheet. Current understanding is too limited to know whether, when, or how rapidly this might happen, but discussions at the meeting included the possibility of several feet of sea-level rise over a few centuries from changes in this region. The experts agreed that to reduce the very large uncertainties concerning the behaviour of the Antarctic ice in the Amundsen Sea Embayment will require new satellite, ground, and ship-based observations coupled to improved models of the ice-ocean-atmosphere system. Issues include:

- The recent changes were discovered by satellite observations; however, continued monitoring of some of these changes is not possible because of a loss of capability in current and funded satellite missions.
- The remoteness of this part of Antarctica from existing stations continues to limit the availability of ground observations essential to predicting the future of the ice sheet.
- No oceanographic observations exist beneath the ice shelves, and other oceanographic sampling is too infrequent and sparse to constrain critical processes.
- Current continental-scale ice sheet models are inadequate for predicting future sea level rise because they omit important physical processes.
- Current global climate models do not provide information essential for predicting ice sheet and oceanic changes in the Amundsen Sea Embayment; for example, ice shelves are not included.
- Resolving these issues will substantially improve our ability to predict the future sea level contribution from the Amundsen Sea Embayment of the Antarctic Ice Sheet.

Contact: J.B. Bird, The University of Texas at Austin, jbird@jsg.utexas.edu
+1 512-750-3512