

FLUIDS

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jpcise@austincc.edu , New York Times , June 14, 2018, by Kendra Pierre-Louis, Dedicated to my Xavier U. Physics prof. Mr. Hart

ANTARCTICA IS MELTING AT A MUCH FASTER PACE



Icebergs in the northern Weddell Sea off Antarctica.

Between 60 and 90 percent of the world's fresh water is frozen in the ice sheets of Antarctica, a continent roughly the size of the United States and Mexico combined. If all that ice melted, it would be enough to raise the world's sea levels by roughly 200 feet.

While that won't happen overnight, Antarctica is indeed melting, and a [study published Wednesday in the journal Nature](#) shows that the melting is speeding up. The rate at which Antarctica is losing ice has tripled since 2007, according to the latest available data. The continent is now melting so fast, scientists say, that it will contribute six inches (15 centimeters) to sea-level rise by 2100. That is at the upper end of what the Intergovernmental Panel on Climate Change has estimated Antarctica alone could contribute to sea level rise this century. you get flooding once a year or so, but if you raise sea level by 15 centimeters then that's going to happen 20 times a year," said Andrew Shepherd, a professor of earth observation at the University of Leeds and the lead author of the study. Even under ordinary conditions, Antarctica's landscape is perpetually changing as icebergs calve, snow falls and ice melts on the surface, forming glacial sinkholes known as moulins. But what concerns scientists is the balance of how much snow and ice accumulates in a given year versus the amount that is lost. **(((Between 1992 and 2017, Antarctica**

shed three trillion tons of ice. This has led to an increase in sea levels of roughly three-tenths of an inch))),

which doesn't seem like much. But 40 percent of that increase came from the last five years of the study period, from 2012 to 2017.

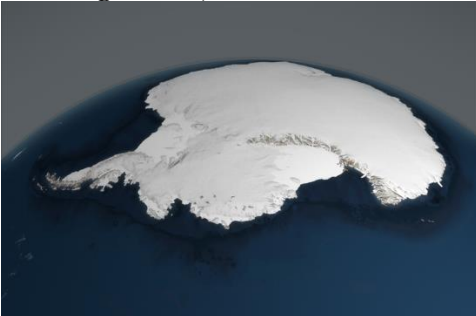
Antarctica is not the only contributor to sea level rise. [Greenland lost an estimated 1 trillion tons of ice between 2011 and 2014.](#)

And as oceans warm, their waters expand and occupy more space, also raising sea levels. The melting ice and warming waters have all been primarily driven by human emissions of greenhouse gases.

East Antarctica has sometimes been a focus of attention for people who deny the science of global warming. "A lot of the argument has been made from stakeholders that are not quite as interested in dealing with climate change that the East Antarctic ice sheet is actually gaining mass — therefore we don't need to worry," said Michele Koppes, a glaciologist at the University of British Columbia who was not involved with the study.

East Antarctica, which makes up two-thirds of the continent, is a remote region of an already remote location, where data is scarcer because there are fewer measurement stations, Dr. Koppes said. Researchers must extrapolate a smaller amount of data over an area the size of the United States, which can make the analysis less precise. The researchers concluded that the changes in East Antarctica were not nearly enough to make up for the rapid loss seen in West Antarctica and the Antarctic Peninsula. Antarctica is, on balance, losing its ice sheets and raising the world's sea levels.

Looming Floods, Threatened Cities Antarctica's potential collapse could damage coastal cities across the globe.



INTRODUCTION: The goal of this application is to verify the oceans rose 0.3 inches between 1992 to 2017 due to Antarctica melting three trillion tons of ice(see article below). The density of ice $\rho_{\text{ICE}} = 934 \text{ kg./m}^3$. $\rho_{\text{WATER}} = 1000 \text{ kg./m}^3$ 71% of earth's surface is ocean. Radius of earth is $6.371 \times 10^6 \text{ m}$. Area of a sphere = $4\pi r^2$ Let h = depth oceans rise due to melting of Antarctica. $A_{\text{OCEANS}} = 0.71 A_{\text{earth}}$, Thus, the volume of ocean increase due to the melting of Antarctica 1992 to 2017 =

$$h A_{\text{OCEANS}} = V_{\text{ice melted now liquid}}$$

QUESTIONS: SEE BELOW

QUESTIONS: (a) Mass of ice melted $m_{\text{ICE}} = m_{\text{WATER}}$ from ice melted. Find m_{WATER} from ice melted in kg.? Article said 3 trillion tons of ice melted.(b) Find volume(m^3) V_{WATER} FROM MELTED 3 trillion tons of ice?, $\rho_{\text{WATER}} = 1000 \text{ kg./m}^3$

HINT: $V_{\text{WATER}} = m_{\text{WATER}}/\rho_{\text{WATER}}$, $m_{\text{ICE}} = m_{\text{WATER}}$, (c) find area of 71% of earth's surface = Area of oceans. ($.71 4\pi r^2$), (d) Find height in meters oceans rise due to ice melt?

HINT: h (area of oceans) = $h (0.71 4\pi r^2) = V_{\text{ICE WATER}}$, r = earth radius listed above (e) Convert h in meters to inches?, (f) How does your result compare which h as is stated in the article? **MORE HINTS:** 2000 lb./ton , 0.4536 kg./lb., 39.37 inches/m.

ANSWERS: (a) $m_{\text{WATER}} = 2.7216 \times 10^{15} \text{ kg}$,, (b) $V_{\text{WATER}} = 2.7216 \times 10^{12} \text{ m}^3$, (c) $362.14 \times 10^{12} \text{ m}^2$,(d) $h = 0.7518 \times 10^{-2} \text{ m}$. , (e) $h = 0.294 \text{ inches}$, (f) VERY CLOSE! Article said oceans would rise 0.3 inches. PHYSICS WORKS!