

FLUIDS

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jpcise@austincc.edu % New York Times April 20, 2018. Dedicated to a friend of Fluids.....Archimedes

Can You Guess What America Will Look Like in 10,000 Years?

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Produced by JASMINE C. LEE, ANJALI SINGHVI and BILL MARSH

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Present-day Boston with more than 170 feet of future sea-level rise



INTRODUCTION: The goal of this application is to verify the oceans would rise 260 ft. if Greenland & Antarctica ($2.85 \times 10^6 \text{ km}^3$ & $26.5 \times 10^6 \text{ km}^3$ of ice respectively from Wikipedia) melted. 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 Greenland & Antarctica. $A_{\text{OCEANS}} = 0.71 A_{\text{earth}}$, Thus, the volume of ocean increase due to the melting of Greenland & Antarctica = $h A_{\text{OCEANS}} = V_{\text{ice melted now liquid}}$ **QUESTIONS: SEE BELOW**

Charles River

What would happen if the current growth trend in greenhouse gas emissions continues for the rest of this century before reversing? It's a question worth pondering, especially with a president who has vowed to quit the Paris climate accord and is aggressively promoting the use of coal, gas and oil. Our research with colleagues indicates that one consequence would be an unrelenting rise of the oceans for 10,000 years, **ultimately reaching more than 170 feet above present levels**), with half of that increase occurring in the next thousand years. The map of the world would be redrawn. **As Antarctica and Greenland lost nearly all of their ice**), vast portions of the United States, some more than 100 miles inland, would be inundated. We're hopeful that the 2015 Paris climate deal will slow emissions, and there are signs that this is happening, though efforts to meet its goals are falling behind. Even if the world's nations manage **to limit warming to near 2 degrees Celsius above preindustrial levels — the accord's main target — seas will continue to rise by 80 feet over 10,000 years, according to our modeling.**

We are at a historic moment, and we have the science to recognize it. Because climate-warming carbon dioxide persists in the atmosphere for thousands of years, how we deal with this problem today will have profound effects long after we are gone.

QUESTIONS: (a) Find combined all ice in Greenland & Antarctica to km^3 ?, (b) Convert all the ice in Greenland & Antarctica to $\text{m}^3 = V_{\text{ICE}}$?, (c) Find volume of ice which is now water? NOTE: $m_{\text{ICE}} = m_{\text{ICE WATER}}$, $\rho_{\text{ICE}} V_{\text{ICE}} = \rho_{\text{ICE WATER}} V_{\text{WATER}}$. Thus, $V_{\text{WATER}} = (\rho_{\text{ICE}} / \rho_{\text{ICE WATER}}) V_{\text{ICE}} = (934/1000) V_{\text{ICE}} = 0.934 V_{\text{ICE}}$
 (d) Find area of all the oceans in m^2 ? (e) Find height (h) oceans would rise if Greenland & Antarctica melted?
 (f) Convert h in meters to feet?

HINTS: 3.37 ft./m , $h A_{\text{OCEANS}} = V_{\text{ice melted now liquid}}$, Area of sphere = $4 \pi r^2$

ANSWERS: (a) $29.35 \times 10^6 \text{ km}^3$, (b) $29.35 \times 10^{15} \text{ m}^3$, (c) $27.412 \times 10^{15} \text{ m}^3$, (d) $362.15 \times 10^{12} \text{ m}^2$, (e) $\sim 75.7 \text{ m}$.
 (f) $\sim 255 \text{ ft}$. **COMMENT:** The article states oceans would rise more than 170 ft. Your calculations got 255 ft. . Certainly, in the MORE range.