

HEAT

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Tx. 78701, jpcise@austincc.edu & New York Times August 18, 2013 by Michael Benson

Gorgeous Glimpses of Calamity Man-made perils to the universe's garden of life are evident from space. The 1960s and early '70s; the global population was half what it is today, and the portion driving cars and leaving the lights on was far lower. Contrast that with the last decade or so, when astronauts and Earth-observing satellites have recorded a different, deeply unsettling picture. While our world remains ravishingly beautiful, it increasingly shows symptoms of distress. Many of these indicators are the direct result of human activity. Others are the indirect consequence of using our atmosphere a dumping ground for carbon dioxide and other greenhouse gases.



July 17 and Aug. 3, 2012: **Ice and snow melted with extraordinary speed in the Northwest Passage in Canada's Parry Channel, a link in the long-sought northern route for ship traffic between the Atlantic and Pacific Oceans. Twice in the last decade, the entire route has become clear of ice. These images were taken with NASA's Terra satellite.**

INTRODUCTION: Good videos on less arctic ice and it's thinning:

<http://m.youtube.com/watch?feature=relmfu&v=m-M37vc-m0>

<http://m.youtube.com/watch?v=ZYaubXBfVqo>

In winter 2004, the volume of sea ice in the central Arctic was approximately $17,000 \text{ km}^3$. This winter it was $14,000$, according to CryoSat. However, the summer figures provide the real shock. In 2004 there was about $13,000 \text{ km}^3$ of sea ice in the Arctic. In 2012, there is $7,000 \text{ km}^3$, almost half the figure eight years ago. If the current annual loss of around 900 km^3 continues, summer ice coverage could disappear in about a decade.

QUESTION: (a) Convert 900 km^3 to m^3 ? (b) Ice density is $1000 \text{ kg}/\text{m}^3$. Determine the mass of 900 km^3 of ice? (c) Latent heat of fusion of ice is $334 \text{ KJ}/\text{kg}$. How much heat (in J) is needed to melt 900 km^3 of arctic ice/year? (d) The heat needed to melt this ice is coming from the warmer arctic air over the $14.6 \times 10^6 \text{ km}^2$ of ice. Convert this area into m^2 ($10^6 \text{ m}^2 = \text{km}^2$)? (e) If we consider the Air Thickness over the ice to be 5000 m , find the volume (m^3) of this air over the arctic ice? (f) The heat to melt the ice comes from the warmer air above the ice. The density of air is $1.2042 \text{ kg}/\text{m}^3$, find mass (kg.) of air above the arctic ice? (g) What is air temperature loss (Δt , $^\circ\text{C}$) needed to melt 900 km^3 of ice each year? $L_{\text{fusion}} m_{\text{ice}} = c_{\text{air}} m_{\text{air}} \Delta t$, $c_{\text{air}} = 1 \text{ KJ}/\text{kg}^\circ\text{C}$

ANSWERS: (a) $9 \times 10^{11} \text{ m}^3$ (b) $9 \times 10^{14} \text{ kg}$. (c) $\sim 3 \times 10^{17} \text{ KJ}$, (d) $14.6 \times 10^{12} \text{ m}^2$, (e) $73 \times 10^{15} \text{ m}^3$, (f) $87.9 \times 10^{15} \text{ kg}$, (g) $\sim 3.4 \text{ }^\circ\text{C}$

Some of the images from NASA's flagship Terra and Aqua satellites are downright heartbreaking. They seem to make the case that we're inexplicably **intent on engineering our own expulsion from the garden**, in a kind of late-breaking, self-inflicted Old Testament dismissal. **The mid-Pliocene epoch, some three million years ago, was the last time atmospheric carbon dioxide was at the levels we are now approaching; some scientists estimate that mid-latitude temperatures then were between 16 and 36 degrees Fahrenheit warmer than today, and sea levels may have been up to 115 feet higher.** In our own era in the 48 contiguous states, according to the Environmental Protection Agency, 7 of the 10 warmest years since 1901 have occurred since 1998. Welcome to the Anthropocene. President Obama should invite world leaders to an emergency conclave in Washington as early as possible and challenge China, India, Brazil, Indonesia and other major greenhouse-gas emitters to equal or exceed the percentage reductions he seeks for the United States. He should also try to rally the nation and globe in support of an international Manhattan Project, in which the best scientific minds would devise carbon-sequestration technologies that could clean the air of the heating elements we've put there — rather than simply seeking to limit the damage.