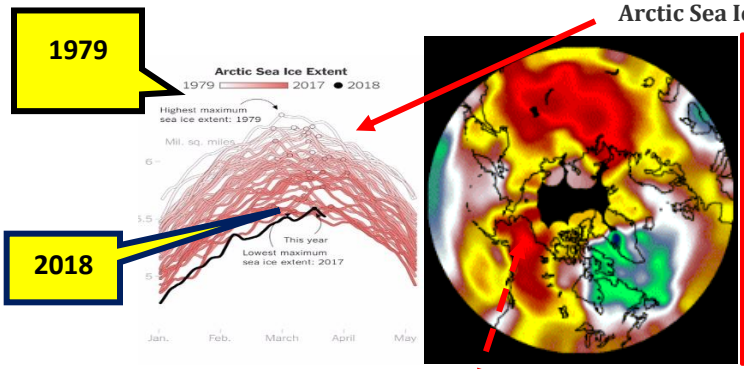
TEMPERATURE & HEAT

Unit 20 Dr. John P. Cise. Professor of Physics, Austin Com. College, Austin Texas USA & New York Times March 23, 2018, **Dedicated to ALL Norwegian Explorers at beginning of 20th century**

Arctic Sea Ice Missed a Record Low This Winter. Barely.

By KENDRA PIERRE-LOUIS, NADJA POPOVICH and ADAM PEARCE MARCH 23, 2018



INTRODUCTION: **According To National Oceanic & Atmospheric Administration the arctic has been warming at 2 – 3 ° C per decade since 1960s. Arctic jet stream changes has been pumping cold air south and warm air north(see last three sentences article below). Thus in the past forty years the arctic has warmed almost 4 to 8 degrees C. This warmer air has prevented the usual huge volume of ice to form. In the past 40 years about 0.8 million sq. miles less ice has been Forming in the arctic. You will show 4-8 degree increase in temp. prevented ~ 0.8 Million sq. mi ice to form.**

This year Lowest maximum sea ice extent: 2017 Highest maximum sea ice extent: **(((1979 6.4 Million sq. miles. Jan.Feb.MarchAprilMay 2018 5.6 Million sq. miles)))**

Arctic sea ice behaves a bit like a human waistline, packing on weight in the winter and slimming down in the heat of summer. But while many of us struggle to lose weight, the Arctic has been struggling to gain it. The maximum extent of Arctic sea ice cover this winter was the second-lowest since satellite record-keeping began, researchers said Friday. **The loss of sea ice is a bellwether of global warming,** suggesting that climate is not just something to worry about far off in the future: It is here. "We've probably known for 100 years that as the climate warms up in response to loading the atmosphere with greenhouse gases, we would see the changes first in the Arctic," said Mark Serreze, director of the National Snow and Ice Data Center in Boulder, Colo., which issued the new data. "This is what we expected and this is exactly what has happened. It's a case where we hate to say we told you so, but we told you so."

With each passing decade, the ice grows a bit less in winter, and melts a bit more in summer. The record for the least amount of sea ice gained in the winter was set last year, when the ice covered 5.57 million square miles (14.42 million square kilometers) at its peak. This winter's maximum extent was slightly greater, at 5.59 million square miles (14.48 million square kilometers), according to the data center. Despite the small increase this year, the downward trend in winter ice coverage is unmistakable, and the past four **The disappearing sea ice is a key indicator of a warming Arctic.** And the consequences of a warming Arctic can be felt further south. **A growing number of researchers are linking the changes up north to unusual winter weather in North America and Europe.** In recent weeks, the Northeastern United States faced four nor'easters in as many weeks, and Western Europe encountered subzero temperatures that were far lower than at the North Pole. **These weather patterns are influenced by the jet stream, the river of wind that encircles the Northern Hemisphere, said Jennifer A. Francis, an Arctic researcher at Rutgers University. Temperature differences between the Arctic and the lower latitudes help create the jet stream. Because the Arctic is warming twice as fast as the rest of the Earth, that temperature difference is getting smaller. As a result, the jet stream is getting weaker and shifting its behavior, sending cold air south from the Arctic and pumping warm air north.**

INTRODUCTION(CON.) **You will find heat needed to melt ($Q = L\, m_{ice}$) 0.8 million sq. miles of ice 6 ft. thick.**

QUESTIONS: **(a) Find m^3 of ice in 0.8 million sq. mi. of ice 6 ft. thick?, (b) Find m_{ice} ?, (c) Find heat(in Joules) $Q = L\, m_{ice}$ needed to melt(or freeze) 0.8 million sq. miles, 6 ft. thick?**

HINTS: **mi. = 5280 ft., 0.02831 $m.^3/ft.^3$, ρ_{water} = 1000 kg./$m.^3$, L_{ice} = 334 KJ/kg. , $\rho = m/V$**
NOTE: In making ice from salty sea water the salt is squeezed out leaving fresh water ice floating on more dense sea water.

ANSWERS: **(a) V = ~3.79 X 10^{12} $m.^3$, (b) m_{ice} = ~3.79 X 10^{15} kg., (c) $Q_{melt\ ice}$ = ~ 1.265 X 10^{21} J**

COMMENT: **In first introduction above, arctic temps have been going up 2-3 °C/decade since 1960, Thus, enough heat existed/year in this warmer air to melt arctic sea ice.**