Going to the Ends of the Earth: Scientists Explore Global Warming

In Barrow, Alaska – population 4,000 – locals are getting a break from their brisk summer weather. Elevated air temperatures and retreating ice cover have bathing suits replacing mustang suits on the Alaskan beaches 340 miles north of the Arctic Circle. But, as comfortable as 65-degree weather might be, it’s troubling to residents and to many scientists.

In the past 100 years, average temperatures in the United States’ most northern city have risen 10 degrees, melting snow and ice. This gradual change means the ice floes that used to allow safe passage for polar bears to mid-Arctic hunting grounds no longer exist. Less frequent snow showers and thawed permafrost have collapsed the foundations of many buildings and roads in northern Alaska. And the impact doesn’t end there. The Arctic is considered a window to global climate change.

Researchers from the warmer climes at the Rosenstiel School literally travel to the ends of the earth to investigate this environmental transformation. Studies draw on 40 years of high Arctic expeditions, aimed at determining whether changes in Barrow and across the Arctic have temporary or long-term climatic consequences.

The heat engine
Arctic climate science is concerned with changes in polar ice content and the possibility of sea level rise. As air temperatures rise above freezing, sea ice, glaciers, permafrost, and snow melt, increasing the fresh water in the world’s oceans. The ice-free water surface is relatively dark compared to ice and reflects less sunlight. The light that isn’t reflected by the water surface is absorbed, heating the upper ocean, and melting ice further.

While this scenario seems to doom polar ice caps, nature has a way to possibly slow ice melt and ocean warming – cloud formation. Heat and moisture over the open water area increase cloudiness that may block enough incoming sunlight to cool the surface beneath the clouds. If it is cool enough to drop temperatures below freezing, ice can re-form. In winter, however, overcast, cloudy conditions may keep heat from escaping to space and encourage melting. Better knowledge of surface temperature and cloud cover effects is vital to understanding ice retreat and its effects on climate and the local ecosystem.

Rosenstiel School researchers have been monitoring these atmospheric changes and looking for related climate patterns for over a decade. Paying particular attention to polar clouds and how they affect ice cover, the scientists take measurements from ships, ice floes, and Arctic coastal stations with a variety of technologies. These data are merged with satellite information over the poles to improve climate forecasts of surface warming and ice retreat.

Water world
With ice melting and sea levels rising, scientists are interested in the water’s composition and how it moves, or more specifically, how it moves other things around. One researcher employs naturally occurring radioisotopes to trace the speed and direction of under-ice currents. In addition to building understanding for how pollutants are transported in these waters, it sheds light on the source of pollutants and acts as a clock, indicating how long they’ve been there. Another scientist uses this information from the “clocks” to learn more about the carbon cycle, investigating carbon and nitrogen transformations and transport through the Arctic. If we determine the fate of carbon and other greenhouse gases, we can better understand our future climate.

Learning from the smallest creatures
From petite zooplankton that feed larger Arctic animals, some Rosenstiel School researchers are observing a frightening trend in the Arctic food web that may stem from regional warming. With changes in ocean circulation come changes in organism migration. Unfortunately, scientists see a decreased food supply for organisms, such as birds, fish, baleen whales, seals and polar bears.

These Arctic changes are key pieces to the global warming puzzle that Rosenstiel School scientists are helping to solve.