HOW WARMING REALLY TURNS UP THE HEAT

Through positive feedback, global meltdown is heating up the world.

This sounds wrong because, in physics, it takes heat to melt ice. But in geography, a loss of ice helps warms the world because solar radiation is more effectively absorbed by land than reflective ice, and by an enlarged ocean than previously un-flooded coastal areas. This cycle of heat causing ice loss, causing more heat, causing more ice loss is an example of a positive feedback loop. A change causes more change. Such loops are the main drivers of climate change.

An even more potent ice feedback loop concerns the dark brown ice within permafrost. It's brown because it's loaded with a windblown dust and lots of particulate organic matter. When these soils thaw at the surface, the organic matter converts to carbon dioxide, the same gas released by fossil fuels. When they thaw under oxygen-poor conditions near the base of the permafrost, they produce methane, an even more potent greenhouse gas.

My most personal feedback loop had to do with taking an ice shower. In 1980, my wife and I lived in Fairbanks, Alaska, in a leased ranch-style duplex on the improbably named Sandpiper Lane. On cold winter mornings, when getting ready to shower, we would find a slab of ice in the tub, which we had to melt before stepping in.

Here's what happened. Coal was burned in a power plant to create electricity. This was used to heat the house. Some of this heat helped thaw the permafrost beneath the house, causing the foundation to subside. It cracked open, letting subzero midwinter air flow into the crawl space.

Simultaneously, the tub tilted backward until its back end sank below the level of the drain. This left a puddle which would freeze if we forgot to squeegee it uphill to the drain. The more heat, the more tub tipping, the thicker the ice, the more hot water needed to thaw it, the more coal burned, the warmer the atmosphere, the more tipping, and so forth. This sort of terrain collapse is happening all over the subarctic today.

And now for the politics. The "News of the Week" section in my March 20 journal Science reported on such feedbacks at a global climate change congress in Copenhagen convened by 11 universities and attended by about 2,000 scientists. They ignored the tipping of tubs, but highlighted the other two meltdown feedbacks.

Unlike the Intergovernmental Panel on Climate Change, which is affiliated with the United Nations and member governments, this congress "answered to no political bosses" and was "far more scientific than a gathering of diplomats."

Although the intergovernmental panel's Fourth Assessment, published in 2007, did reach a broad consensus among world scientists, it has been widely criticized for being too politicized and too conservative with potentially bad news. For example, the dynamic processes of glacial motion beneath ice sheets were conveniently omitted from consideration.

Since then, however, glaciologists have learned that ice dynamics is causing the Greenland ice sheet to melt like gangbusters, and that the Antarctic also seems to be losing mass as well. Their improved estimates of coastal flooding from these two sources point to more than a meter of global rise by the end of the century, significantly higher than the intergovernmental panel's projections of two years ago. Such rises also contribute to ocean warming through greater absorption.
Scientists have also improved their estimates for the amount of carbon sequestered in permafrost that will convert to CO\(_2\) and methane upon melting. It's 1.7 trillion tons, more than twice that of the panel's estimate.

Katherine Richardson, co-chairwoman of the Copenhagen congress, lamented: "The worst-case IPCC projections, or even worse, are being realized . . . Emissions are soaring, projections of sea level rise are higher than expected, and climate impacts around the world are appearing with increasing frequency." Most of this is being caused by positive feedbacks in a negative direction.

The good news is that the current U.S. administration has created a positive feedback loop in a positive direction. Good political change is causing more good political change.

Hope springs eternal.