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Permafrost thaw — just how scary is it?

Posted by Brad Plumer at 01:07 PM ET, 12/19/2011

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One of the least understood — and one of the more unnerving — facets of climate change is the question of what will happen as the Arctic region heats up and permafrost in places like Alaska and Siberia thaws out. There's a whole lot of carbon locked up in all that frozen soil and organic matter. And, as the frost melts, that carbon will enter the atmosphere, most of it as carbon dioxide, but some of it transformed by bacteria into methane, an even more powerful heat-trapping greenhouse gas. That, in turn, will warm the planet further. It's a potent feedback mechanism, and scientists still aren't sure just how potent it might be.

Currently, permafrost thaw isn't very well incorporated into existing climate models. Indeed, most of the widely cited computer models — the ones that experts rely on to argue, for instance, that global greenhouse-gas emissions should peak in the next five years if we want to limit warming to 2°C — actually underestimate the role permafrost could play in warming the planet. "There's a growing realization of how large that carbon stock is," says David Lawrence of the National Center for Atmospheric Research. "The models are still playing catch-up."



Thawing permafrost in Noatak National Preserve in Alaska. (Edward Schuur - Associated Press)

So how worried should we be? Over the weekend, Justin Gillis had a beautifully reported piece in The New York Times on the permafrost question that summed up what scientists do and don't know: "In the minds of most experts, the chief worry is not that the carbon in the permafrost will break down quickly — typical estimates say that will take more than

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a century, perhaps several — but that once the decomposition starts, it will be impossible to stop.” There’s no looming apocalypse, but melting permafrost could make it much harder to avoid setting the planet down a path of irrevocable warming.



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Last month, the journal *Nature* published a [survey](#) (PDF) of 41 scientists from the Permafrost Carbon Network, who estimated that, by 2100, the amount of carbon released from thawing permafrost could be 1.7 to 5.2 times greater than models indicate. That means current emissions plans to try to prevent more than 2°C of global warming could be on pace to fail badly. (On a longer time scale, if humans *keep* burning fossil fuels, then, the *Nature* survey reports, the overall effect from permafrost emissions could be 2.5 times greater than that from deforestation.) NCAR’s David Lawrence, one of the survey’s participants, stressed to me that this was a preliminary estimate, and a lot more work needs to be done here.

So permafrost is, potentially, a big deal — and something to keep in mind when pondering the question of whether humans might get lucky, and global warming might turn out to be less dire than expected. The state of permafrost research offers one piece of evidence that current climate-change predictions seem to be overly optimistic.

Meanwhile, Gillis’s piece — and the *Nature* survey — largely dealt with carbon that’s frozen in the northern soils. There’s a separate, though related, issue of what happens with the methane [locked in frozen hydrates](#) that’s buried in ocean sediment. There are thousands of gigatons of methane beneath the seas, comparable to the amount of carbon contained in the Earth’s coal deposits. And, as the Arctic waters warm, some of this methane is likely to bubble up into the atmosphere. Another troubling feedback.

The problem is that scientists have had similar difficulties getting a handle on just how much methane actually *is* bubbling up, since the Arctic isn’t exactly an easy place to take measurements. It can also be unclear whether observed methane plumes are new developments related to current warming or long-standing natural trends. At the moment, despite some [frightening headlines](#) in the British press, there doesn’t seem to be a “methane time bomb” ready to go off. Read [Andy Revkin](#) or University of Chicago ocean

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chemist David Archer for more context here. There's no need for lurid Hollywood disaster-movie scenarios. The reality of what's actually transpiring is apocalyptic enough.

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12/20/2011 7:06 AM GMT-0900

I'm not a scientist, politician or intellectual...but, it seems to me that humans are incapable of working toward a common goal, whether it's a balanced budget, feeding the hungry or ensuring we won't become extinct by our own hand. I think one day we will be going about our normal activities and- just before whatever cataclysm hits- will think, "Oh, I get it!" And Earth will be another Mars - too little, too late.

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jtmkinds wrote:

12/20/2011 5:56 AM GMT-0900

Just another Chicken Little story. Humans will stop burning fossil fuels when they either run out, or something cheaper comes along...end of story. Go to China, or India, or any other emerging market nation and tell them your concerns...If they don't arrest you, they'll most certainly laugh you out of the country. Computer models suck...just ask any weather person how often the "models" are wrong. It's a problem of "garbage in, garbage out". I can make you a computer model using real "data" to show how the world will explode by the end of next year (Mayan calendar anyone?). These people hype this crap so they can get some grant money to fund their pitiful existence...and we're all really tired of hearing about the sky falling.

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