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# Bundle Up, It's Global Warming

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THE earth continues to get warmer, yet it's feeling a lot colder outside. Over the past few weeks, subzero temperatures in Poland claimed 66 lives; snow arrived in Seattle well before the winter solstice, and fell heavily enough in Minneapolis to make the roof of the Metrodome collapse; and last week [blizzards closed Europe's busiest airports](#) in London and Frankfurt for days, stranding holiday travelers. The snow and record cold have invaded the Eastern United States, with more bad weather predicted.

All of this cold was met with perfect comic timing by the release of a [World Meteorological Organization report](#) showing that 2010 will probably be among the three warmest years on record, and 2001 through 2010 the warmest decade on record.

How can we reconcile this? The not-so-obvious short answer is that

the overall warming of the atmosphere is actually creating cold-weather extremes. Last winter, too, was exceptionally snowy and cold across the Eastern United States and Eurasia, as were seven of the previous nine winters.

For a more detailed explanation, we must turn our attention to the snow in Siberia.

Annual cycles like El Niño/Southern Oscillation, solar variability and global ocean currents cannot account for recent winter cooling. And though it is well documented that the earth's frozen areas are in retreat, evidence of thinning Arctic sea ice does not explain why the world's major cities are having colder winters.

But one phenomenon that may be significant is the way in which seasonal snow cover has continued to increase even as other frozen areas are shrinking. In the past two decades, snow cover has expanded across the high latitudes of the Northern Hemisphere, especially in Siberia, just north of a series of exceptionally high mountain ranges, including the Himalayas, the Tien Shan and the Altai.

The high topography of Asia influences the atmosphere in profound ways. The jet stream, a river of fast-flowing air five to seven miles above sea level, bends around Asia's mountains in a wavelike pattern, much as water in a stream flows around a rock or boulder. The energy from these atmospheric waves, like the energy from a sound wave, propagates both horizontally and vertically.

As global temperatures have warmed and as Arctic sea ice has melted

over the past two and a half decades, more moisture has become available to fall as snow over the continents. So the snow cover across Siberia in the fall has steadily increased.

The sun's energy reflects off the bright white snow and escapes back out to space. As a result, the temperature cools. When snow cover is more abundant in Siberia, it creates an unusually large dome of cold air next to the mountains, and this amplifies the standing waves in the atmosphere, just as a bigger rock in a stream increases the size of the waves of water flowing by.

The increased wave energy in the air spreads both horizontally, around the Northern Hemisphere, and vertically, up into the stratosphere and down toward the earth's surface. In response, the jet stream, instead of flowing predominantly west to east as usual, meanders more north and south. In winter, this change in flow sends warm air north from the subtropical oceans into Alaska and Greenland, but it also pushes cold air south from the Arctic on the east side of the Rockies. Meanwhile, across Eurasia, cold air from Siberia spills south into East Asia and even southwestward into Europe.

That is why the Eastern United States, Northern Europe and East Asia have experienced extraordinarily snowy and cold winters since the turn of this century. Most forecasts have failed to predict these colder winters, however, because the primary drivers in their models are the oceans, which have been warming even as winters have grown chillier. They have [ignored the snow in Siberia](#).

Last week, the British government asked its chief science adviser for

an explanation. My advice to him is to look to the east.

It's all a snow job by nature. The reality is, we're freezing not in spite of [climate change](#) but because of it.

*Judah Cohen is the director of seasonal forecasting at an atmospheric and environmental research firm.*