

## **Cold winter on a warming planet**

*by Lynn Jones, March 6, 2014*

It's early morning; the floor feels icy under my feet. As the fire starts to crackle in the woodstove, the smoke already puffing out of my neighbour's chimney has the tell-tale look of chimney smoke on a very cold morning. Outside the kitchen window, the chickadees, puffed against the cold, are already feeding on black sunflower seeds and suet. Hoar frost sparkles on the cedar trees as the first rays of sunlight touch their high branches. Although it is early March here in the Ottawa Valley, the temperature has dipped well below -20 overnight, yet again, in this long, cold winter of 2014.

Throughout much of Central and Eastern North America it has been a record-breaking winter. Extreme cold caused school bus cancellations and school closures in many locations. Record snow falls and record low temperatures have been experienced in many eastern and central states in the U.S. On January 7th, every state in the lower 48 had a location that was below freezing (United States National Weather Service).

The Great Lakes are inching toward an all time record for ice coverage. Home heating bills are surging according to the CBC, a difficult situation for many. The previously unfamiliar meteorological term "polar vortex" has come into widespread usage to describe the long stretches of immersion in frigid arctic air masses that has been the defining characteristic of this winter for many. And, according to Environment Canada cold weather is expected to persist through March which is forecast to be colder than normal.

This old-fashioned, and in many cases severe winter begs the question "Whatever happened to global warming?" However, there is a great deal of evidence showing that our planet is still warming.

In fact, while we have been enjoying (or not) our cold and snowy winter here, it has been hot elsewhere in the world. Alaska set several new records for daily high temperatures in December and January. Temperatures have also been unusually high this winter in China, Mongolia and in Russia where ski jumpers at the Sochi Olympics landed in puddles while organizers scrambled to reschedule events and make artificial snow.

The Southern Hemisphere has had the hottest start to a year ever recorded. Australia, Argentina and Brazil have experienced extended heatwaves. Several cities in Australia have recorded 10 or more days above 40 degrees Celsius and the capital, Canberra had 19 days above 35 degrees, close to five times normal. According to the World Meteorological Organization 2013 was the warmest year ever recorded in Australia, and the sixth warmest for the planet as a whole since records began.

In the Arctic, air and water temperatures have been exceptionally warm recently, about 10 ° C above normal resulting in the lowest extent of Arctic sea ice ever recorded in February. Herein lies a critical factor that may partially solve the conundrum: How can we be breaking records for snow and ice in eastern North America while global warming continues apace?

As the Arctic sea ice shrinks, the Arctic warms up faster than the rest of the planet (no ice to reflect the sun's rays and keep a lid on the warmth stored in the Arctic Ocean). A warmer Arctic region affects the jet stream - the wavy river of fast-moving air 10 kilometres above the Earth's surface that brings us our weather. The jet stream moves from west to east and forms the boundary between cold polar air to the north and warm tropical air to the south. The bigger the difference in temperature between the North Pole and the Equator, the stronger the jet stream and the faster it flows.

As the Arctic has rapidly warmed in recent years the jet stream has slowed and become weaker. It meanders more and gets stuck in what meteorologists call "blocking patterns". Big meanders and blocking patterns have brought us the long stretches of frigid Arctic temperatures this winter and they have caused the polar air masses to reach much further down in the United States than normal. A picture is worth a thousand words in understanding this phenomenon; excellent graphics are readily available on the internet; a good place to start is by doing a Google image search on "wobbly jet stream".

Unfortunately (or fortunately if you love winter) this pattern may be one that we will have to live with for a while. According to the Science and Technology Advisor to President Obama, Dr. John Holdron, "a growing body of evidence suggests that the kind of extreme cold experienced by the United States is a pattern we can expect to see with increasing frequency as global warming continues."

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