'Dirty snow' warming Earth, study finds
Canada urged to lead international cleanup

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A team of U.S. scientists has found that "dirty snow" is a surprisingly significant contributor to global warming, and is urging Canada - as "custodian" of a vast, snowbound nation - to lead an international cleanup effort.

The researchers have measured, in the first comprehensive study of its kind, how snowy landscapes tainted by carbon particles from inefficiently burned fuels and forest fires are absorbing more of the sun's heat than the less sooty snow cover of centuries past.

"Snow becomes dirty when soot from tailpipes, smokestacks and forest fires enters the atmosphere and falls to the ground," the team explains. "Soot-infused snow is darker than natural snow. Dark surfaces absorb sunlight and cause warming, while bright surfaces reflect heat back into space and cause cooling."

Even a slightly darkened surface impairs the natural reflective properties of snow crystals, say the scientists, who calculated that dirty snow accounts for one-third of rising temperatures in the Arctic over the past two centuries.

"When we inject dirty particles into the atmosphere and they fall onto snow, the net effect is we warm the polar latitudes," says Charlie Zender, a University of California atmospheric physicist and co-author of a study published in the latest Journal of Geophysical Research. "Dark soot can heat up quickly. It's like placing tiny toaster ovens into the snow pack."

About 80% of "black carbon" pollutants are man-made, the researchers estimate, with forest fires accounting for the rest.

Mr. Zender told CanWest News Service that although all nations contribute to the problem of snow impurity through the long-range transport of pollutants, Canada bears particular responsibility to push for cleaner-burning fuels and reduced industrial emissions of soot.

"Just as Brazil is the custodian of the Amazon, a world resource whose deforestation has all sorts of negative consequences, so is Canada a custodian of an important swath of snow-covered land that helps to cool the planet," Mr. Zender said.

He also raised a red flag about increased ship traffic through the Northwest Passage - widely viewed as a potential economic boon for Canada in the coming decades - as a result of the melting Arctic ice pack.

"One implication," Mr. Zender said of his team's research, "is that any increase in shipping through the Arctic Ocean - for example, the Northwest Passage - is likely to exacerbate these effects by putting soot emissions right in the middle of the remaining snow and sea-ice. We must think very carefully about this."

In their NASA-funded project, Mr. Zender and three colleagues from UC-Irvine and the University of Colorado calculated that dirty snow caused the Earth's temperature to rise 0.1 to 0.15 C, or up to 19% of the total warming of 0.8 C over the past 200 years.

In that time, the Arctic has warmed about 1.6 C, and dirty snow has caused at least 0.5 C of the warming, the team found.

"The global warming debate has focused on carbon dioxide emissions," the scientists note. But their research has "determined that a lesser-known mechanism - dirty snow - can explain one-third or more of the Arctic warming primarily attributed to greenhouse gases."

While the international Kyoto strategy to cut greenhouse gases is deemed essential to fight climate change, Mr. Zender's team says targeting sources of dirty snow could pay faster dividends in curbing some of the increase in global temperatures.

"Carbon dioxide lives in the atmosphere for a century, so cutting back on emissions can prevent further warming but does not produce immediate cooling," they said. "Policy makers could use these research results to develop regulations to mitigate global warming. Limiting industrial soot emissions and switching to cleaner-burning fuels would leave snow brighter. New snow falls each year, and if it contained fewer impurities, the ground would brighten and temperatures would cool."

The researchers warn that dirty snow not only results in gradual warming but can also create temperature spikes where surface snowmelt is accelerated enough to expose the deeper, darker layers of previous years' snowfall, or even...
the soil lying below.

"In some polar areas, impurities in the snow have caused enough melting to expose underlying sea ice or soil that is significantly darker than the snow. The darker surfaces absorb sunlight more rapidly than snow, causing additional warming. This cycle causes temperatures in the polar regions to rise as much as 3 C during some seasons," the scientists say.

"Once the snow is gone, the soot that caused the snow to melt continues to have an effect because the ground surface is darker and retains more heat."

A map produced by the team to highlight the impact of dirty snow around the planet shows a minimal effect across most of mainland North America, a zone of slightly elevated temperatures in Canada and the United States around the heavily industrialized Great Lakes region, and extensive areas of significant heating from darkened snow throughout the High Arctic latitudes.