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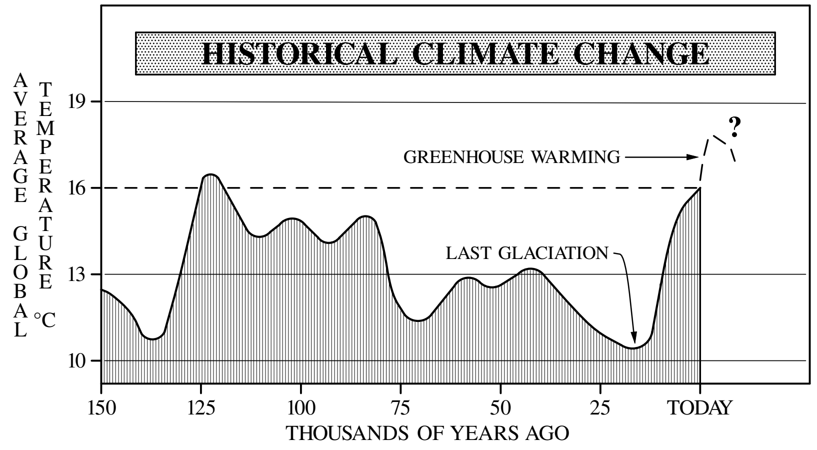
Out of Control

Tampering with atmosphere is no trivial matter



A change of only 6 degree Centigrade in global temperature separates ice ages from warmer periods. Anticipated global warming over the next 50 years could exceed anything experienced in human history.

SOURCE: Environment Canada

BY CRAIG McINNES
The Globe and Mail

ON THE ROOF of the Atmospheric Environment Service building in Metro Toronto, five identical robots track the sun through the urban haze as it arcs across the sky.

The silent boxes measure the amount of ozone in a band of the upper atmosphere found between 20 and 50 kilometres above the Earth's surface. What the unblinking machines are seeing alarms the scientists who try to interpret the data they collect.

The ozone layer appears to be decaying.

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"Not only are we the cause, we're the guinea pigs as well," said Henry Hengeveld, a climate expert with the Atmospheric Environment Service.

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Environment Canada is developing a series of projections on the effects of global warming on this country, based on the current models of the greenhouse effect.

Among its predictions:

☐ The sea level will rise, flooding low-lying coastal areas.

☐ The water level in the Great Lakes will fall, hindering navigation.

☐ The prairies will become dryer and hotter, and different crops will have to be developed for the southern prairies. The growing season will be extended, so northern areas of the Prairie Provinces will become more suitable for farming.

☐ Forests will become more vulnerable to fires, seriously disrupting the logging, lumber and pulp and paper industries.

☐ The skiing industry in southern Canada will be largely wiped out.

The predictions, which correspond closely to projections made by other climate monitoring agencies around the world, are based on a steady increase in the level of the gases and a gradual increase in average temperature.

But some scientists believe there will not be a smooth transition into the warmer climate, but a series of unpleasant surprises.

Scientists have been able to learn something about climatic conditions in the past by examining polar ice and ocean sediments.

"What these records indicate is that Earth's climate does not respond to forcing in a smooth and gradual way," Wallace Broecker of Columbia University's Lamont-Doherty Geophysical Institute wrote in a recent article in the influential journal *Nature*. Rather it responds in sharp jumps, which involve large-scale reorganization of Earth's systems. If this reading of the natural record is correct, then we must consider the possibility that the main responses of the system to our provocation of the atmosphere will come in jumps, whose timing and magnitude are unpredictable.

"Coping with this type of change is clearly a far more serious matter than coping with a gradual warming," he wrote.

Are we into the greenhouse already?

The tremendous natural variability of weather makes that very difficult to determine. Two warm winters may be followed by a bitterly cold one, for example. But there are trends that could indicate the Earth is already starting to warm.

"We've seen about half a degree rise in global temperatures over the last 150 years," Mr. Hengeveld noted; "1987 was the warmest in that record, and the five warmest years in the record occurred from 1980 on. Seven of the 10 warmest years occurred since 1973, so something is happening."

Scientists still consider the greenhouse effect a theory, however, because the increase is still within the range of natural climate fluctuations over the past 10,000 years.

"Although the consensus is that what we're seeing fits into the greenhouse theory, until it exceeds the variability bounds, we really haven't proved it yet," Mr. Hengeveld said.

One of the major unknowns is the effect of the oceans. In the short term, they are acting as a global shock absorber. They are so massive that they can absorb a tremendous amount of energy before they start to warm up perceptibly.

It is estimated that the oceans delay global warming by about 50 years. It has also been proposed that global warming might alter ocean currents. That would have major effects on local climate.

Much of Europe might actually get colder, in spite of the greenhouse effect, if the current that now carries warm water northward were to change direction.

Even with no surprises, the climate will remain variable as the average temperature rises.

"If you have a warmer trend in winters, you are going to get more frequent warm winters that set new records, you're going to get much less frequent cold snaps in winters and you are less likely to reach the old records on the cold side," Mr. Hengeveld said. In summer, "heat spells are going to get hotter and longer."

The federal Government has called an international conference in Toronto in June to discuss the social and economic implications of climate change in order to develop an international law of the air.

The article EM8805 reprinted overleaf on page 4.27 is used in Figure 4.9 of the STAT 220 Course Materials.