YORKSCIENCE

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Have you ever wondered about the ring of pollution around Toronto?

York scientists have been studying this infamous 'Brown Haze' since 1977. The work is being done as a part of a study for the Energy Research Office of the National Research Council in Ottawa by members of CRESS (Centre for Research in Experimental Space Science).

The main reasons for the study are related to solar energy. In order to properly use the sun's energy in the future we must first know what part of the spectrum reaches the ground. This is done by measuring the solar intensity at ground level over long durations.

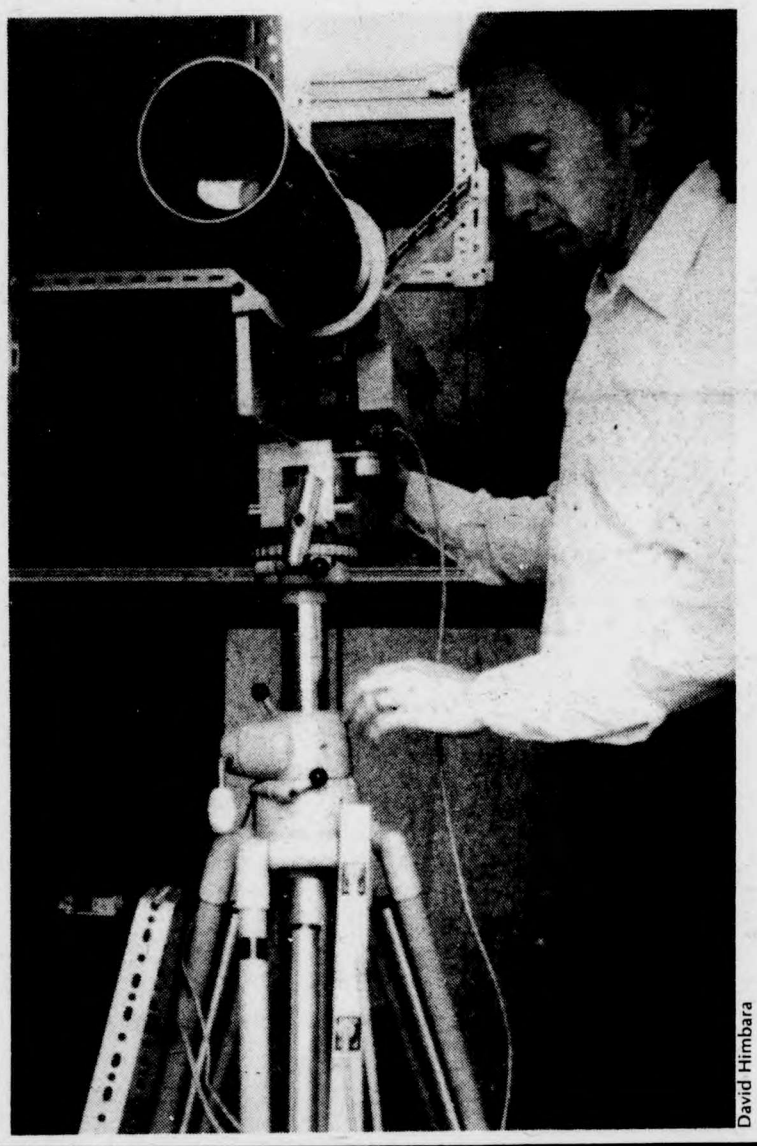
The Toronto area is similar to most other major cities. The layer of pollution as well as being a potential health hazard, presents a particular problem to solar energy use since it absorbs the sun's energy.

Monitoring the brightness of the sun gives reliable information for the first time on the spectrum of daylight in the Toronto area and how it changes with time and atmospheric conditions.

CRESS director Dr. R.W. Nicholls, along with Dr. Peterson and Dr. Bunn (both York graduates) have set up a laboratory in a green trailor next to the ice facilities building on the north portion of the campus. In this trailer they have assembled instruments to measure the spectrum of the sky at the zenith (straight up) and at low angles (near the horizon). The measurements are being carried out by Nick Balaskas, research assistant and former York Graduate.

The solar energy reaching the ground from directly overhead is mainly in the more energetic blue region of the spectrum; however light from the horizon is occasionally brown because of the absorption due to Nitrogen Dioxide, a major constituent of the brown haze.

The Nitrogen Dioxide pollution causes significant absorption of the blue portion of the spectrum, producing the brown colour of the haze. Part of the pollution comes from industry, but the main source is the internal combustion engine.



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Analysis of the atmosphere is done using spectroscopic techniques. Chemicals and pollutants are detected by the absence of the sunlight they absorb. In this way species such as carbon dioxide, water vapour, carbon monoxide, calcium, iron, etc. can be observe and monitored. Sulfur Dioxide has been of special interest lately because this is one of the major causes, along with Nitrogen Dioxide, of acid rain.

Measurement of the sky's spectrum has been taken regularly for the last three years with the total number of scans increasing each year.

These studies have indicated that NO_2 pollution may be on a down swing. "It seems that the anti-pollution laws may be doing some good..." stated project scientist Dr. Peterson. "Statistically there has been a decrease in the number of brown hazes observed over the last few years."

However, Dr. Peterson does not rule out the possibility of long term weather changes as the cause of this decrease.

Pollution in the Toronto area is very dependent on the prevailing winds and weather conditions. Cold north westerly winds bring clear fresh air to Toronto forcing the pollution to the United States. However, warm southerly winds carry much of the pollution from the industrial northeastern states into the Toronto area.

The worst case of pollution occurs during a "temperature inversion" where pollutants in a warm atmosphere are trapped by an overriding mass of cool air. Fortunately this does not occur too often in the Toronto area because of its flat terrain.

Additional information from this study concerns the densities of pollutants in the atmosphere. The sizes and numbers can be estimated from intensity measurements of the solar absorption and will have an effect on sun's rays that finally do reach the ground.

A white haze has also been observed in the Toronto region. This has been shown to be due to an increased amount of water vapour in the air.

These observations have been carried out for the first time at York. The spectrum observed during periods of light and heavy pollution tell us much about what types of solar energy technology could be efficiently used. Future studies will extract reliable information about the full sky. Development of suitable automatic instruments that analyze and display the data with aid of microprocessors is continuing.