Chinook

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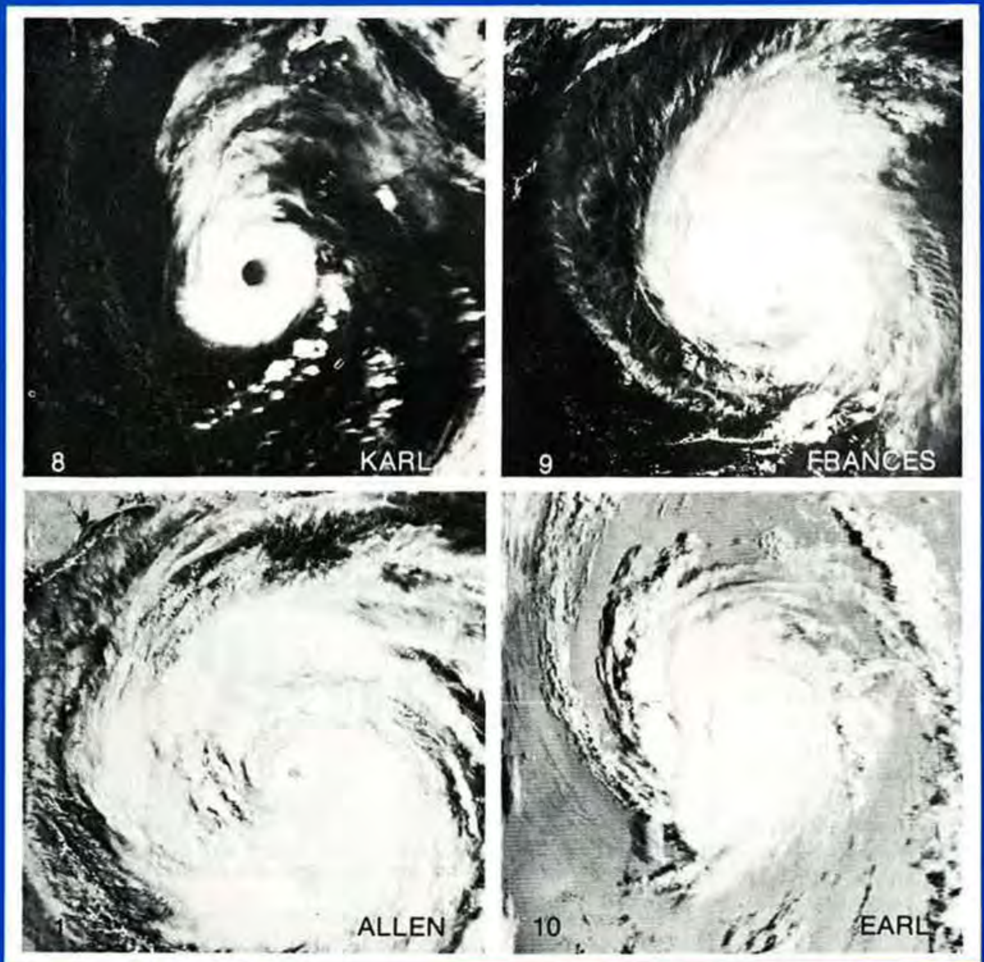

INSIDE THE CO_2 CRISIS
LA VILLE ET SON CLIMAT
DESIGNING FOR A NORTHERN CLIMATE

Nouveau. Section Française

NEWS AND NOTES

CHINOOK INTRODUCES A FRENCH SECTION

In keeping with ***Chinook's*** intention of being Canada's national magazine dealing with the weather and the atmospheric environment, a new French section is introduced in this issue. We are happy to welcome **Claude Masse** as its editor. **M. Masse,** a meteorologist with Environment Canada, is glad of the opportunity to prepare material which will be national in scope, and of interest to the francophone segment of our country.

The suggestion for such a section was actually originated by **M. Richard Leduc,** President of La Société de Météorologie de Québec, who is one of the first contributors (see "La Ville et son Climat", page 23).

As is presently the case in the remainder of the magazine, the topic "weather and atmospheric environment" will be interpreted in the broadest possible fashion in order to bring to the reader the rich variety of activities in this sphere. It is in this spirit that **Peter Chen** has contributed his article "L'éclipse solaire de 1979", on page 22.

To the Section Française we wish "bonne chance".

RECOLLECTIONS OF A RECORD COLD DAY

Gordon Gee, well known for his CBC radio weather commentaries, has made the following letter available for the readers of ***Chinook.*** It was sent to him during the course of his northern Ontario network broadcasts, and adds a dimension of human interest to that chilling statistic of minus 58.3°C (73°F below zero) which has entered the record books as Ontario's coldest temperature ever. The letter was written by **Clifford C. Ollivier** (retired) of Rutherglen, Ontario.

"The most unusual day in our part of the country was January 23rd, 1935 when the lowest recorded temperature in the province (73°F below zero) was observed at Iroquois Falls, Ontario. I was working for the T&NO railway, now the Ontario Northland, as Operator and Ticket Clerk and had to be on the job at 6 a.m. I knew it was c-o-l-d for the air was still and heavy with frozen crystals and quite foggy. I can still see that engine pulling out of the shop track with his bell ringing in the crisp air and only his dim headlight showing.

"Later that morning, reports came in from all over the area that it was 60°F below and lower. There were no cars in those days, roads not plowed like today, and horses were all kept in the barn due to possible lung damage on account of the extreme cold. Our daughter, age 7, went off to school and very few pupils missed their

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Articles

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THE COVER

Close-up views of four of the ten hurricanes which formed during the 1980 season. Reproduced here at a scale of 1:18 million, their counter-clockwise (or cyclonic) spiralling symmetry is clearly visible. Of the four, *Allen* was the most dangerous, and at the time of the picture (1335 GMT, August 8, 1980) was producing maximum sustained winds of 210 km/h. By way of comparison, the maximum sustained winds of *Frances* were about 160 km/h at the time of the photograph (1900 GMT, September 16, 1980). *Karl* was photographed at 2235 GMT Novermber 14, 1980 and *Earl* at 1143 GMT September 9, 1980.

For more about the hurricanes of 1980, see the *Severe Weather Log* section, page 26.

Photographs courtesy of the Satellite Data Laboratory, A.E.S.

News and Notes, Cont'd

classes that day. Clarke Davis, Woods Manager, reported sleeping with his bedroom window open. Mostly the town folk took it in their stride, after all, they had other days much colder. Thirty below with a stiff wind penetrates and bites much more than 50 to 60 below with no wind factor.

"All hell broke when word went out via Canadian Press. The *Toronto Star* and other city papers sent in their reporters and they filed yards of readable (?) stuff which I sent out by telegraph. The *London Times* phoned trans-atlantic at $25 per minute to our Dr. Maitland Young, asking if the hospital was full of frozen patients, and how many had died. Dr. Young was very slow of speech and tight in purse and he said 'Hey! Who is paying for this call?' 'We are' came the reply. 'Oh', said the doctor, 'then we'll carry on'. We figured that the *London Times* had to pay a $250 phone bill only to find that no-one was frozen and that there were no deaths.

"Leon Kent, Abitibi meteorologist, was in charge of weather reports. He used instruments which were all government approved, but it took him two years of correspondence and testing before he finally received official confirmation of the 73°F below. Why? Because Abitibi made these daily weather observations for their own company operations and not for the public or government records. The government's closest weather station at that time was Moosonee."

AN INADVERTANT PROMOTION

In our last issue we inadvertantly "promoted" **D. G. Schaefer** to the position of Chief of Scientific Services, AES Pacific Region. Our apologies to **S. Nikleva**, the real incumbent.

FOREST FIRE LOSSES ACROSS CANADA

Last December the Canadian Forestry Service reported that the 1980 forest fire season was the worst on record with a total of 8973 fires, and 4,823,488 hectares (ha) burned (a little less than the entire area of Nova Scotia). Forest fires on the scale encountered last year severely taxed the forest protection resources of the provinces worst hit. Saskatchewan suffered the greatest loss. By the end of October 1980, 743 fires had consumed 1,495,593 ha. Other major losses were as follows; N.W.T., 1,044,286 ha and 345 fires; Alberta 639,724 ha, 1338 fires; Manitoba 603,706 ha, 1076 fires; Ontario 560,323 ha, 1778 fires; National Parks 305,024 ha, 97 fires.

The Canadian Forestry Service is looking at the possibility of a national fire centre for co-ordination of fire fighting efforts and special research into fire management is also under consideration.

THE CO_2 CRISIS

by H. A. Buckmaster

It is not widely appreciated that there exist two limits to the global amounts of energy that can be consumed by humankind. One limit of course is the availability of energy sources. The other limit arises because of the "greenhouse effect". This effect is due to the fact that carbon dioxide (CO_2) absorbs radiant energy from the earth at infrared wavelengths but is transparent to the incident solar radiation at visible wavelengths in a way similar to window glass. Given enough atmospheric CO_2 it is possible that less energy would escape from the earth than it would absorb from the sun, resulting in a net warming trend. Since the industrial revolution started in about 1850, increasing amounts of CO_2 (which is one of the waste products from generating energy) have been released into the atmosphere. It is estimated that the concentration of this gas was about 265 to 290 ppm (parts per million) in 1850 and had increased until it was 331 ppm in 1975. It was recognized before 1900 that the CO_2 concentration played an important role in determining the mean global temperature, but not until 1938 was it suggested that the burning of fossil fuels was altering the composition of the atmosphere.

In 1957 R. Revelle and H. Suess wrote, "human beings are now carrying out a large-scale geophysical experiment of a kind that could not have happened in the past nor repeated in the future. Within a few centuries, we are returning to the atmosphere and the oceans the concentrated organic carbon stored in the sedimentary rocks over hundreds of millions of years. This experiment, if adequately documented, may yield a far reaching insight into processes determining weather and climate." Unfortunately, Revelle did not appreciate that this is an experiment which we cannot afford to perform with the vigour that is presently occurring without it having, as we shall see, disastrous socioeconomic and geopolitical implications.

Revelle was instrumental in ensuring that regular sampling of the CO_2 concentration was initiated as part of the International Geophysical Year (IGY) program in 1958. Since that time the increase and variation of the atmospheric CO_2 concentration has been measured at Mauna Loa, Hawaii. This site is at an altitude of 3400 m and is within the trade wind belt, as well as being remote from all sources of industrial activity in the northern hemisphere. It is observed that there is an annual cycle, with an amplitude of 6 ppm, which reaches a maximum in February when the consumption of fossil fuels reaches a maximum, and the amount of photosynthesis reaches a minimum in the northern hemisphere. The cycle reaches a minimum in August when the fossil fuel consumption attains a minimum and the amount of photosynthesis is a maximum. The validity of these statements can be tested by considering similar measurements in the Antarctic which have a smaller oscillation amplitude (1.6 ppm) and are shifted by six months in phase, as expected, since the climate cycle is shifted by this amount in the southern hemisphere. The temperature of the sea water also plays a role in these cycles.

The consumption of fossil fuels has been increasing at a rate of about 4.3% during the past 30 years. This annual rate may have continued since 1850 as Figure 1 indicates. For reasons unknown, only 50% of the CO_2 which is produced remains in the atmosphere. It is clear, however, that deforestation, particularly in the tropics, is likely to play a critical role in any change of this balance because photosynthesis normally counters the decomposition of terrestrial and oceanic biota into CO_2. Virtually nothing is known about the effect of the increasing atmospheric burden of CO_2, but it is possible to estimate what will happen to the climate by using mathematical models of the atmosphere and its behaviour. The models fall into three principal classes as follows: (a) Simple models which assume that the atmosphere is everywhere in radiative equilibrium, with outgoing infrared radiation balancing incoming solar radiation at each point on the earth's surface; (b) First order models which assume that in addition to radiative processes, heat is transported by eddy-diffusion from the equator to the poles through the oceans and atmosphere; (c)General circulation models which assume that the basic hydrodynamic equations describing atmospheric motion can be solved numerically.

If it is postulated that the concentration of CO_2 doubles to 600 ppm, the simple model estimates that the average world-wide temperature will increase by 2.8°C. An added refinement which assumes that the average global relative humidity will also increase to 60% leads to a 3.9°C temperature increase, whereas a 40% relative humidity leads to a smaller increase of 1.9°C in the average world-wide temperature. First order models are latitude sensitive but lead to an average temperature increase of 2.4°C. The increase is least in the equatorial regions and very marked in the polar regions (10°C). These models lead to higher temperatures in the summer. General circulation models are much more complex and are limited only by the available computing facilities. They confirm the simpler models and lead to average increases of 2.9°C with the polar regions experiencing 8 to 12°C increases.

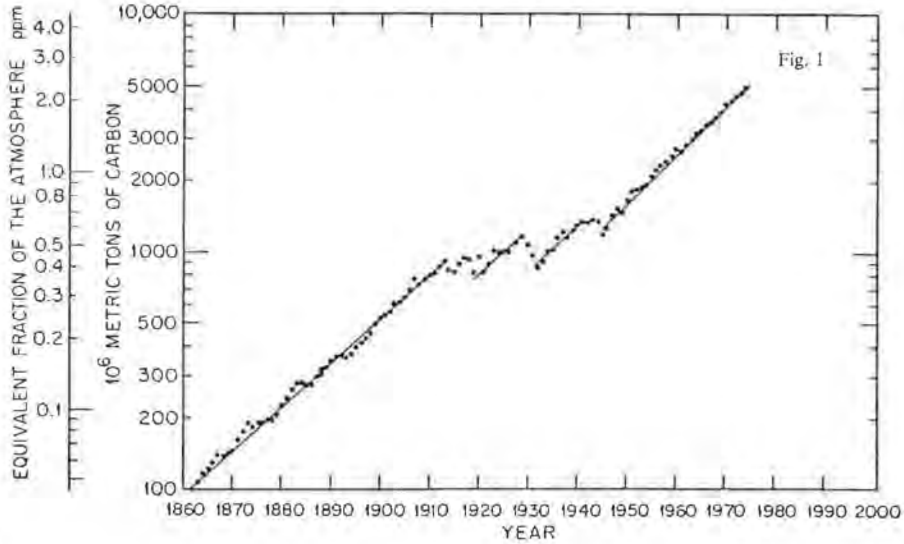
Superficially, a warmer climate would seem to be an attractive proposition particularly for Canadians. However, a major result of the predicted mean temperature increase would be to produce significant melting of the Antarctic ice cap where it is estimated that 90% of the world's glaciation is located. Glaciologists are convinced that it is the west Antarctic ice sheet which is most likely to melt under the influence of a warmer climate. This would raise world-wide sea levels by about 5 m and could occur within fifty years. The implications of this rise are very serious. For example, a significant portion of Florida (25% for a 4.6 m rise, and 33% for a 7.6 m rise), particularly in the south, would be flooded. It has been estimated that the effect of a 4.6 m sea level rise on continental U.S. would be to flood 1.5% of the land area containing non-removable taxable property valued at 110 billion 1971 dollars, and inhabited by 11 million people (6% of the population). A rise of 7.6 m would affect 2.1% of the land area, valued at 150 billion 1971 dollars and inhabited by 16 million people (8%). At least 10 nuclear plant sites would be involved.

A much greater catastrophy would occur if the entire Antarctic ice cap melted. The time scale for this event is unknown, but the best estimate places it at not less than 100 years and not longer than 1000 years. The effect would be to raise the mean level of the oceans by 60 m. Figure 2 shows the impact on Europe. The Baltic basin would enlarge and the Netherlands and Belgium would disappear. All major estuaries would back up. The Irish problem would be solved by physical partition.

A "business-as-usual" energy scenario for the 21st century, with a constant annual increase of 4.3% in the use of carbon fuels will lead to a doubling of the CO_2 concentration by the year 2035. More modest growth rates give us only about 25 years longer. In other words, this critical date cannot be significantly altered without changing the fuel mix. At present, approximately 84% of the global energy comes from fossil fuels and it will take some time for changes to occur throughout the Western world. Alternative energy sources can help alleviate the CO_2 problem but it will take consumate dedication by everyone to arrest population growth; to redistribute wealth between the developed, emerging and underdeveloped countries; to decrease the world energy consumption as well as the fraction of energy generated by fossil fuels. The cheapest and most efficient alternative source of energy is that which is gained by practicing conservation. The only ray of hope on the horizon is the fact that the U.S. consumption of energy has decreased by 1% in each of 1978 and 1979, while the real economic growth was a respectable 2%. It will take 70 years for this process to cut their energy consumption by a factor of two. At the same time, Canadians have distinguished themselves as energy hogs by continuing to increase their demand by a rate of 3 to 4% which will double consumption within 25 years. During that time we will consume as much energy as we have already done during our entire past history.

The economic feasibility of using renewable energy sources depends critically on the level of consumption. The CO_2 crisis can be averted only if we learn to conserve so that these alternative sources can become the norm.

Dr. H.A. Buckmaster is Professor of Physics, the University of Calgary.



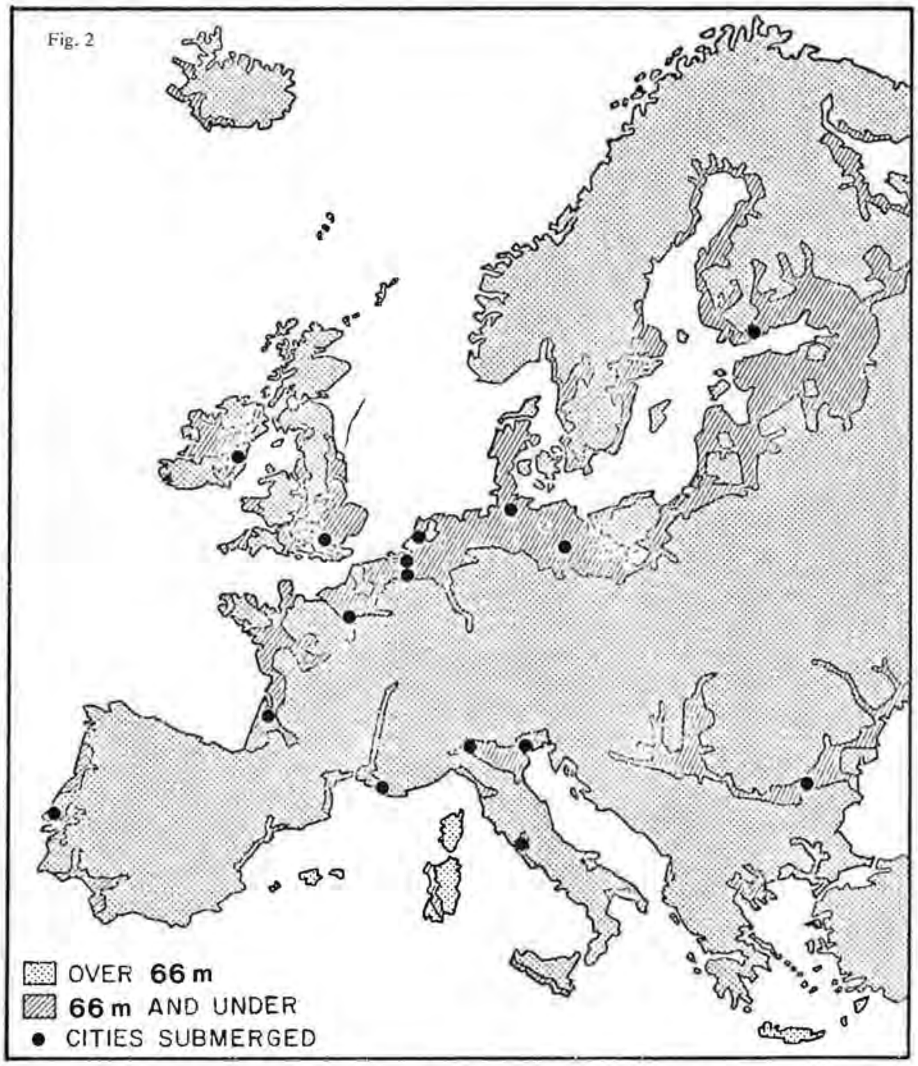
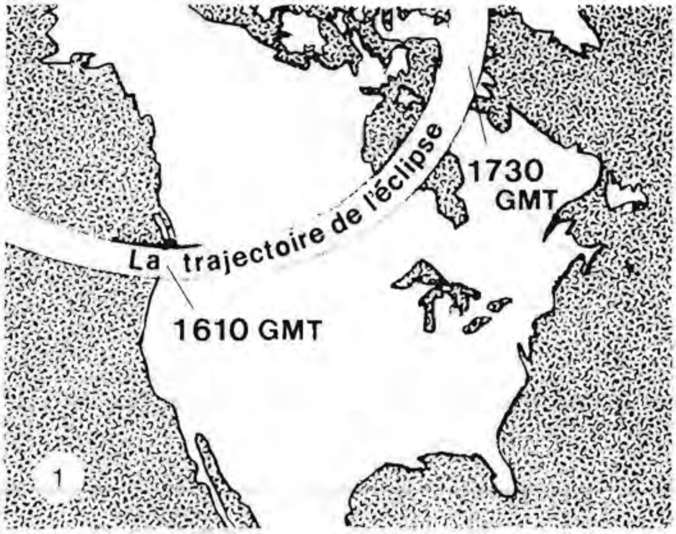


FIG 1. (Top). THE ANNUAL CO_2 PRODUCTION from burning fossil fuels and manufacturing cement has been increasing steadily since 1860. Of fuels such as oil, coal and tar sands derivatives, natural gas is much more efficient in producing energy while minimizing the impact of its combustion on the atmospheric CO_2 burden.
FIG 2. MAP SHOWING THE PRESENT BOUNDARIES OF EUROPE as well as if the melting of polar icecaps were to raise the sea level by 66 m.

SECTION FRANCAISE Edité par Claude Masse



L'ECLIPSE SOLAIRE DE 1979 par Peter Chen

L'éclipse solaire du 26 février, 1979 a donné une occasion unique au grand public et aux spectateurs scientifiques d'assister à l'alignement du soleil, de la lune et de la terre.

L'éclipse est apparue d'abord sur le Pacifique, à l'ouest de l'état du Washington, a atteint la côte vers 1610 GMT puis s'est dirigée vers les prairies et le nord-ouest de l'Ontario. Elle a atteint la terre de Baffin vers 1730 GMT et a continué sa trajectoire vers le Groënland (c.f. figure 1). J'ai observé l'éclipse totale au sud du Manitoba; le spectacle était impressionant. Les conditions atmosphériques étaient presque parfaites. Il n'y avait qu'une mince couche de cirrus qui présentait un obstacle, mais son effet était pratiquement nulle.

Les photos prises d'un satellite géostationaire de nous montre l'ombrage que la lune fait sur les nuages au'dessus des prairies canadiennes et des états du nord des E-U. Les figures 2, 3, et 4 sont des photos visuelles prises par GOES-EAST le 26 février à 1530, 1601, et 1636 GMT. Sur la photo de 1530 GMT (environ une demi-heure avant le début de l'éclipse dans le Pacifique), on peut voir une couverture nuageuse assez extensive au dessus du Montana, des Dakotas et du sud de la Saskatchewan, et s'étendant dans le sud du Manitoba. On peut aussi voir une dépression importante au sud-est des Grands Lacs.

La photo de 1601 GMT, nous montre que l'éclipse a envahi la côte ouest, puisque les nuages à gauche de l'image sont dans l'obscurité.

A 1636 GMT le centre de l'éclipse vient du de traverser la frontière sud entre le Manitoba et la Saskatchewan. Les nuages au dessus des prairies sont dans l'ombre de la lune, tandis que ceux à l'extrémité ouest de la photo ont réapparu. Au retour de mon voyage au Manitoba, j'étais très emballé par ces photos-satellites qui me rappelait cet événement important...mais rien, ni même la mémoire la plus fidèle ne saurait reproduire ces quelques instants extraordinaires d'obscurité et de silence.

LA VILLE ET SON CLIMAT

par Richard Leduc

Depuis l'apparition de l'humanité sur la planète, le climat terrestre a subi de nombreux changements dans lesquels la part de l'homme reste négligeable. D'autre part, depuis ces temps lointains, l'un des faits historiques des plus significatifs fut l'augmentation de la population et la migration de l'homme du milieu rural vers le milieu urbain.

Actuellement, les deux grandes agglomérations de Toronto et Montréal contiennent à elles seules environ 20% de la population canadienne. En l'an 2000, 81% de la population des pays développés vivra en milieu urbain et au niveau mondial cette proportion atteindra 51%.

L'environnement urbain est donc celui où vivra une partie sans cesse croissante de la population et il devient donc important de comprendre comment la ville modifie le climat; peut-être, par la suite, sera-t-il possible de gérer le climat urbain de façon à minimiser ses désagréments et à profiter de ses avantages. Nous présentons ici quelques éléments d'information sur la modification du climat par le milieu urbain.

Pour le moment, il semble pratiquement impossible de prévoir le détail des influences sur le climat des ensembles bâtis. Cependant, plusieurs études expérimentales ont permis de dégager l'influence générale de la ville sur les variables climatologiques majeures comme la température, le vent, la précipitation ect.

Le citadin est principalement sensible à l'effet de la température d'ou l'importance du nombre d'études consacrées à l'îlôt de chaleur urbain. Récemment, à Québec on a procédé à deux expériences réalisées dans des conditions optimales de contraste rural-urbain. En hiver comme en été, la différence moyenne de température entre le secteur le plus chaud et la zone rurale était de 5°C; en été la différence maximale de température était de 8°C. Les secteurs les plus densement urbanisés sont les plus chauds; en été, les parcs agissent comme des climatiseurs donnant un air nettement plus frais que dans les quartiers avoisinants. En hiver, alors que la neige et la glace recouvrent les espaces verts, la température est beaucoup plus uniforme sur les secteurs de banlieues, ces derniers se a comportant presque comme le milieu rural. Les différences notées sur Québec et ses banlieues lors de ces deux expériences sont importantes et le cidadin doit, pour son confort, ajuster sa tenue vestimentaire. Cependant, dépendant de sa taille, l'influence de la ville peut se détecter jusque dans les températures annuelles moyennes. Par exemple, à Londres, la température moyenne annuelle est de 1.4°C supérieure à celle de la campagne environnante. Une telle différence se répercute sur la croissance des plantes et sur les besoins de chauffage et de climatisation. De même à Paris, la saison sans gel s'est rallongée d'environ un mois et demi depuis le dernier siècle.

Mais les effets ne sont pas seulement bénéfiques. Lors de situations synoptiques entraînant des conditions de canicule particulièrement sévères, l'augmentation de la température en milieu urbain peut s'avérer néfaste pour le citadin évoluant dans les secteurs les plus urbanisés. A Montréal, une étude portant sur le confort thermique a montré que l'augmentation de la température, combinée à un vent faible, avait pour effet d'accroître de façon importante l'inconfort du citadin tandis que le rythme cardiaque lui-même s'élevait jusqu'à la limite supérieure de sécurité (110 b/m) pour l'individu en bonne santé.

Le flux d'air dans la zone urbaine diffère de celui observé en zone rurale, cette dernière étant aérodynamiquement moins perturbée par suite d'une plus faible rugosité et d'une température plus basse. En général, le vent en milieu rural est d'environ 25% plus élevé que celui en milieu urbain. Cependant, ceci peut s'avérer faux dans le cas où l'ilôt de chaleur est bien développé; l'air chaud ascendant au-dessus de la ville est remplacé par de l'air plus frais en provenance de la périphérie et si cette convection est assez forte, le vent qui en résultera sera plus élevé que celui à la campagne. On a noté à St-Louis une pulsation apparente de cette convergence vers le centre-ville, l'air en provenance de la banlieue devant se réchauffer suffisamment pour pouvoir se soulever. Le vent en milieu urbain est souvent accéléré très fortement par la présence même des édifices et par une canalisation dans les rues convenablement orientées par rapport au vent régional; les citadins sont familiers avec ces effets désagréables (au coin des édifices surtout) qui en certaines occasions peuvent entraîner des blessures ou des dommages matériels. En hiver, lors des tempêtes, ces vents peuvent balayer d'énormes quantités de neige qui seront déposées dans des endroits les plus incongrus. Il est donc important de connaître la réaction du flux d'air à de nombreux édifices ou à des ensembles bâtis puisque certains arrangements peuvent être très néfastes pour la santé et la sécurité du citadin.

Pratiquement, les bénéfices a retirer d'une planification d'ordre climatique sont intéressants; par exemple, au point de vue de la conservation de l'énergie, des rues convenablement orientées réduiraient de façon significative les pertes par infiltration. Un autre exemple intéressant nous est donné par Fermont, où une bonne partie de la ville bénéficie de la protection des vents du nord et du nord-ouest par la présence d'un édifice public spécialement localisé à cette fin.

La ville modifie aussi l'ennuagement et la précipitation mais ces modifications se font surtout sentir en aval de la ville. On croit que ce sont les pluies les plus importantes qui sont le plus affectées alors que la fréquence des orages est à la hausse d'environ 15%. La ville, par sa chaleur artificielle, peut aussi, quand la température est près du point de congélation, favoriser la fonte des cristaux de neige; on observera alors de la pluie à la ville et de la neige en milieu rural. A Paris, une étude a montré qu'il existait une corrélation entre le jour de la semaine et la précipitation; l'activité urbaine sur semaine favoriserait une augmentation de la précipitation tandis qu'une diminution en fin de semaine suivrait. La surface urbaine étant hautement imperméable (béton, asphalte, toitures, etc), l'eau de précipitation ruisselle presque automatiquement après sa chute; le temps de réponse de la ville devient donc extrêmement rapide comparativement à celui du milieu rural. Lors de précipitations très intenses, la quantité d'eau de pluie à évacuer, en un temps relativement court, est phénoménale. Si les systèmes sont inadéquats ou défectueux, des inondations sont à craindre.

La ville modifie le climat. A bien des points de vue, les mécanismes et les conséquences de ces modifications sont encore peu compris. Beaucoup de travail reste à faire avant de pouvoir planifier correctement l'environnement urbain pour le bien être des citadins et la préservation de la nature en général.

DESIGNING FOR A NORTHERN CLIMATE

by John C. Royle

Rocketing energy prices have suddenly made Canada's severe northern climate a much more important consideration in structural design. A few dozen architectural, engineering and construction firms are taking advantage of the nation's vast severe climate laboratory to earn national and international reputations.

Structures are our primary response to climate. Other responses include clothing, life style, attitudes and to a lesser degree landscaping. In our winter latitudes, structures are necessary not only for comfort and convenience, but for very survival.

To mention a few notable climate-influenced projects: the Eaton Centre, designed by architect Eberhard Zeidler, and the Joseph Shepard Federal building, designed by architect Macy DuBois, both in Toronto; Saskatoon's Meewasin Valley Project, conceived by architect Raymond Moriyama; Hornepayne's new town-in-a-town complex spearheaded by developer Ernest Balmer of Hallmark Hotels Ltd; Edmonton's new convention centre, now being built, designed by architect B. James Wensley; the fiberglass and plastic buildings in the Canadian Arctic designed by Montreal architect, Guy Gerin-Lajoie; and the Gulf Canada Square complex in Calgary built by developer Gerhard Moog.

Besides architects and developers, the new breed of climate-design specialists include consulting engineers, planning consultants, energy consultants, contractors specializing in solar and energy-efficient technology, and manufacturers of such items as solar heaters, thermal drapes windmills and heat exchangers. The growing volume of enquiries reaching these firms form across Canada and beyond its borders indicate that the much-maligned Canadian climate could, in fact, turn out to be a considerable asset, an "unsuspected resource" unrecognized as long as energy was so cheap we could afford to throw it away.

Studies recently undertaken with the help of the Canadian Climate Centre, Atmospheric Environment Service (AES) have turned up some interesting climate statistics. Saskatoon, for example, with an average annual mean (airport) temperature of 1.6 degrees C., and Edmonton, with an annual mean of 1.4 degrees C (airport), are colder than Anchorage, Alaska's only big city (200,000 pop.) which has an annual mean of 1.7 degrees C. Northern Ontario's temperature range shows it is colder than Finland, Europe's coldest country except for the Soviet union. Northern Ontario's coldest average annual mean is Trout Lake, -3.1 degrees C.; its warmest, South Bay Mouth, 5 degrees C. Finland's coldest is -2 degrees C. at Enontekio; its warmest, 5.9 degrees C. at Uto. A series of studies and comparisons, checked with A.E.S., convinced me that Canada is the second coldest large developed country in the world, next to the Soviet Union. Antarctica, Greenland and Alaska are colder but could not be considered as developed countries. Saskatoon, Edmonton and Regina were shown to be the coldest big cities (100,000 pop. plus) in the world outside of the Soviet Union, with Calgary, Winnipeg and Thunder Bay not far behind. The Southern Hemisphere has no large developed countries in the comparable climatic belt.

Generally recognized as the pioneer of the design-for-severe-climate school was a British architect named Ralph Erskine who twenty years ago moved to Stockholm (average annual mean, 6.5 degrees C., the same as Montreal airport) and could not understand why people seemed to prefer to suffer under the rigorous climate rather than trying to do something about it. He began to look for new ways to use structures in order to soften the harshness of winter, and to design climate-sensitive buildings in Stockholm and "Arctic towns" for northern Sweden and Finland. His fame soon spread to Canada. He served as consultant in designing the sub-Arctic town of Fermont, a mining town of 10,000 population near the Labrador border in Quebec. The town uses a "windscreen" building which is three-quarters of a mile long in order to protect it from winter winds. All services are linked with this building and the main street is in effect the fully-enclosed walkway extending through its lower floor. Erskine was then invited to submit plans for a new townsite at Resolute Bay, centre of much oil-exploration activity in the High Arctic. The new community was to be a model of Arctic design, featuring windscreen buildings, a glass-enclosed park, polished metal reflectors to increase availability of sunlight, and other unique features. Much of the site was prepared, but the project was suspended in 1978, after a small group of buildings was erected, because of uncertainty over Resolute's future. While this was happening, Dr. William C. Rogers, Director of the World Affairs Center of University of Minnesota, Minneapolis, having lived in balmy Kansas, was increasingly concerned that Minnesotans were ignoring the drabness, discomforts and inconvenience of their cities in the winter months, while losing industry, people, wealth and energy to the U.S. sun belt. Rogers coined the phrase "The Livable Winter City" and set out to rouse public interest in the subject through a series of conferences and public meetings. These are still being held. Rogers has also written a book, "The Livable Winter City".

In Canada, the energy crunch has convinced architects and developers that designing for climate is the way of the future. Underground concourses have been constructed or expanded in Montreal, Toronto, Winnipeg and Edmonton. Glass-enclosed second-story connecting walkways are spreading through downtown Calgary and are appearing in Winnipeg and elsewhere. New covered shopping malls and glass-domed blockbuster developments, such as the Eaton Centre, were soon jammed with customers, showing that people wanted more winter comfort and convenience. Quebec City and Thunder Bay have put roofs over parts of their central downtown streets. Sherbrooke, Ottawa, Guelph, Kitchener and other communities are working on plans for similar amenities. Big new energy-efficient structures, including the new Reference Library in Toronto and Gulf Canada Square in Calgary were built without conventional boilers, to be heated by the sun's rays plus the heat given off by human bodies and by internal lighting and machinery.

In 1979 Saskatoon retained Raymond Moriyama, noted architect, to devise a 100-year conceptual master plan that would make it an outstandingly livable city in all seasons. Named the "Meewasin Valley Project" the plan has attracted international attention. Buffalo University School of Architecture has used it for special studies. And Dr. Frederick Gutheim, Washington, D.C., world-known planner and consultant with the United Nations, will feature the Meewasin plan in a lecture in Minneapolis in January. Dr. Gutheim sees the Meewasin plan as a world benchmark in the design of winter latitude cities. The Meewasin plan, now approved and in the process of being implemented by a duly-established "Meewasin Valley Authority" ("Meewasin" is the Cree word meaning "beautiful" and "happy meeting place") will make Saskatoon and the surrounding area a delight to live in, and a major attraction for visitors. The underlying emphasis is to induce people to spend as much time out of doors as possible in all seasons, while providing a range of glass-domed and climate-controlled alternative attractions and amenities. The city's heritage will be cherished and preserved, and every encouragement will be given to cultural and social activities.

An integrated climate-designed townsite, akin to Fermont, was constructed this year by Hallmark Hotels Ltd., at Hornepayne in Northern Ontario and will soon be officially opened. Similar structures are in use at Leaf Rapids and Churchill, Man. Winnipeg, late in 1979, held a "Wonderful Winter Winnipeg" conference and series of celebrations. Manitoba's provincial Ministry of Tourism, in its 1980 fall promotion campaign, urged Manitobans and visitors alike to "Warm Up to Winter". Edmonton asked its civic staff to prepare a report o what could be done to make the city more pleasant in winter. The "Winter City" idea seems, without doubt, to be taking hold. Some predictions can surely be made: the design-for-climate specialists of all types will learn through experience. Design flaws will be eliminated. Products and services will improve, and as a consequence the demand for them will grow.

As the general public observes that changes and improvements can be made in the worst aspects of winter, widespread attitudes, which presently range from indifference to trauma, will improve. Winter, the longest season for a large majority of Canadians, can be tamed by appropriate design. Inevitably there will always be sun-seekers, but more Canadians will be content to stay at home during the coldest months of the year and foreign visitors will be more inclined to take advantage of the harmoniously designed city facilities. From any point of view, be it economic, energy conservation or improved life-style, designing for the climate makes sense. Increasingly, Canadians and Canadian firms are coming to the forefront in the fight to cut winter down to size.

John Royle is a technical journalist who for fome years has researched, written and spoken in Canada and internationally on the need for northerners, including most Canadians, to open their eyes to their winter latitude climate.

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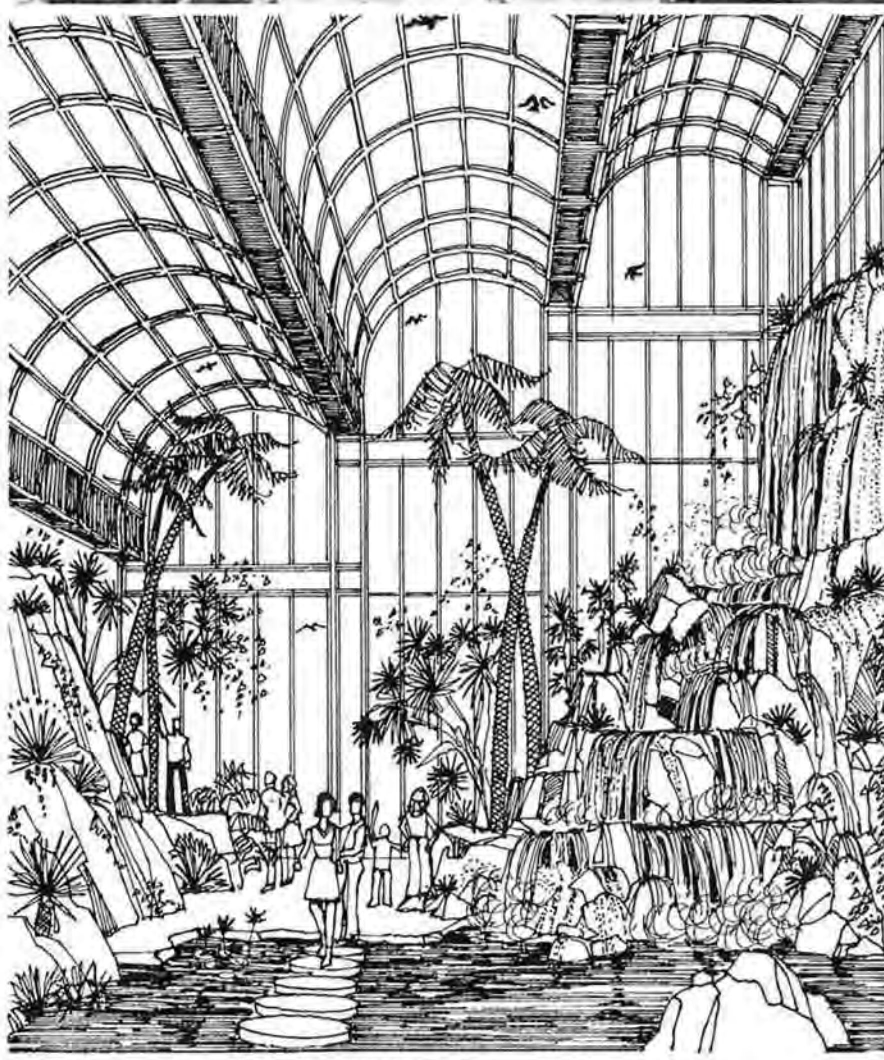


The Winter Garden Courtesy RAYMOND MORIYAMA

PHOTO (Top). A HISTORICAL VIEW OF THE CONVENTIONAL CITY. Toronto shovels out from beneath the record 24 hour snowfall of 52 cm which paralyzed transportation on December 11 and 12, 1944. BELOW. THE CITY OF THE FUTURE. The Winter Garden, part of Raymond Moriyama's design for the Meewasin Valley Project, a 100-year Master Plan for the Saskatoon, Saskatchewan area which among other things envisages tiered gardens within glass structures. It is a "forest" of tall tropical trees interspersed with walks, streams and waterfalls — a joy in summer and an elevating experience in winter, and connects with adjacent shopping centres and convention or trade centres.

At first glance it would appear that the general weather regime in Canada during 1980 was not particularly favourable for the production of severe local storms. In the west, a widespread prairie drought during the spring and early summer deprived the atmosphere of the moisture necessary for thunderstorms. In parts of the east, the summer and fall was cooler and more cloudy than normal thus reducing the amount of solar energy available to fuel local storms. In spite of these inhibiting factors, 69 hail days were reported in Alberta by the Alberta Hail Project, a number which was 48% above normal. There were at least 79 tornadoes across the country which was comparable to other years, but in Ontario, the 1980 seasonal total of 45 was well above the average seasonal total of 27 that would be expected based on data for the past 15 years. Perhaps this can be explained by the fact that on balance, normal or above normal amounts of moisture were actually available everywhere, even in the areas previously stricken by drought.

Tornadoes and Hailstorms

The geographical distribution of tornadoes is presented in Table 1. Due to incomplete information only 66% of the total can be classed as "probable" or "confirmed" tornadoes. It is noteworthy that only two of the 79 reached the F2 category on the Fujita-scale (a scale from zero to 5 which gives an indication of tornado strength). One occurred on Wednesday morning July 16, 1980 in Windsor, Ontario, injuring 10 people and causing an estimated $0.5 million damage. During the early hours of Thursday July 17th., about 20 hours later this same storm complex struck again in Dollard-des-Ormeaux a western suburb of Montreal, P.Q., causing a similar amount of damage. The remaining tornadoes were all classed as weaker F0 or F1 types. The general trend towards a larger number of weaker storms was also reported by the Alberta Hail Project.

This is not to say that large hail or tornado damage was lacking altogether. Golf ball sized hail was reported in each province from Nova Scotia to Alberta, particularly in association with tornadoes. On Monday June 23, 1980 such a storm combination caused damage estimated at $1.6 million in Yorkton, Saskatchewan. The photographs on this page illustrate some of the $0.9 million damage sustained during a tornado which swept from Georgetown to Brampton, Ontario on Saturday May 31, 1980. On May 23rd., Hilda, Alberta and vicinity suffered $400 thousand damage from a tornado, and on April 6th., the first tornado of the year caused $100 thousand damage near Altona, Manitoba.

Funnel Clouds and Waterspouts

Besides tornadoes, which are funnel clouds reaching the ground and causing damage, 43 funnel clouds aloft were reported across Canada during the tornado season which began on April 6th., and ended on October 10th additionally, 16 waterspouts were spotted over Canadian waters.

Fatalities and Injuries

Although tornadoes were fairly numerous, other phenomena were the cause of all the fatalities directly attributable to the weather (see Table 2) as well as for most of the injuries. Flash floods claimed 5 lives, lightning killed 5 people and injured another 11, windstorms killed 2 people and injured 8, while tornadoes accounted for 13 injuries. These totals are not necessarily complete and therefore represent the minimum number of fatalities and injuries due to the weather during the local severe storm season.

Hurricanes

The 1980 season produced 10 North Atlantic hurricanes, none of which directly affected Canada, although the track of *George* (see opposite page) approached within 275 km of Cape Race, Newfoundland. Of this total, only *Allen*, the first of the season, represented extreme danger to populated land areas. It left a swath of death and destruction through the Caribbean, killing more than 250 people as it travelled westwards towards the mainland. Rated as a category 5 on the Saffir-Simpson scale (the top of the scale representing catastrophic damage), it slammed ashore north of Brownsville, Texas. Hurricane warnings had prepared the population around the western shores of the Gulf of Mexico and mass evacuations of many thousands of people limited the impact to a score of injuries and a few deaths in that area.

Karl, shown on the front cover, was not a true tropical cyclone.

Province TABLE 1	Number of Tornadoes	Number of deaths (All causes)	Number of injuries (All causes)
B.C.	0		
ALTA.	7*		
SASK.	8	1	3
MAN.	6	1	
ONT.	45	7	26
QUE.	6	3	3
N.B.	1		
N.S.	3		
P.E.I.	3		
NFLD.	0		
TOTAL	79	12	32

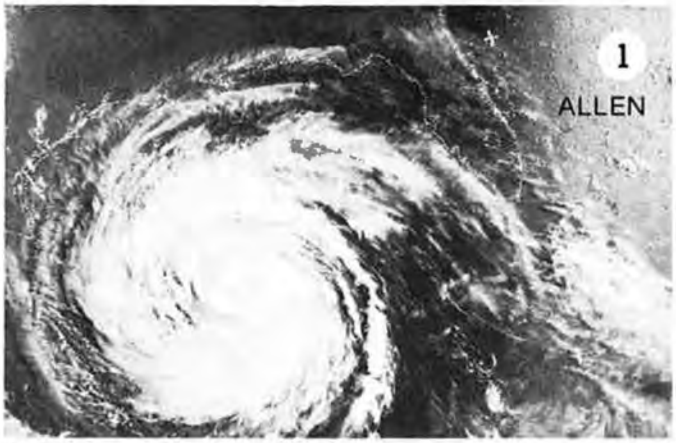
CAUSE	DEATHS	INJURIES
FLASH FLOOD	5	
LIGHTNING	5	11
TORNADO		13
WINDSTORM	2	8
TOTAL TABLE 2	12	32

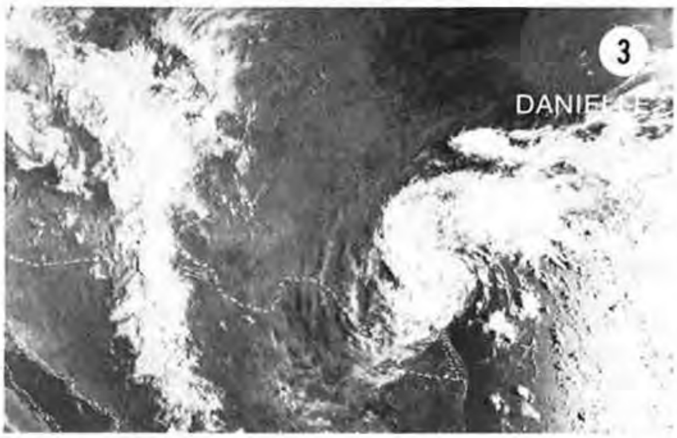
PHOTOS (Above). DAMAGE CAUSED DURING THE GEORGETOWN TO BRAMPTON TORNADO of May 31, 1980. Photos by P.J. Elms.

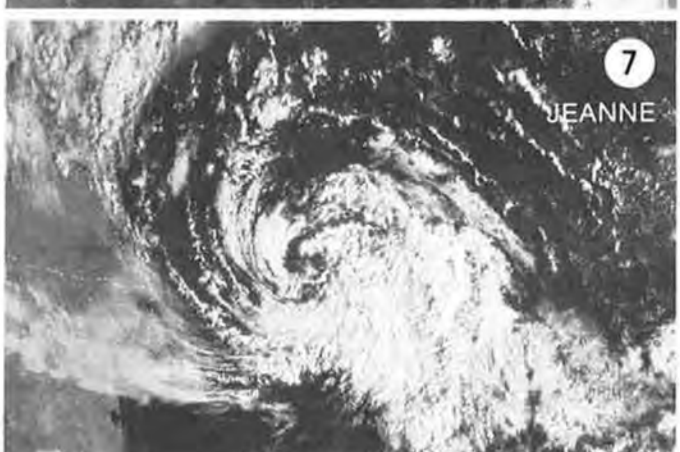
TABLE 1. THE GEOGRAPHIC DISTRIBUTION OF TORNADOES, deaths and injuries due to severe local storms of all types in 1980. *Information for Alberta was provided by Dr. K. D. Hage, University of Alberta.

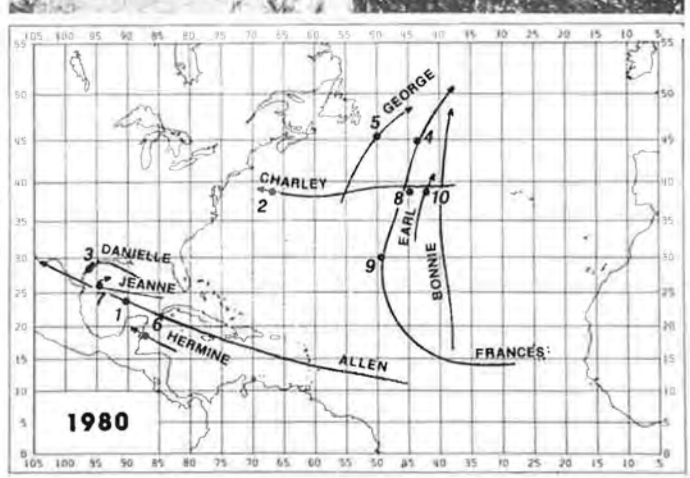
TABLE 2. CAUSES OF DEATHS AND INJURIES in Canada due to severe local storms in 1980. (This table does not include deaths and injuries due to large scale storms in the colder months of the year).

THE DIAGRAM (opposite, lower right) SHOWS THE APPROXIMATE TRACKS TRAVELLED BY THE NORTH ATLANTIC HURRICANES OF 1980, except for **Karl**. A picture of each hurricane (except **Bonnie**) is shown opposite, and on the front cover, and each is numbered to show the location where it was photographed by means of weather satellites. **1 Allen** photographed at 1331 GMT, August 8, 1980; **2 Charlie** at 2021 GMT August 23, 1980; **3 Danielle** at 1428 GMT September 6, 1980; **4 Frances** at 1828 GMT September 19, 1980; **5 George** at 1202 GMT September 8, 1980; **6 Hermine** at 1401 GMT September 22, 1980; **7 Jeanne** at 1407 GMT November 14, 1980.



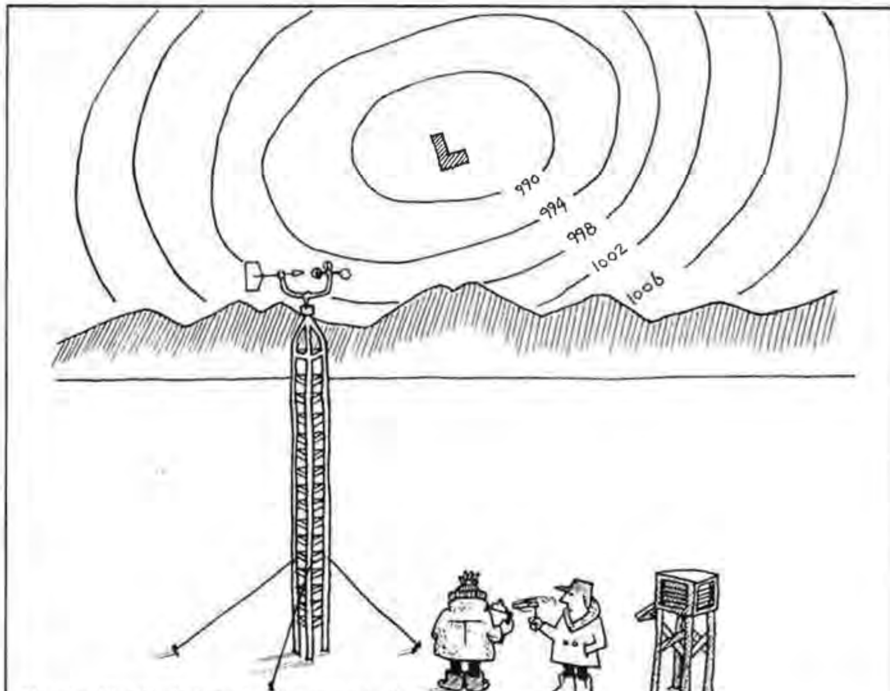






Photos courtesy SDL, A.E.S.

BOOK REVIEW



"Looks like that deep low is moving in."

PROSPECTS FOR MAN: CLIMATE CHANGE. Edited by J.R. Miller. York University, Toronto, 1980. Hardcover, 253 pages. $11.95.

This book is really one of four printed proceedings resulting from the York University symposia series entitled "Prospects for Man". It contains the contributions of seven prominent scientists, each of whom is familiar with the questions and implications relating to climate change, who were invited to speak at the fourth Prospects for Man symposium in June 1978. Each chapter is composed of the paper presented by its author, as well as what appears to be an edited version of the discussion following the presentation. The closing chapter is a reproduction of the final panel discussion by the seven men.

Dr. F. Kenneth Hare contributed the first paper entitled "Climatic Change: introductory Remarks". This in turn is followed by "Recent Climate Trends" by Dr. Jerome Namias; "Climate Theories" by Dr. W. Lawrence Gates; "Anthropogenic Impact on Climate" by Dr. J. Murray Mitchell; "An Experimental Deterministic Climate Model with Predictive Properties" by Dr. Reid Bryson; "Climate Change and World Grain Production" by Dr. Louis M. Thompson; "Potential Effects on Canada" by Dr. Patrick D. McTaggart-Cowan.

In spite of the heavyweight academic credentials of these contributors, this collection of papers deals with many aspects of the topic in a fashion which can be easily read and understood. Is the climate linked to ocean temperature anomalies? What is the effect on climate of current trends in the consumption of fossil fuels? What are the successes in long range forecasts of seasonal climate patterns? What results will climate change have on world grain crops? How should governments plan for increased climate variability? These and other questions are answered in a way which permits the reader to develop an insight into the complexities of climate, the difficulties in making climate predictions, and the implications of failing to respond to expected future increases in climate variability. Recommended reading.

FOCUS ON AIR by Angela and Derek Lucas. Crane Russak, New York, 1977. (Available in Canada from John Wiley & Sons, Toronto. Hardcover, 46 pages. As a set with "Focus on Earth", same author, $12.50.

Focus on Air is one of four titles dealing with water, oceans and the earth as well as in this case, the atmosphere. It is a lively information book designed for children in the higher grades of public school. The authors, a husband and wife team, have packed a surprisingly large number of concepts into the 46 pages (3 pages of which contain investigations which can be carried out by the reader).

Many full colour illustrations throughout help the reader visualize the concepts as they are presented. These include, for example, the concept of a beneficial envelope of air held by gravity around the earth; atmospheric pressure and temperature; the water cycle; energy exchange between the equator and the poles, and the winds which result. Specific weather phenomena are examined, how weather conditions are reported, and how weather information is applied to daily activities.

In this book the atmosphere is seen as a great force, an essential for life and something to be treated with respect, and protected so that life may continue. Its composition is explained and so too is the effect of changing the balance by means of pollution.

It should be noted that imperial units are used which could be a distinct disadvantage to those in areas where metric units are in common use. Otherwise the simple language and compact presentation make this a valuable learning source for younger children.

TRADE WINDS Edited by Claude Labine

Mory Hirt

The video scan system

CHINOOK VISITS MEP

Recently, Meteorological and Environmental Planning Ltd., (MEP), held an open house at their Downsview, Ontario office. A large group of visitors toured the MEP facilities and saw for themselves why this company is a leader in the private meteorological sector in Canada. MEP has clients worldwide and is known for its expertise in the field of air quality. This was the primary service offered when the company was founded in 1970 by its President, **Mory Hirt.** Since then, the company has expanded into four divisions to deal with the broad range of activities and services that it now offers. One of these is the Prediction Systems Division, which is new and responsible for a wide variety of activities in meteorological and environmental prediction. **Dr. Joseph Clodman,** recently retired from the Atmospheric Environment Service and internationally known for his work in the design and development of such systems, has accepted the position of vice-president. **Mr. F. Bernard Muller** has been named as chief scientist of the new division.

Guests at the open house were shown the weather video scan system of communication operated by MEP in support of the off-shore oil drilling operations of Aquitaine Canada. Video scans of weather forecast charts, satellite photographs and any other required imagery can be transmitted using a variety of communication links, for example broadband and/or regular telephone lines, H.F. radio, as well as satellites such as TELSAT, MARISAT, and ANIK. MEP regularly uses H.F. radio for this purpose, and relays information to video monitors located either on the bridge of the support ship at the drilling site, or to the MEP northern advance weather briefing office located at the support base on Brevoort Island (off Baffin Island). The video picture is digitized and the signal is sent via an antenna, located in Newfoundland, which can be operated by remote control from the Downsview office. The video transmission can be made simultaneously to several different locations for conference briefings, and the two way continuous communication operates as though the decision makers are in the office where the forecasts are actually produced.

A number of other services offered by MEP, including climatological studies, air pollution studies, meteorological network design and evaluation, snow forecasting, and forecasts for the media, to name a few, are handled by the Consulting and Forecast Divisions. The Computer Division is the fourth and final organizational component of the company, and provides support to the other activities. Apart from the Downsview office, MEP has branch offices in Montreal and in Calgary (Promet Environmental Group).

MEP has come a long way since it was founded ten years ago. Now, with the appointment of **Dr. Clodman** and **Mr. Muller,** the corporate credentials are even more impressive.

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15

ARCH PUZZLE

#15 and #16. Identification Tasks.

The task posed by the pictures on this page (#15 and #16) is to identify what they represent. Look at the pictures carefully. It is possible to identify from visual inspection alone; (a) the subject matter; (b) many different elements in each; (c) the location (in general terms) where they were taken; (d) the approximate time of the year. A prize will be awarded to the person who, in the judgement of ***Chinook,*** makes the most complete and correct identification of each picture. To be eligible, please send entries to Arch Puzzle, c/o Chinook, PO Box 427, Brampton, Ont., L6V 2L4, before March 15, 1981. The winner of each task will receive a copy of the book "Prospects for Man: Climate Change" edited by J. R. Miller.

Arch Puzzle #14 was the creation of the editor's daughter, who, after looking at previous puzzles, said she could do just as well at designing one. Somewhat dubious of this claim, the editor challenged her to produce, expecting to be able to crack it in a very short time. After spending three-quarters of an hour figuring it out, he finally came up with "It thought he was cool". The real answer, of course, is "He thought it was cool".

16

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