NRC·CNRC

NRC Publications Archive
Archives des publications du CNRC

Icing Observations 1964-65 - First Progress Report

Boyd, D. W.

For the publisher's version, please access the DOI link below./ Pour consulter la version de l'éditeur, utilisez le lien DOI ci-dessous.

Publisher's version / Version de l'éditeur:
https://doi.org/10.4224/20338569
Technical Note (National Research Council of Canada. Division of Building Research), 1965-09-01

NRC Publications Record / Notice d'Archives des publications de CNRC:
https://nrc-publications.canada.ca/eng/view/object/?id=bb862589-c177-4918-88c5-f486614a258d
https://publications-cnrc.canada.ca/fra/voir/objet/?id=bb862589-c177-4918-88c5-f486614a258d

Access and use of this website and the material on it are subject to the Terms and Conditions set forth at
https://nrc-publications.canada.ca/eng/copyright
READ THESE TERMS AND CONDITIONS CAREFULLY BEFORE USING THIS WEBSITE.

L'accès à ce site Web et l'utilisation de son contenu sont assujettis aux conditions présentées dans le site
https://publications-cnrc.canada.ca/fra/droits
LISEZ CES CONDITIONS ATTENTIVEMENT AVANT D'UTILISER CE SITE WEB.

Questions? Contact the NRC Publications Archive team at PublicationsArchive-ArchivesPublications@nrc-cnrc.gc.ca. If you wish to email the authors directly, please see the first page of the publication for their contact information.

Vous avez des questions? Nous pouvons vous aider. Pour communiquer directement avec un auteur, consultez la première page de la revue dans laquelle son article a été publié afin de trouver ses coordonnées. Si vous n'arrivez pas à les repérer, communiquez avec nous à PublicationsArchive-ArchivesPublications@nrc-cnrc.gc.ca.

National Research Council Canada | Conseil national de recherches Canada

Canada

NATIONAL RESEARCH COUNCIL OF CANADA

DIVISION OF BUILDING RESEARCH

No. 459

TECHNICAL NOTE

PREPARED BY D. W. Boyd CHECKED BY LWG APPROVED BY RFL

DATE September 196

PREPARED FOR Inquiry and record purposes

SUBJECT ICING OBSERVATIONS 1964-65 - FIRST PROGRESS REPORT

The weight of rime or glaze ice and the pressure increase caused by a gust of wind are two of the loads usually considered in the design of electric power transmission and communication lines and similar structures. Some information about wind gust speeds is available (for example in Supplement No. 1 to the National Building Code of Canada), but very little is known about the thicknesses of ice that may accumulate in different parts of the country. In recent years the Division of Building Research has been receiving a gradually increasing number of requests for information about the accumulation of ice on such structures. At the same time the Canadian Standards Association Committee on Aerial Joint Use of Poles (which is responsible for a part of the Canadian Electrical Code) was considering the possibility of revising their storm loading map.

There are several possible sources of information about icing loads or ice thicknesses resulting from freezing rain. The most obvious one is the Meteorological Branch of the Department of Transport which collects weather observations from over 2000 locations in Canada. At most of these stations the relatively infrequent reports of freezing precipitation and ice thickness have been entered in the "Remarks" column of the weather report form and have not been abstracted, averaged nor published. At over 250 stations where weather observations are taken every hour the occurrences of freezing precipitation are recorded on punched cards but the thickness of accumulated ice is only available from the "Remarks" in the

original report. So far the time needed to examine the "Remarks" for ice thicknesses has not been available.

A second possible source of information is the files of all the communication and power companies in the country. There are several reasons for not using this source, of which the most important is probably the difficulty of extracting the information from many years of files for many companies.

A third possibility is to consider new information or current weather only, at least for a start. If the assistance of many people can be enlisted then a little work from each of them might provide enough information in a few years.

This last source of information seemed to be the most promising. Early in 1964 the Division of Building Research drew up an "Icing Report Form" and the Subcommittee on General Requirements of the CSA Committee on Aerial Joint Use of Poles arranged for the distribution of over 1800 copies of the form to telephone, telegraph, electric power and other companies and commissions. It was hoped that all the power and communication organizations in the country would report the ice thickness for any storm that damaged any of their equipment. The use of damage as a criterion for reporting icing storms would naturally eliminate all the minor occurrences of freezing precipitation and at the same time ensure at least two reports (one from a telephone company and one from a power company) of any major icing storm.

ICING REPORTS

By the end of June 1965, 37 Icing Report forms had been returned to the Division of Building Research from 12 companies. Nine of these reports, from seven different companies, could not properly be considered icing reports. Two reported only hoarfrost, two reported drifting snow (one of them "with some rime and glaze"), and the other five reported "no ice". None of these nine reports mentioned any damage.

A second group of five reports was received from the weather station on Old Glory Mountain near Trail, B.C., at 7700 ft above sea level. These were mostly reports of rime icing caused by supercooled droplets in the clouds that frequently cover the mountain tops in winter. Such rime icing is very important at high elevations but it is formed in a quite different way from the glaze ice at lower elevations and should be studied

separately. It will not be dealt with further in this preliminary report.

The remaining 23 reports all mentioned ice that was reported or assumed to be mostly glaze. Most of the information in these reports is summarized in Table I. It should be noted that the first report refers to the winter of 1963-64. It is included in this report because of its severity. The place names are, in most cases, the nearest populated places; if needed, more precise locations are usually available from the original reports. The elevations are in feet above sea level but several of them are only approximate. The author of each report is identified only by the main business of his company. The date is the one on which the icing began. Winds are in miles per hour. Values following "G" are gust speeds. "S & ZR" means snow and freezing rain. If two values of ice thicknesses (in inches) were given in the original report, the larger is included in this report. If the distribution around a wire was not uniform then the average thickness was listed. "Other" includes poles, towers, railings, and flat surfaces. The abbreviation lgt. stands for light. In the damage column, "wires" or "poles" indicates that many of these were broken. The entry "2 wires" indicates that only 2 breaks were found.

FREEZING PRECIPITATION

The occurrences of freezing precipitation at over 250 hourly-reporting weather stations are recorded on punched cards by the Meteorological Branch. A routine tabulation (TAB 41) prepared from these cards lists, among other items, the dates of freezing precipitation at each station. If a freezing rain storm is defined as a period of from one to four days with freezing precipitation, then about 850 freezing rain storms were reported during the period from October 1964 to February 1965, inclusive. The weather stations in the Northwest Territories and the Yukon were excluded from this count, leaving approximately 230 stations.

Many of these storms seemed to fall into groups as if a storm were born in Alberta, for example, and gradually moved eastward to Newfoundland and was lost at sea six or eight days later. Others seemed to enter Ontario from the southwest and cross the Maritimes a few days later. This could be confirmed or refuted in each case by studying the synoptic weather maps, but for a preliminary report the rougher method of grouping is probably adequate. Eighteen such groups were identified comprising a total of 550 individual reports. The remaining 300 freezing rain reports seemed to be scattered and unrelated.

The first and last icing reports are outside the period for which freezing precipitation reports were studied. The other 21 icing reports all fell within one of the groups of freezing rain storms, except the one at Calgary for which a nineteenth group was formed. These freezing rain storms that resulted in one or more "Icing Report" are listed in the first part of Table II. The remaining freezing rain storms are listed in the latter part of that Table. The number of stations reporting each freezing rain storm is shown, and the average number of stations when there were, and were not, Icing Reports.

On 22 July an additional 69 Icing Report forms were received from Alberta. Of these, 44 reported frost but "no ice" and no damage. In the other reports the "diameter of ice" was reported (not the thickness as indicated on the form) and there is some doubt about what was meant because in 8 cases the "diameter of ice" was less than the diameter of the wire on which it formed. Whatever was meant, these 8 cases and 5 others marked "slight" cannot be considered to have caused appreciable loads. One report was repeated half an hour later. The remaining 11 reports are listed in Table III. The last column indicates whether there was freezing rain reported at any weather station in Alberta on that date or not. No mention of damage was made in any of these reports.

ILLUSTRATIONS

There is probably a marked correlation between the frequency of freezing rain and the thickness of icing accumulations. It was thought, therefore, that a map showing the average annual number of hours with freezing precipitation would be of sufficient interest to justify its inclusion in the report. Figure 1 was copied from a preliminary draft of a map being prepared by the Climatology Division and it may be revised before publication.

Three of the Icing Reports included photographs, some of which are reproduced in Figure 2. Those of a tower near the south tip of Conception Bay show that the clear ice on the guy wires was about 5 in. in radial thickness. Damage to other structures was caused by falling chunks of ice (like those shown) after melting began. On the power line near Antigonish some of the 4- by 8-in. wooden crossarms were broken. In the Gander photographs the ice on the twig is about 3/4-in. thick after some melting. On some of the small trees the ice was 1 in. thick.

DISCUSSION

Naturally it is not possible to draw even tentative conclusions about the distribution of icing in Canada from the Icing Reports for a single winter season. The number of significant reports received, however, was smaller than expected so that it will take many similar winters to collect enough information for even a tentative map of icing severity.

There were about 850 periods of freezing rain reported by about 230 weather stations. There were 106 Icing Report forms returned, 34 of which reported measurable icing, but only 11 of which reported any damage in the period from October 1964 to February 1965. There are two possible reasons for the few reports of damage: first, that most freezing rain storms are harmless, only about one in 77 causing damage; second, that much of the damage caused by icing was not reported. It is probable that both reasons affected the number of reports of damage but it is difficult to say which was more important.

The storms between 28 December 1964, and 9 January 1965, were severe over much of Cape Breton and part of the mainland of Nova Scotia. The four men who sent in Icing Reports from four different areas all work for the same company. It seems improbable that no other company suffered any damage.

The latest icing report from near Sedgewick, Alberta, seems to have been sent in by an off-duty meteorologist from Edmonton. He reports broken power lines and 40 telephone poles down in a 4-mile stretch, and says that "the old-timers in the place describe this storm as the worst spring storm in living memory." No report on this storm has been received yet (September 23) from any power or telephone company in Alberta.

In conclusion, it seems to be reasonably certain that the majority of occurrences of freezing precipitation do not cause any damage to power or communication lines. On the other hand it is evident that all the damage sustained last winter was not reported. It will be difficult to prepare an ice loading map of Canada based on a predetermined frequency or return period unless virtually all damaging storms are satisfactorily reported.

TABLE I

ICING REPORTS

LOCATION	PROV.	ELEV. feet	COMPANY	DATE	DURATION hours	WIND mph	WIND LATER mph	TYPE	THICKNESSES inches WIRE	THICKNESSES inches OTHER	EXPOSURE	DAMAGE
				1964								
Conception Bay	Nfld.	950	Manuf.	Jan.24	—	No	No	Glaze	5	8	Severe	By falling ice
Marathon	Ont.	1000	Rlwy.	Oct. 8	31	20	No	S&ZR	1	—	Low Flat	By broken trees
Dorval	Que.	98	Met.	Nov.16	6	No	G30	Glaze	1/8	1/8	Flat	None
Moncton	N.B.	248	Met.	Nov.20	4	20	30	Glaze	3/8	3/8	Flat	None
Haycroft	Ont.	—	Rlwy.	Dec. 4	7	Yes	No	Glaze	½	—	Flat	Wires
Halifax	N.S.	461	Met.	Dec. 5	17	26	26	Glaze	lgt.	—	Rolling	None
Dorval	Que.	98	Met.	Dec.11	4	10	No	Glaze	1/16	1/8	Flat	None
Smiths Falls	Ont.	—	Rlwy.	Dec.30	14	No	No	Rime	1/8	1/8	Flat	None
Spruce Lake	N.B.	MSL	Rlwy.	Dec.28	18	No	Yes	Glaze	3/8	—	Flat	None
Halifax	N.S.	461	Met.	Dec.28	21	G25	G25	Glaze	—	½	Rolling	None
Cheticamp	N.S.	1750	Power	Dec.29	10	90	30	Glaze	2	—	Flat	Poles and wires
				1965								
Antigonish	N.S.	920	Power	Jan. 1	24	Yes	No	Glaze	1½	4	Hilly	Poles and wires
Cape Mabou	N.S.	1050	Power	Jan. 2	7	35	20	Glaze	2	—	Flat	2 wires
Bay St.Lawrence	N.S.	1250	Power	Jan. 4	22	40	15	Glaze	2	—	Flat	Wires
Gander	Nfld.	488	Met.	Jan. 2	38	No	No	Glaze	—	1½	Flat	Trees and antennae
St. Hilaire	Que.	125	Rlwy.	Feb.10	2	Yes	Yes	Glaze	¼	—	Flat	Poles and wires
Lacolle	Que.	—	Power	Feb.10	2	Gusty	Gusty	Glaze	2	4	Flat	Poles and wires
Dorval	Que.	98	Met.	Feb.10	10	20G40	No	Glaze	3/8	¼	Flat	None
Dorval	Que.	98	Met.	Feb.12	3	G22	Yes	Glaze	1/10	—	Flat	None
Calgary	Alta.	3540	Met.	Feb.27	10	32	—	Glaze	—	1/8	Rolling	None
Millgrove	Ont.	—	Rlwy.	Feb.25	18	20	40	Glaze	½	½	Flat	Wires
Bethanie	Que.	650	Power	Feb.25	1	75	—	—	¼	—	Flat	Poles
Sedgewick	Alta.	2300	Met.	May 16	9	40G55	Yes	S&ZR	1	6	—	Poles and wires

TABLE II

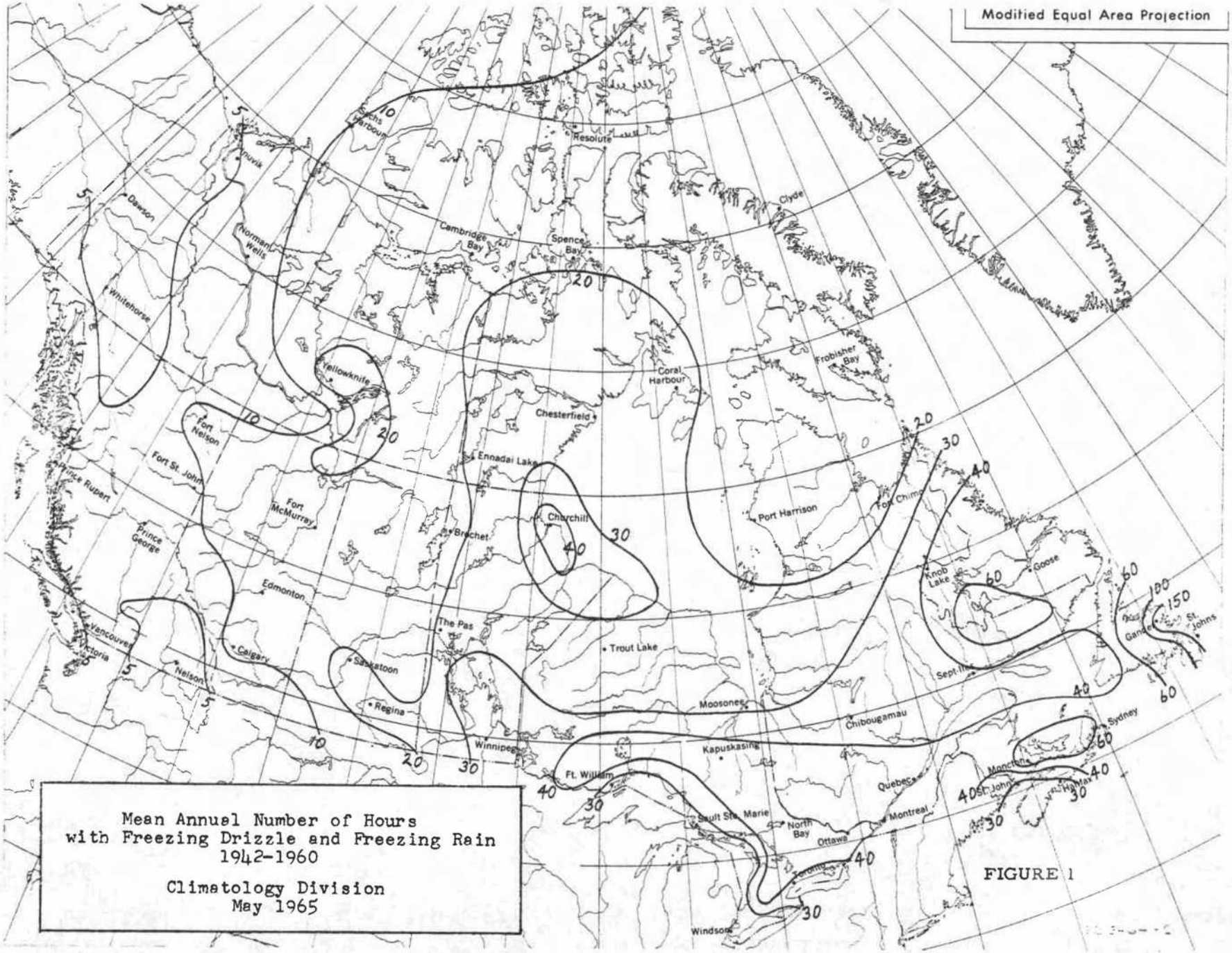
FREEZING RAIN STORMS

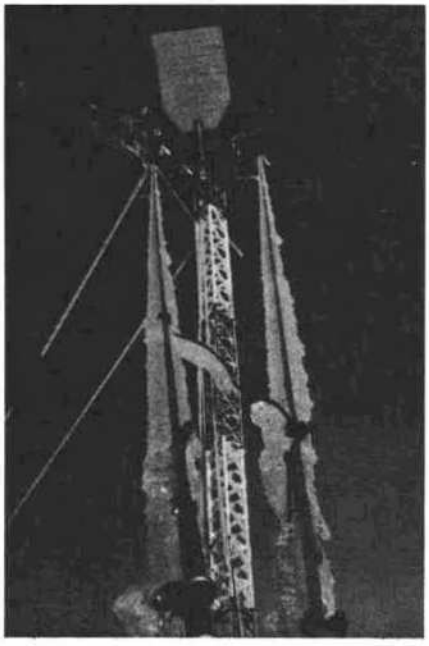
REGION	DATES	NO. OF STORMS	CORRESPONDING ICING REPORTS
	1964		
N. Ont. and N. Que.	Oct. 4- 9	7	Marathon
Alta. to Marit. & Nfld.	Nov. 9-20	73	Dorval, Moncton
S. Ont. to Marit. & Nfld.	Dec. 4- 7	26	Haycroft, Halifax
Alta. to Marit.	Dec. 10-13	42	Dorval
Man. to Marit. & Nfld.	Dec. 28-30	44	Smith's Falls, Halifax, Spruce Lake, Cheticamp
	1965		
Que., Marit. & Nfld.	Jan. 1- 9	34	Antigonish, Cape Mabou, Bay St.Lawrence, Gander
Ont. to Marit. & Nfld.	Feb. 9-13	62	St. Hilaire, Dorval, Lacolle, Dorval
Alta.	Feb. 27	2	Calgary
S. Ont. to Marit. & Nfld.	Feb. 25-28	48	Millgrove, Bethanie
Average number of stations = 38			
	1964		
N. Alberta to N. Que.	Oct. 17-23	10	
Alta. to N. Ont.	Nov. 22-24	27	
Alta. to N. Ont.	Dec. 3- 9	14	
Man. to Que.	Dec. 23-26	17	
	1965		
B.C.	Jan. 9-20	9	
Alta. to N. Ont.	Jan. 14-17	20	
Alta. to Ont.	Jan. 19-26	36	
Ont. to Nfld.	Feb. 6- 9	39	
Ont. to Marit. & Nfld.	Feb. 21-23	14	
Alta. to N. Ont.	Feb. 17-20	19	
Average number of stations = 21			

TABLE III

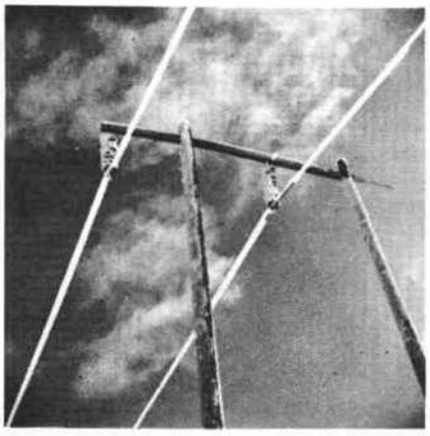
LATER REPORTS

LOCATION	PROVINCE	DATE	DIAMETER inches	DAMAGE	ZR REPORT
		1964			
Strathmore	Alta.	Nov.19	1/4	None	Yes
Camrose	Alta.	Nov.24	1/4	None	Yes
Fairview	Alta.	Dec.17	3/16	None	No
		1965			
Fairview	Alta.	Jan.4	3/16	None	No
		Jan.6	3/16	None	No
Red Deer	Alta.	Jan.22	1/8	None	Yes
Fairview	Alta.	Feb.1	5/16	None	No
		Feb.5	1/4	None	Yes
		Feb.8	1/4	None	Yes
		Feb.15	1/4	None	No
Calgary	Alta.	Feb.27	1/2	None	Yes


Modified Equal Area Projection
Mean Annual Number of Hours
with Freezing Drizzle and Freezing Rain
1942-1960
Climatology Division
May 1965
Resolute
Clyde
Cambridge Bay
Spence Bay
Frobisher Bay
Coral Harbour
Chesterfield
Yellowknife
Dawson
Whitehorse
Norman Wells
Fort Nelson
Fort St. John
Prince Rupert
Fort McMurray
Ennadai Lake
Churchill
Port Harrison
Brochet
Prince George
Edmonton
Vancouver
Victoria
Nelson
Calgary
Saskatoon
Regina
The Pas
Trout Lake
Winnipeg
Moosonee
Kapuskasing
Chibougamau
Ft. William
Sault Ste. Marie
North Bay
Ottawa
Montreal
Quebec
Knob Lake
Goose
Gander
St. Johns
Sept-Iles
Moncton
Sydney
Halifax
Windsor
FIGURE 1



Jan. 24, 1964
Conception Bay
Nfld.



Jan. 1, 1965
Antigonish
N. S.

Jan. 2, 1965
Gander
Nfld.

FIGURE 2

AR 3464-1