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An Investigation of the Storm of 24 November 1986

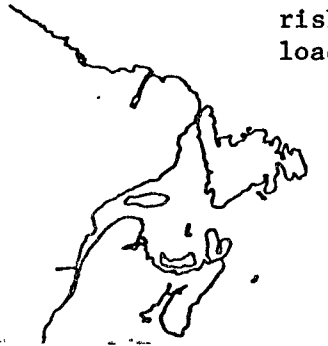
by

K.A. Macdonald
P.J. Bowyer
P. Pommainville

Maritimes Weather Centre
Bedford, N.S.

ABSTRACT

On the morning of 24 November 1986, the opening day of the lobster season off southwestern Nova Scotia, one fisherman drowned and four vessels were lost after heavy seas swamped a number of boats. Forecasts issued by the Maritimes Weather Centre accurately predicted wind speeds and significant wave heights associated with the storm; however, the most important factor was the steepness rather than the height of the waves. This steepness was the result of either a shoaling effect, the influence of the tidal current, or both. An equally important factor in this incident was a non-meteorological one. Competition amongst the lobster fishermen drove them to take risks, setting out into known bad weather conditions in heavily loaded vessels.



AN INVESTIGATION OF THE STORM OF 24 NOVEMBER 1986

Introduction

On the morning of 24 November 1986 the lobster fishing season opened along the coast of Nova Scotia from Halifax to Digby. Within less than two hours of the season opening a number of vessels were reported in distress in the area between Cape Sable Island and Yarmouth after being swamped by heavy seas. In the end four fishing vessels were lost and five others had to be towed into harbour. One fisherman from Morris Island lost his life in the sinking of his boat.

This report investigates the weather conditions which resulted in these losses. It begins with an overview of the synoptic situation which lead to these conditions. It then describes the wind conditions that were observed and assesses the accuracy of the forecasts issued by the Maritimes Weather Centre. Sea state conditions are then discussed and a physical explanation is given for the steep, breaking waves believed to have been responsible for the swamping of the fishing boats.

Synoptic Situation

On the evening of 23 November 1986 (240000Z) light southeasterly winds of 10 to 15 knots were blowing over the Lurcher Marine Area as a broad ridge of high pressure, centred near Sable Island, moved eastward away from the Maritimes (Figure 1). At this same time, a deepening low pressure system near Timmins, Ontario, was proceeding eastward on a heading towards the mouth of the St. Lawrence. A maritime frontal wave associated with this low was positioned near Sarnia, Ontario, with a warm front extending to Long Island and a cold front stretching towards the southwest.

During the subsequent 18 hours all of the above systems moved fairly rapidly eastward at approximately 40 knots in a strong upper flow. The low moved to near Baie Comeau, Quebec, by the afternoon of 24 November (241800Z), while the frontal wave moved to near Moncton, New Brunswick (Figure 3). The maritime warm front crossed the Lurcher Marine Area between 6 and 8 a.m. AST (Figure 2). The frontal passage resulted in a shift in wind direction as south-southeasterlies veered about 40 degrees to the south-southwest. Winds veered further to the west around 6 p.m. as the maritime cold front passed.

Wind Conditions

The light southeasterly winds which were reported over the marine areas off the southwestern shore of Nova Scotia on the evening of 23 November gradually strengthened during the night as the high pressure system gave way to the approaching low. By 8 a.m. on 24 November, approximately the

time the fishing vessels were getting into distress, winds are believed to have been from the south-southwest at between 20 and 25 knots. Later in the morning as the pressure gradient tightened about the deepening low, winds strengthened further to south-southwest at 30 knots with gusts to 35.

During this period, the Maritimes Weather Centre received no wind reports from the Lurcher Marine Area. The wind conditions described above have been inferred from reports received from surrounding marine areas, from the Bay of Fundy to Georges Bank, and from reports from the Fisheries Patrol Vessel Louisbourg, which were obtained during the follow-up investigation. A chronological summary of the reported wind conditions is given in Table 1.

Wind Forecasts

At 5:30 p.m. on 23 November, the evening before the incident, the marine forecast predicted southerly winds of 20 to 30 knots for the Lurcher Marine Area during the morning of 24 November. This prediction was repeated in the forecast issued at 12:45 a.m. on the morning of 24 November. As the situation evolved during the night, slightly stronger winds were expected to develop and at 5:45 a.m. a gale warning was issued for the Lurcher Area with winds forecast to increase to southerly 25 to 35 knots later that morning.

Sea State

Sea state forecasts are issued by the Maritimes Weather Centre twice daily based on guidance prepared by the Canadian Forces Meteorological and Oceanographic (MetOc) Centre in Halifax. Forecasts are for open water conditions and there is an advisory statement indicating that conditions may vary significantly in coastal areas where water depths are less than 50 metres. At 5 a.m. on 24 November the forecast predicted significant wave heights of 2 metres in the Lurcher Marine Area building to 2 to 3 metres in the afternoon.

Sea state observations are often quite sparse and this was certainly the case on 24 November. The data which were available, however, are consistent with the forecast. At 8 a.m., significant wave heights were reported to be 2.5 metres at a NOAA environmental buoy in the Gulf of Maine, while the report received later from the Louisbourg gave seas of 2 to 3 metres.

The Louisbourg also made a remark concerning the sea conditions which may shed light on the sinking of the fishing vessels. They reported that the 2 to 3 metres seas became very steep and were breaking in the shallow water near shore.

Two factors are likely to have contributed to this condition. First is the shoaling effect: as waves move into shallow water the bottom exerts a drag force. This results in the waves slowing down, causing incoming waves to gain on those ahead. This effectively concentrates more energy into a

smaller surface area and some kinetic energy is converted to potential energy. As a result the waves increase in height until they become top-heavy and break.

The second factor which may have come into play is the influence of the tidal current. The large tides associated with the Bay of Fundy are responsible for significant currents in and out of the Bay. These currents can be as great as 2.5 knots in the waters off Yarmouth, Nova Scotia. At 8 a.m. on 24 November the current would have been at its maximum, flowing towards the south as water receded from the Bay of Fundy. This tidal current would be acting in opposition to the advancing waves, in effect exerting an additional drag force. This, like the shoaling effect, would result in a steepening of the waves.

Non-meteorological Factors

The fishing boats which set out from port on the morning of 24 November 1986 were heavily loaded with lobster traps ready for deployment on this first day of the season. There was urgency to set out and get traps placed in the best areas. As evidence of this there are reports of over 16 captains being charged with leaving port prematurely before the 7 a.m. opening of the season.

Once setting out from ports in the Yarmouth/Cape Sable Island area, vessels must turn either to the east or west to reach the fishing grounds. This would leave them exposed to the broadside impact of the waves. According to Fisheries officials, it was at this point that the boats got into distress as the steep waves hit the heavily loaded vessels broadside and swamped them.

Conclusions

On the morning of 24 November 1986, a deepening low pressure system north of the Maritimes produced strengthening southerly winds over the Lurcher Marine Area. By approximately 9 a.m. winds were blowing at 30 knots and gusting to 35 knots. These winds generated waves which grew to 2 to 3 metres significant height.

The above conditions were accurately predicted through the forecasts issued by the Maritimes Weather Centre on 23 November and on the morning of 24 November.[1]

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[1] It could be argued that the gale warning issued at 5:30 a.m. on 24 November gave only limited advance notice of the gales; however, it must also be pointed out that the actual winds were only 5 knots stronger than forecast prior to the gale warning being issued. Even then, winds were only above 30 knots in gusts. Also, the warning was issued 1.5 hours before the vessels should have departed, thus their crews should have been aware of the forecast conditions.

Meteorologically it appears that the most important factor in the swamping of the fishing vessels was the steepness, rather than the height, of the waves. This steepness is believed to be the result of a shoaling effect, the influence of the tidal current or both. This would explain why the problems were concentrated in the Yarmouth area even though lobster fishermen were setting out from ports from Digby to Halifax.

The conditions described above, although predictable, were not described in the Maritimes Weather Centre forecasts. This level of detail (eg. describing the character of the seas and the near-shore variablility of the wind and seas) could not be achieved without significant improvements in weather and sea state observational networks, enhanced communications and the assignment of a dedicated meteorologist to marine forecast production.

Finally, it is apparent that an equally important factor in this incident is a non-meteorological one. Competition amongst the lobster fishermen drove them to take risks; setting out into known bad weather conditions in heavily loaded vessels.

Table 1

Marine Reports on 24 November 1986

Time	Vessel or Station	Location	Wind	Seas
240400Z	Yarmouth	(1)[2]	150/11	
240600Z	Mary Hichens (CGQW)	Southwestern Shore 44.2N 64.3W (2)	170/20	
240600Z	Buoy 44005	Browns Bank 42.7N 68.3W (3)	170/15	2m
240900Z	Mary Hichen (CGQW)	Southwestern Shore 44.2N 64.3W (2)	160/15	
240900Z	Buoy 44005	Browns Bank 42.7N 68.3W (3)	180/10	2.5m
240900Z	Yarmouth	(1)	160/12	
240900Z	Shelburne	(4)	170/05	
241100Z	Louisbourg	Lurcher near Cape Sable (5)	200/25	short/ steep
241100Z	Buoy 44005	Browns Bank 42.7N 68.3W (3)	200/10	2.5m
241200Z	Princess of Acadia	Grand Manan 45.2N 66.3W (6)	160/35	1m
241200Z	KNBD	Browns Bank 41.8N 67.7W (7)	200/24	1m sea 2m swell
241200Z	3FIN2	Browns Bank 42.1N 66.0W (8)	190/26	
241200Z	Yarmouth	(1)	180/18G23	
241200Z	Shelburne	(4)	170/13G20	
241330Z	Louisbourg	Lurcher (5)	200/30G35	
241330Z	Yarmouth	(1)	190/20G28	

[2] Numbers refer to locations which appear on map in Figure 4.

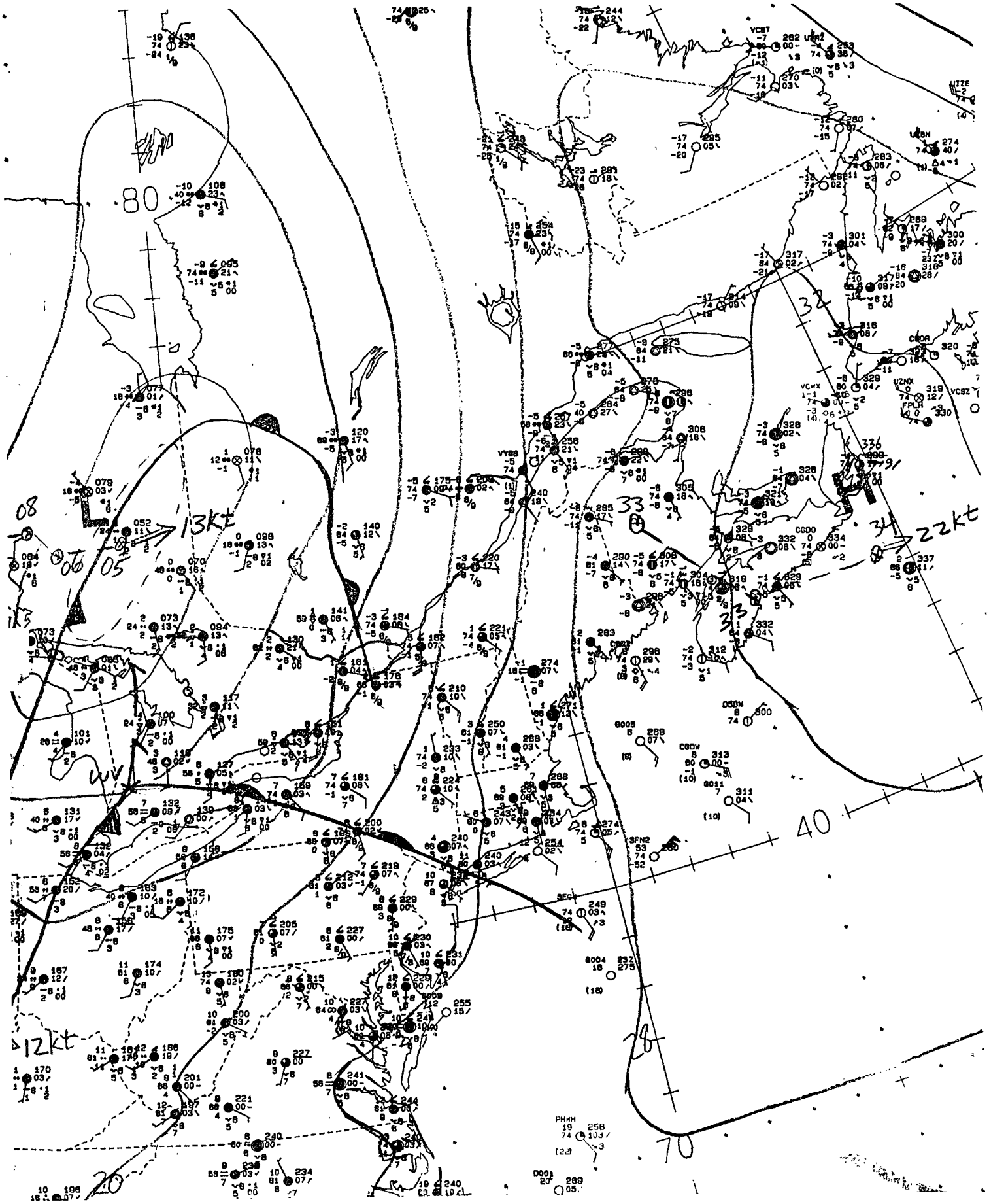

Figure 1
Maritimes Weather Centre Surface Analysis
24 November 1986, 0000Z

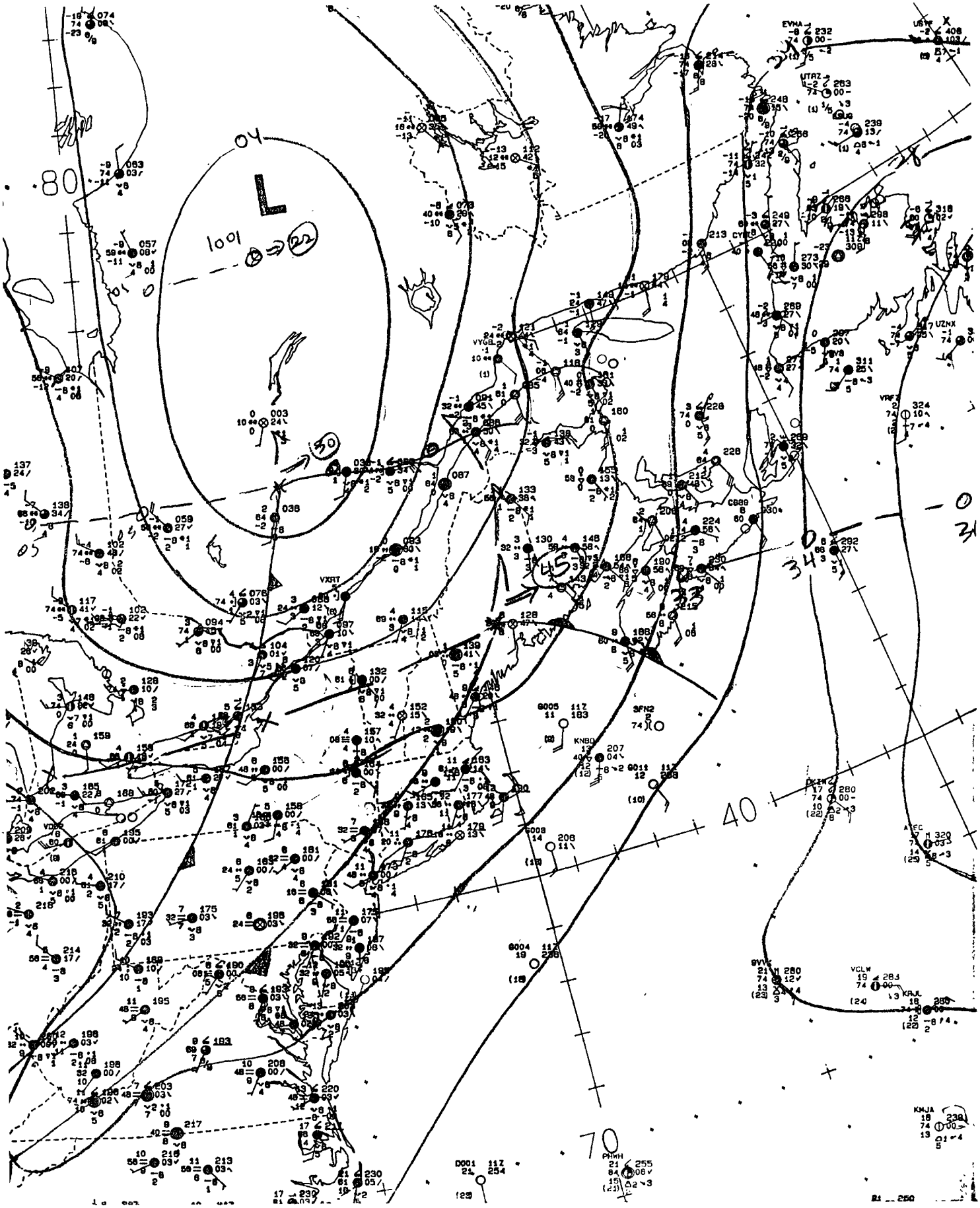

Figure 2
Maritimes Weather Centre Surface Analysis
24 November 1986, 1200Z

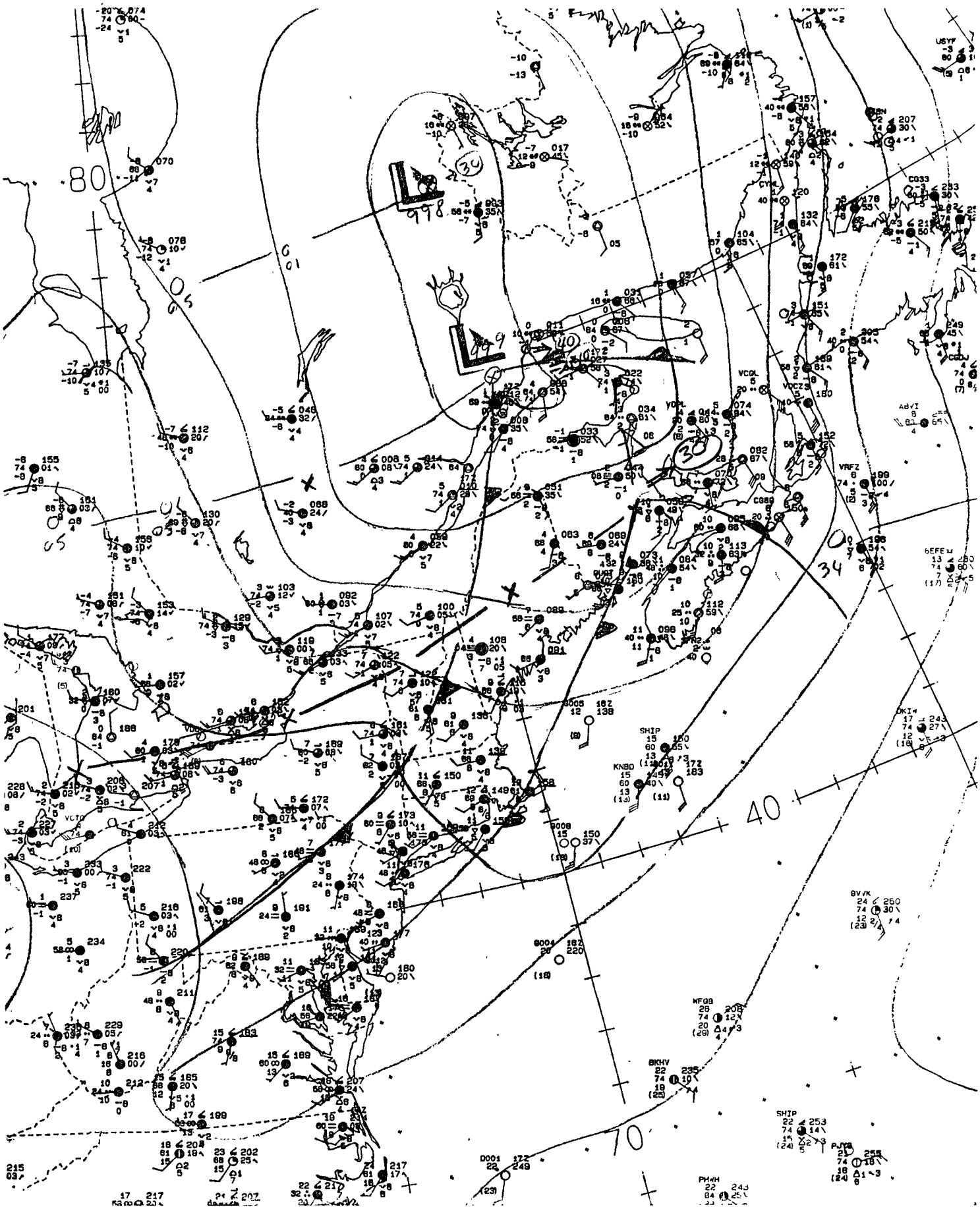

Figure 3
Maritimes Weather Centre Surface Analysis
24 November 1986, 1800Z

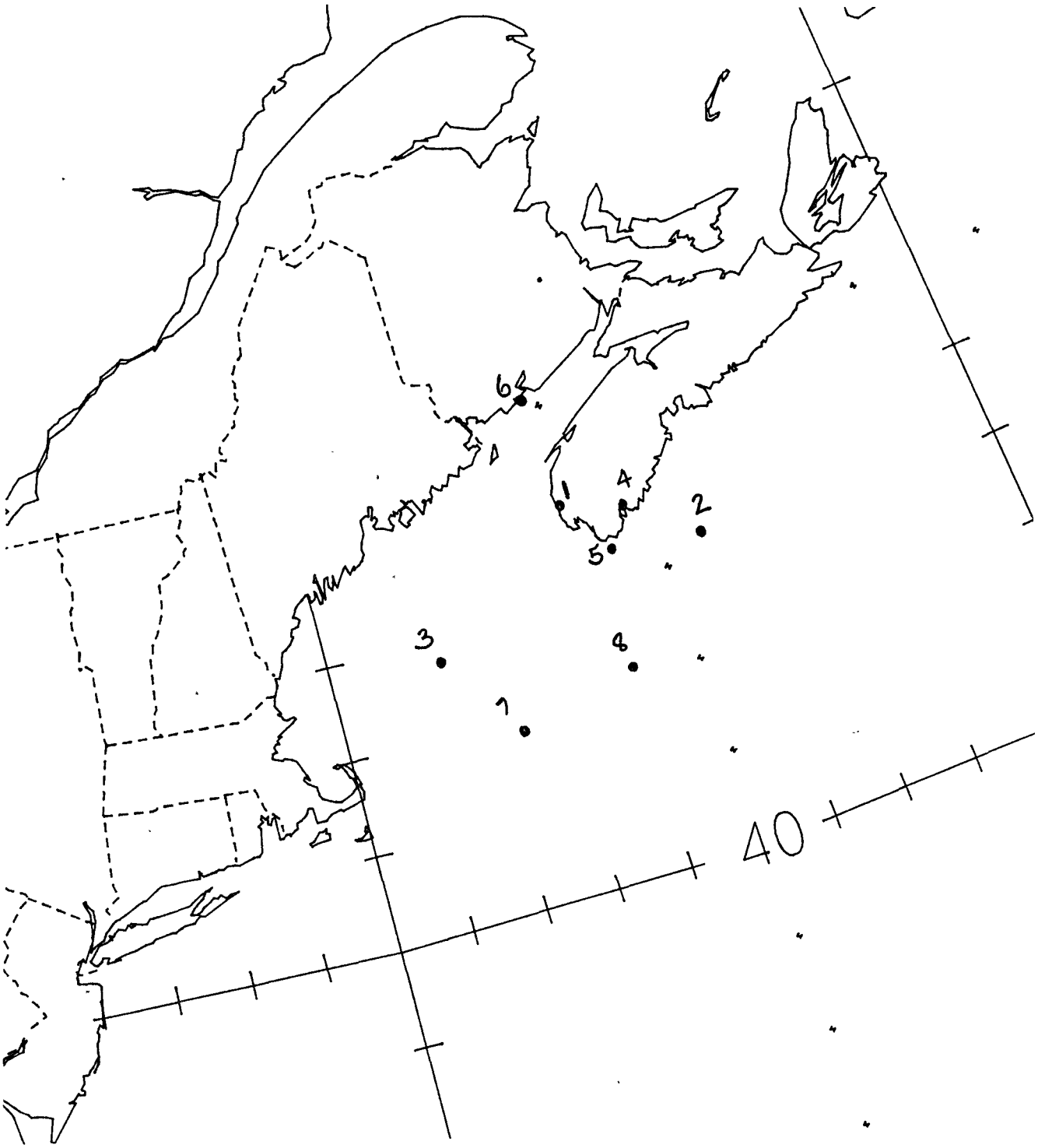

Figure 4
Location of Available Marine Wind Reports
as referenced in Table 1