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COLD AIR WATERSPOUTS OVER LAKE ERIE

Frank Kieltyka
WSFO Cleveland, Ohio

Cold air waterspouts over Lake Erie are sometimes elusive to forecast. (For this report waterspouts will be used to mean cold air funnels or cold air waterspouts.) Even though waterspouts are not as dangerous as tornadoes, they still contain sufficient punch to be a danger to boaters. There were two problems in defining this study; (a) not all waterspouts are likely to be reported, and (b) virga or scud might be reported as a waterspout by an untrained observer.

Waterspouts are most frequently reported between mid-summer and early fall when the lake is at its warmest and cold air from Canada moves across Lake Erie. However, with proper atmospheric conditions they may be reported at other times.

Waterspouts were reported on Lake Erie nine times during the boating seasons of 1983 through 1986. A comparison was done between these cases and five cases where cold air funnels were not observed, but the atmosphere seemed conducive to their formation.

Of the nine reports of waterspouts, five were in the morning and some were associated with showers. A Cleveland rule of thumb is during a cold outbreak in summer, funnels are possible, while during the fall months, waterspouts or funnels are likely.

Important upper air features seem to be depth of cold air, moisture, and wind speeds as obtained from the 12 UTC soundings. At the surface (Figure 1) a ridge of high pressure was usually oriented north-south over Ohio or Indiana or east-west just north of Lake Erie several hours before the waterspouts were reported. The 850 mb thermal trough was usually 50 to 200 nautical miles upstream from where the waterspouts were reported. The 700 mb and 500 mb troughs were either over Ohio or just east and there was NVA or weak PVA.

Following are the critical atmospheric conditions needed for waterspouts to form over Lake Erie. If these conditions are present, waterspouts are likely!

1. On the 12 UTC Flint sounding, if an inversion is present, the base of the inversion must be between 800 millibars (mb) and 550 mb (Figure 2).

   If no inversion is present or if the inversion meets the above criteria, the temperature-dew point spread at 800 mb must be 3 degrees or less.

2. The 12 UTC 850 mb winds at Flint and Buffalo should be from the northwest quadrant while the speeds must be 25 knots or less.

3. The difference between the water temperature at Cleveland and Flint's 12 UTC 850 mb temperature must be 16 degrees (celsius) or greater. (As a supplement the difference between Buffalo's water temperature and Buffalo's 12 UTC 850 mb temperature must be 12 degrees (celsius) or greater.)

4. The water temperature off Cleveland must be 66 degrees or warmer and 63 degrees or warmer off Buffalo.

In many cases when waterspouts developed, the surface winds at CLE the night before were generally south to southwest at 10 knots or less.

In the five cases where cold air funnels weren't reported the atmospheric conditions did not meet Rule 1 or 2 and, in one of those cases, the upper trough was not in the right position. Of the nine cases of waterspouts, all satisfied the critical criteria.

Even though this scheme is dependent on 12 UTC raob data, a midnight shift forecaster can still use these rules by forecasting what the 12 UTC raob will look like. Thus, if the synoptic conditions are right and the air mass is cold and deep enough, waterspouts are likely on Lake Erie and may not be too elusive for forecasters.

SCIENTIFIC SERVICES DIVISION, ERH
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Attachments (Figures 1 and 2)

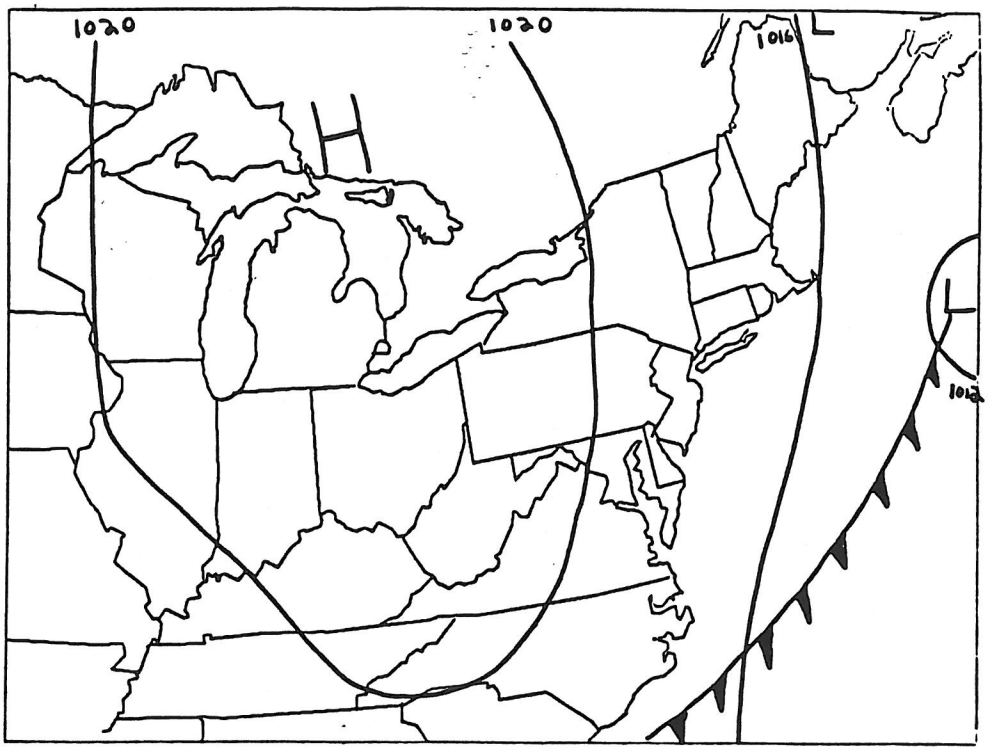

FIGURE 1. Surface Map 12 UTC August 22nd 1985. Cold air funnels were observed near Port Clinton and Sandusky, Ohio around 14 UTC.

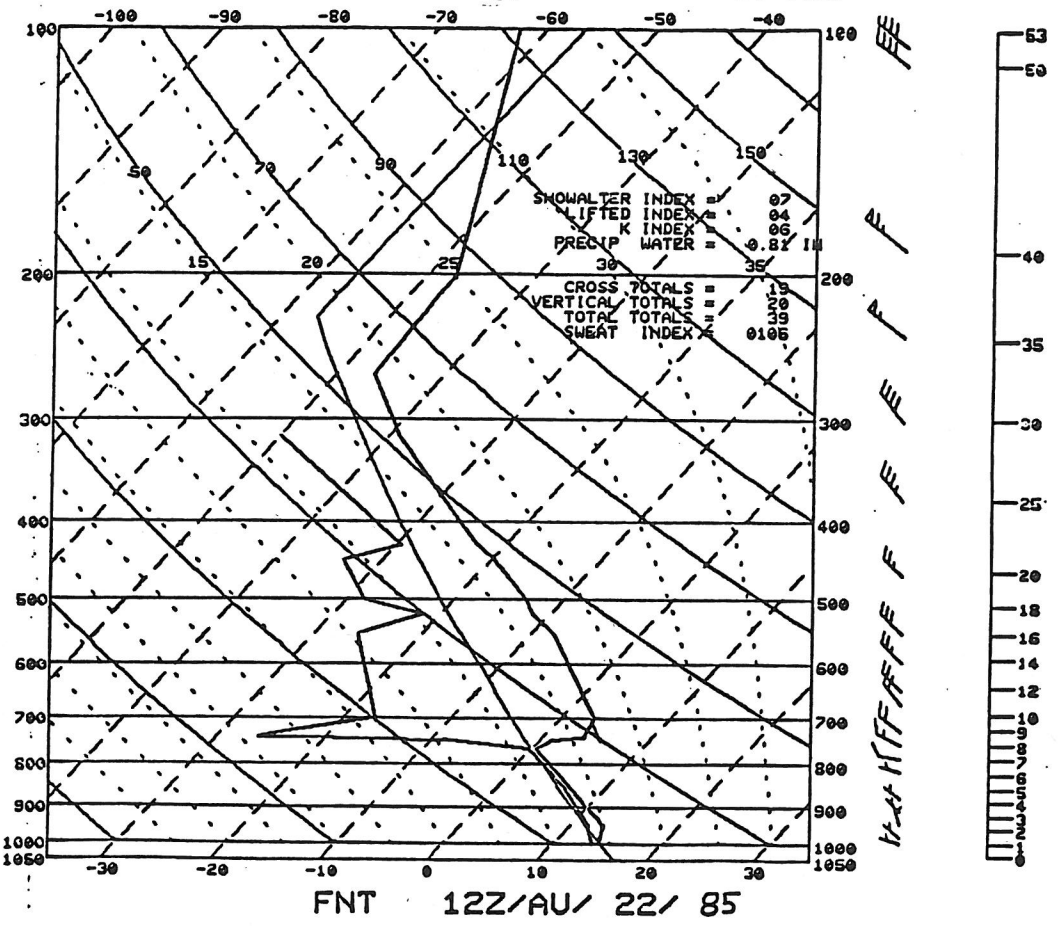

FIGURE 2. Raob from Flint, Michigan at 12 UTC August 22nd 1985. Base of the inversion is around 750 mb.