

A Short Case Study of an Exceptionally Hot Summer Day: August 10th, 2001

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On August 10th, 2001 very hot temperatures were recorded across central and northern Nova Scotia, southern New Brunswick, Prince Edward Island and central Newfoundland. Many localities recorded highs between 35 and 38°C (95 to 100°F). Aloft, the flow was somewhat zonal with a weak trough approaching from the west. A strong southwesterly flow at the surface was present across the region on that day.

1. The Data

The manual surface analysis from the Newfoundland Weather Center valid for 18 UTC 10 August 2001 is shown in [Fig. 1](#). The 500 mb geopotential height analysis from the National Centers for Environmental Prediction (NCEP) web site, valid for the same time, is shown in [Fig. 2](#). At 18 UTC a cold front was approaching New Brunswick from the west with a southwesterly flow across Nova Scotia, Prince Edward Island and Newfoundland. Later that day a line of thunderstorms associated with the cold front moved into New Brunswick. In [Fig. 2](#) a west-southwest flow is observed at 500 mb with a trough to the west over Quebec.

Analyses of 850 mb temperature from NCEP are shown in Figs. [3](#) and [4](#) for 12 UTC and 18 UTC 10 August, respectively. A warm pool of air can be seen moving across Nova Scotia. At 12 UTC it was located over western Nova Scotia and by 18 UTC it was over Cape Breton. The warm pool was characterized by temperatures of 21°C (70°F) or more. Geopotential thicknesses in the 1000 to 500 mb layer (not shown) were near 576 dam over Nova Scotia during the day.

A plot of maximum temperatures on 10 August appears in [Fig. 5](#) for selected stations reaching or exceeding 30°C (86°F). It is no surprise that these sites were either located well inland or downstream of land in the southwest flow.

The airmass was also very humid with dew point temperatures between 19 and 22°C (66 to 72°F) giving humidex values between 41 and 44°C (106 to 111°F). Visibilities were as low as 3 miles (5 km) in haze at Greenwood, Nova Scotia. Other stations across Nova Scotia also reported reduced visibility in haze.

An analysis of sea surface temperatures prepared by the Canadian Forces Metoc Centre on 07 August is shown in [Fig. 6](#). A large region of cold water (10°C (50°F) or less) extended from southwestern Nova Scotia to near Saint John, New Brunswick. Water temperatures through the Northumberland Strait and southern Gulf of St. Lawrence were 20°C (68°F) or higher.

The most extreme temperatures were observed in the Annapolis Valley of Nova Scotia, northern mainland Nova Scotia and Cape Breton with high temperatures of 36°C (97°F) or more. Kentville in the Annapolis Valley reached 36.4°C (97.5°F), New Glasgow hit 36.6°C (98°F), Southside Harbour (near Antigonish) reached 37.3°C (99°F) and Ingonish in Cape Breton recorded the highest in the province that day with 37.7°C (100°F).

2. Interpretation

It is common for temperatures to rise to 32 or 33°C in early August but it takes a certain airmass to produce widespread readings above 35 degrees. The reason for such warm temperatures can be attributed to the warm anomaly in the lower troposphere as shown in [Figs. 3](#) and [4](#). There was also a closed core of warm temperatures at the 700 mb level (not shown).

Since the prevailing winds were southwesterly, the highest readings occurred over central and northeastern Nova Scotia. The exceptional high in Ingonish may be partly attributed to the warm down-slope flow over the Cape Breton Highlands. Southside Harbour was situated near the maximum over-land fetch achievable across Nova Scotia given the flow on August 10th. In Newfoundland, the same pattern was observed with the highest temperatures inland and closer to the low-tropospheric warm anomaly.

Very warm temperatures in Prince Edward Island were achieved given the relatively warm waters of the Northumberland Strait (see [Fig. 6](#)). Temperatures were drastically cooler along the Atlantic coast of Nova Scotia where maximum temperatures were very similar to the adjacent sea surface temperatures along the immediate coastline.

3. Forecasting Perspective

Indications that such temperatures would occur were present on the morning of August 10th. The 12 UTC sounding from Yarmouth ([Fig. 7](#)) showed a nose of very warm air below 700 mb. The estimated maximum temperature from this sounding, by drawing a dry adiabat down to the surface from 850 mb, is approximately 36°C (97°F).

If the forecaster has a chart of 850 mb temperatures, or even better, raw model data of temperatures at 850 mb, he/she can get an estimate of the highest temperatures to expect inland or in areas downstream of warm land. The following rules of thumb apply assuming a sunny, well-mixed boundary layer:

Surface Pressure	Addition to 850 temperature
1000-1015 mb	add 15°C (27°F)
1015-1030 mb	add 16°C (29°F)
1030-1040 mb	add 17°C (31°F)

Forecast charts of 850 mb temperature (every 5°C) from the GEM regional model can be found on the IM circuit using the following search mask: **M CMC REG 850**. Prognostic soundings can also be used to assist in forecasting maximum temperatures.

The formulation for T_{SFC} given T_{850} and surface pressure P (T in °C and P in mb) is

$$T_{\text{SFC}} = \frac{(T_{850} + 273) P^{0.286}}{6.8836} - 273$$

Forecast example: The afternoon 850 mb temperature over northern Nova Scotia was 21°C (70°F) and the sea level pressure (approximately the surface pressure) was 1004 mb. Using the numbers in the table, we would expect the warmest temperatures to be around 36°C (97°F) inland and/or downstream of warm land – which in this case is almost everywhere. Treating Figs. [1](#) and [4](#) as forecast maps, an appropriate forecast assuming sunny conditions for northern Nova Scotia for this day might read “*Mostly sunny. Southwest winds 30 to 40 km/h. Hot. high 33 to 36*”.

4. Conclusion

There are many tools available for forecasting temperatures, but a useful tool for forecasting maximum temperatures on summer days is the model 850 mb temperature or morning sounding representative of the airmass using the rules discussed in section 3. One must not rely on the 1000-500 mb thickness alone to forecast the significant high temperature events such as August 10, 2001. A more accurate predictor will be the low-level temperature or thickness prognostics. As in this case, there was a strong warm anomaly at 850 mb.