The Structure of the Weather\(^1\) at Blue Hill, as Indicated by the Hours at which the Diurnal Extremes of Temperature Occur.

By

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Abstract. The frequency with which the daily minimum temperatures occur at the end or beginning of the 24 hours—instead of at the usual time, about sunrise, as controlled by radiation—may be used as a measure of the frequency of daily strong advection.

A great number of advective minima occur in the last hour of day (23–24h), owing to the invasions of cold air masses. A smaller, yet prominent number occurs in the first hour (0–1h), due to the invasions of warm air masses. Numerical tables of this distribution and also of probabilities of cold and warm invasions facilitate understanding and reference.

The Blue Hill results are compared with those obtained from Mt. Washington temperature by V. Conrad.


Résumé. Le minimum journalier de température se produit normalement aux environs de l’heure du lever héliaque. Sa fréquence d'apparition à la

\(^1\) The title is taken from a paper by V. Conrad quoted at the end (see [3]).
fin ou au début du jour (compté à partir de 0h) peut servir de mesure de la fréquence des fortes advections. De nombreux minima de température d'origine advective apparaissent dans la dernière heure du jour (23 à 24h) par suite d'invasions froides; ils se produisent un peu moins souvent dans la première heure du jour (0 à 1h) ce qui est dû à des arrivées d'air chaud. Cela est confirmé numériquement par des tableaux de distributions de fréquences et des probabilités des arrivées d'air froid et chaud. On compare les résultats obtenus pour Blue Hill avec ceux que V. Conrad a déduits pour le Mt. Washington.

As is well known, the average diurnal course of temperature, in tropical and temperate latitudes, is dominated by the daily period of solar radiation. The daily maximum of temperature usually occurs about 2 hours after the sun has reached its highest altitude, and the minimum occurs about sunrise. However, besides these extremes, which are caused by radiation, there are also extremes which are the consequence of advective processes, i.e., invasions of cold or warm air masses. If the duration of the invasion of cold air is longer than 24 hours (depending upon temperature conditions), the daily maximum occurs at the beginning of the day (midnight), the minimum at the end and vice versa in the case of strong advection of warm air. Consequently, interesting conclusions may be inferred from statistics of the hours at which the temperature extremes occur.

In the present paper, the times when temperature extremes occur at Blue Hill Meteorological Observatory ("B. H." hereafter) (Lat. N. 42° 13', Long. 71° 07', Alt. 635 ft.) are studied, by two-hour intervals from the thermograms of 1940-44, the period for which several elements of temperature have been studied in the investigations [1], [2].

Table I shows the relative frequencies (%) of the extremes, according to time of day. The temperature maximum occurs with the greatest frequency between 12 and 14h in autumn; in the other seasons, and the average year, however, between 14 and 16h. On Mount Washington ("M. W.".) (Alt. 6270 ft.), during the period 1935-37 [3] in spring, summer, autumn, and the year, maxima occur with the highest frequency between 12 and 14h, while in winter the greatest frequency lies between 22 and 24h. Considering only the average distribution for the year, it is to be noted that at B. H. (Tab. 1) 89% of all maxima occur during the six-hour interval from 10 to 16h. The corresponding frequency on M. W. is only 48%. Also, while at B. H. the frequency of maxima in the two first hours of the day (0–2h) is 3% and in the last two hours (22–24h) only 1%, the corresponding numbers for M. W. are 15% and 11%. In addition, during the daytime (6–18h) the frequency of maxima at B. H. is 94%, while on M. W. it is only 65%. In summer, at B. H. 99% of all maxima occur during day-

1 Daily open-scale thermograms.
2 An average of 2 to 4 days a month had to be omitted from consideration. This was owing to the difficulty on some days of determining when the extremes occurred, chiefly overcast days with small range.