A DIFFERENCE-METHOD FOR PREDICTING NIGHT-FROST

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In Denmark the following formula has been tried with fairly good results for estimating the local minimum-temperatures of the coming night:

$$T_n = T'_n + k_T(T_2-T_1) + k_U(U_2-U_1) + k_N(N_2-N_1) + k_F(F_2-F_1) + f(W),$$

where T'_n is the observed minimum-temperature last night and further:

T_1 and T_2 : temperature observed (°C or °F)
U_1 and U_2 : humidity observed (per-cent)
N_1 and N_2 : cloudiness observed (scale 0–8)
F_1 and F_2 : wind force observed (scale 0–12),

these observations being partly from the afternoon yesterday (indices 1), partly from the afternoon to-day (indices 2), preferably taken at 13^h or 14^h, or in some special cases later (in the evening) [1]).

The 3 coefficients k_U, k_N and k_F have to be found empirically from cases, where U, N and F do not change notably from the afternoon and throughout the night. They vary considerably from site to site, but are mainly all positive and seem to be rather independent of the altitude above the ground as well as of the time of the year. On the other hand, T'_n must be observed exactly at the same spot (altitude), for which T_n shall be calculated.

Using this "frame method" one soon acquires some expecience as to the magnitude of the 3 coefficients, according to the type of site considered.

Finally, the term f(W) has been put in as a function of the changeability of the day-night's weather. The mean error of T_n being about ½–1° C, a front passage at night (or similar reasons) may upset the calculations completely, if f(W) is not taken into account. This may be settled by means of the common synoptic forecasts (or, if possible: the forecasts for agriculture), giving at least some guidance as to the magnitude of f(W), this term being negative as well as positive. But even in such cases the other right-hand terms of the formula should be handled as usually, or – if the practical purposes of the calculation of T_n make a delay possible – renewed calculations, based upon further observations later in the afternoon or in the evening, may be carried out.

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1) In the meantime a more simple frostformula has been used, in which the terms $k_T(T-T') + k_U(U-U')$ were replaced by: $k_w(T_w - T'_w)$, where T_w is the wet bulb temperature, directly observable. The results of this amended method have been rather satisfying.