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A COMPARISON BETWEEN MEAN MONTHLY VAPOUR PRESSURES COMPUTED FROM VARIOUS COMBINATIONS OF FIXED HOUR OBSERVATIONS

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INTRODUCTION

The present exercise is designed to show the reliability of monthly mean vapour pressure obtained using a varying number of observations at fixed times per day, and whether the application of standardised monthly corrections to such data would result in closer agreement with the "true" mean vapour pressure, defined as that obtained using all 24 hourly observations per day. Penman's (1) formula for estimating potential transpiration calls for knowledge of the monthly mean vapour pressure.

2. Aldergrove, Co.Antrim, is the only station in Northern Ireland for which hour by hour vapour pressure data are available on punched cards for machine processing: its data have been used for the sixteen years, 1949-1964.

3. At a later date it may be possible for a further check to be carried out using data from Clones (Co.Monaghan) and Malin Head (Co.Donegal) for a similar period.

The reliability of the mean vapour pressure obtained by meaning the monthly means of the 03h, 09h, 15h and 21h GMT observations

4. The difference between the monthly mean vapour pressure obtained by using only the data from the four six-hour period spaced observations (03h + 09h + 15h + 21h G and that obtained by using all 24 hourly readings was ± 0.1 mb or less for 188 months out of the 192 months used in this investigation, and for the remaining four months it was ± 0.2 mb.

The reliability of the mean vapour pressure obtained by meaning the monthly means of the 09h, 15h and 21h GMT observations

5. The following Table 1 sets out the monthly corrections which would need to be applied to the mean of the three observations (09h + 15h + 21h GMT) to obtain values differing by not more than ±0.1 mb from the "true" vapour pressure on virtually all occasions.

TABLE 1 - Correction to be applied to $\overline{(09h+15h+21h)}$ data

JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC	
0.0	0.0	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1	0.0	0.0	mb

6. Due to the slight increase in variability of difference in the mid-summer period, isolated months' values may be up to ±0.3 mb different from the "true" value: there is no evidence to show that these larger differences are associated with months whose "true" mean vapour pressure is significantly higher or lower than the average.

The reliability of the mean vapour pressure obtained by taking the mean of only the daily 09h GMT observations

7. As may be expected, the variability of the correction increases with the adoption of a single hour as "representing" the mean over the whole day; but, as in many other meteorological parameters, the 09h GMT observation is a reasonably stable guide and corrections can be applied with reasonable confidence to bring such data nearer to the "true" mean vapour pressure (see Table 2).

TABLE 2 - Correction to be applied to the 09h data

JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC	
+0.2	+0.2	-0.1	-0.3	-0.3	-0.2	-0.2	-0.3	-0.3	-0.1	+0.2	+0.2	mb

8. The application of the above corrections in the October to March period would in most cases give values differing by not more than ±0.1 mb from the "true" value: in the summer period the application of the corrections would give differences of not more than ±0.2 mb in most cases, although data for June shows greatest variability (viz. the differences being 0.0 in two cases, +0.1 or -0.1 in eight cases, two cases each of -0.2 and -0.5, and one each of -0.6 and -0.8 mb). The June data, and perhaps a few other summer months' data for particular years, may be worthy of further investigation to identify conditions which resulted in these larger deviations.

Routine monthly check of homogeneity of mean vapour pressure data

9. Associated with the now routine calculation of potential transpiration for selected stations in Northern Ireland, the Belfast Office plots each month a map of mean vapour pressure at 09h GMT using all stations' data, upon which are entered additionally the means of vapour pressure obtained from other hours' data (e.g. the 24 hours of Aldergrove, Ballykelly*, Clones and Malin Head, and the appropriate combination of 09h, 15h and 21h GMT observations from auxiliary reporting stations). These maps readily reveal discrepancies which are investigated, whether or not the station is used for potential transpiration calculations. There is generally very good agreement between stations in the north of Ireland (± 0.1 mb for adjacent stations of around the same altitude, and up to ±0.5 mb between coastal and inland stations' data, with rather less variation between nearby high level and low level stations). It is not always easy to identify the causes of discrepant values: in the main such values are higher than expected, suggestive of drying out wet-bulbs. There remain a few unresolved cases where values are consistently high (notably Castle Archdale Forest, Co.Fermanagh, where a special duplication of equipment, etc. check, is being carried out, and, at times, at stations over deep peat bogs).

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* Whilst Ballykelly climatological data are available for the 24 hours, special arrangements operate from 1965 under which mean temperature and mean vapour pressure based on the full 24 hours' observations are made available to the Belfast Office.

REFERENCE

(1) PENMAN, H.L., J.Agric.Sci. (1962), 58, p.343