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Met.O.8. Evap.Memo No.15

Climatological Station Networks for Potential Evaporation Estimates in the British Isles.

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Introduction and Source of Data

Estimates of Potential Evaporation (PE) over river catchments are required for water balance calculations.

In this simple preliminary investigation monthly fields of P.E.(March-October 1970) for the two areas shown in Figure 1. are examined. The first is a generally lowland area bordered, to the east, by the North Sea; the second area is topographically complex in every sense.

The PE estimates used are taken from the P.E.tables published as part of the Soil Moisture Deficit Bulletin. The stations used are those considered to have adequate data of quality good enough to produce useful PE estimates.

Analysis of P.E. Estimates

The PE estimates, given in Tables 1 and 2 were plotted on monthly maps (Figs 2 and 3). Simple analyses were constructed by the addition of isopleths at 5 mm intervals on the basis that the PE values between stations were linearly distributed.

A transparent overlay (Fig.4), carrying a grid of 25 points at 20 Km intervals in the x and y directions, was applied to each monthly map and PE values (to the nearest millimetre) were read off and tabulated (Tables 3 and 4).

In the first case, the centre point (13) was placed over Honington and in the second case over Abbotsinch.

At the foot of each column in Tables 3 and 4 is shown (i) the average of 25 grid point values (ii) the %age error involved in using the Point 13 (Honington or Abbotsinch) computed value as an estimate of the average value over square A B C D (10,000 Km^2), (iii) the average of the 9 grid points 7-9, 12-14, and 17-19 values and (iv) the %age error involved in using the computed Point 13 value as an estimate of the average value over square E F G H (3,600 Km^2).

Percentage errors are small for both squares in both areas. Using the smaller square (i.e. one calculation to represent 60 x 60 Km) all percentage errors are $\leq 6\%$.

Conclusions

Assuming that the PE estimates are of good quality (i.e. produced from good class, area-representative data) and that the simple analyses are fair approximations to those which would have been obtained from considerably denser station networks, it appears that one station per 60 x 60 Km square can provide a

general, monthly PE estimate "accurate" to within about 6% for the months March to October.

Recent work in the hydrometeorological branch of the Meteorological Office has shown that, in the months with appreciable average values of PE, the sums of 6 5-day and 3 10-day estimates are very close to the value of the corresponding 30-day estimate. Since, in addition the sum of 2 5-day estimates is usually very close to the value of the corresponding 10-day estimate it is probably fair to suggest that the network relationship found in this investigation could be applied to 10 and 5-day estimates as well as to monthly estimates.

March 1971
Met08c Bracknell

Fig. 1. Trial areas used in the analysis. (Station heights given in metres).

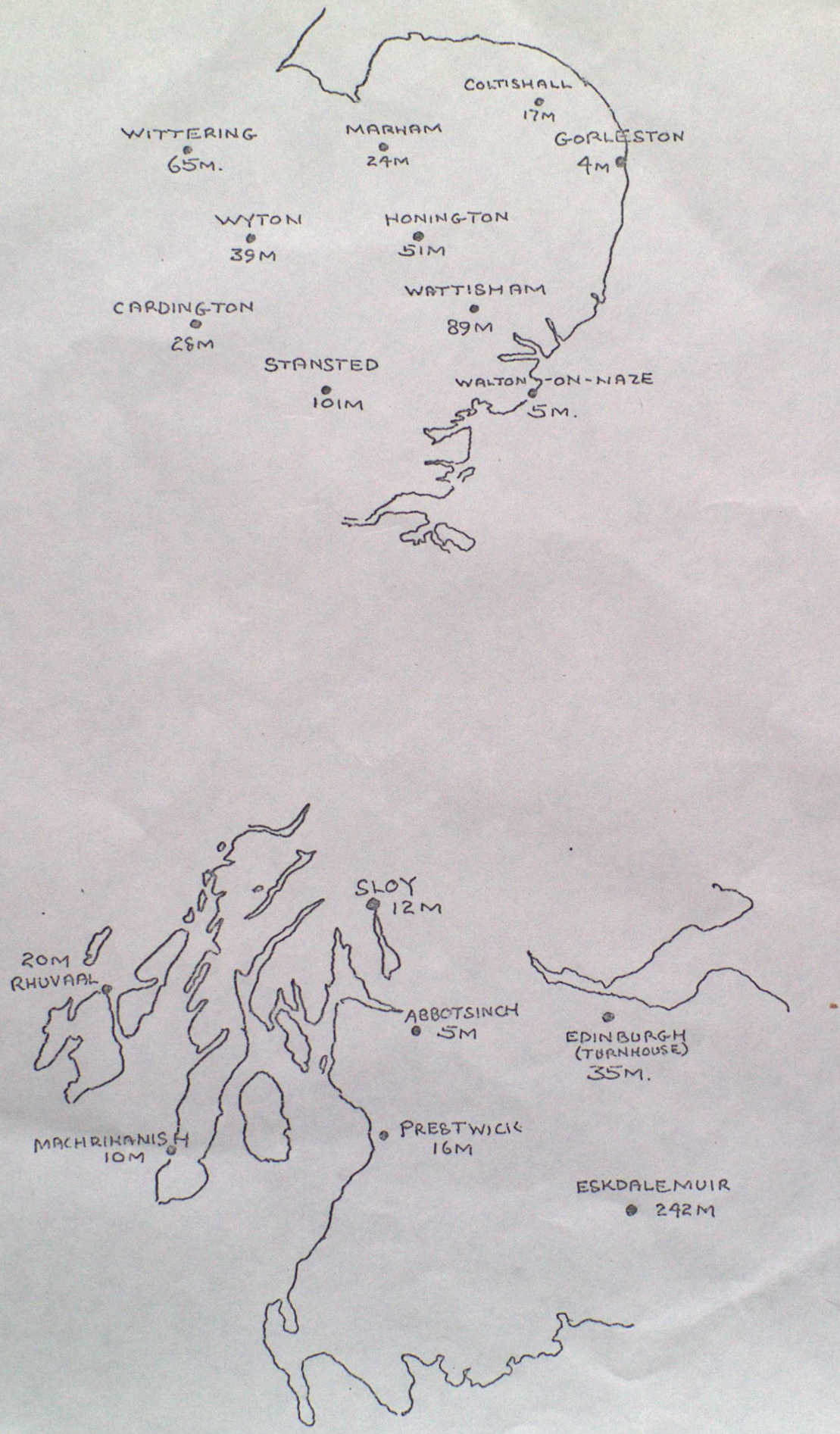
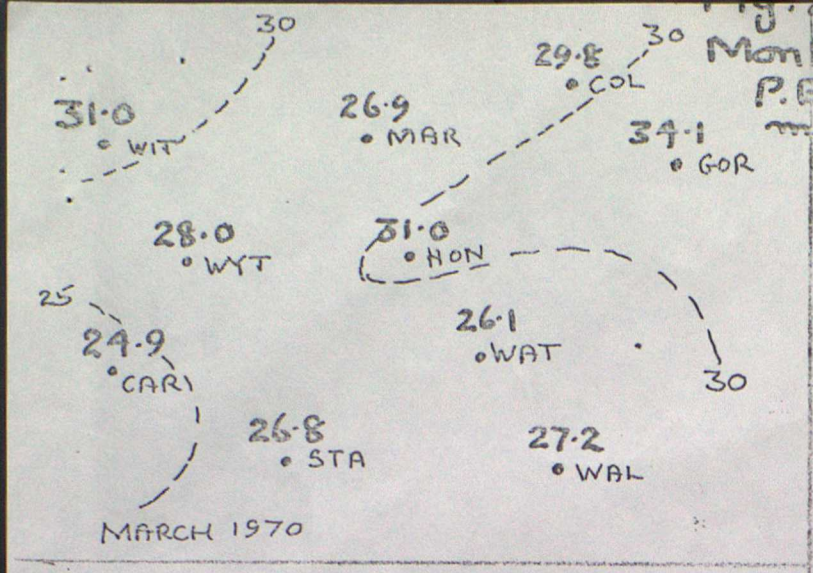
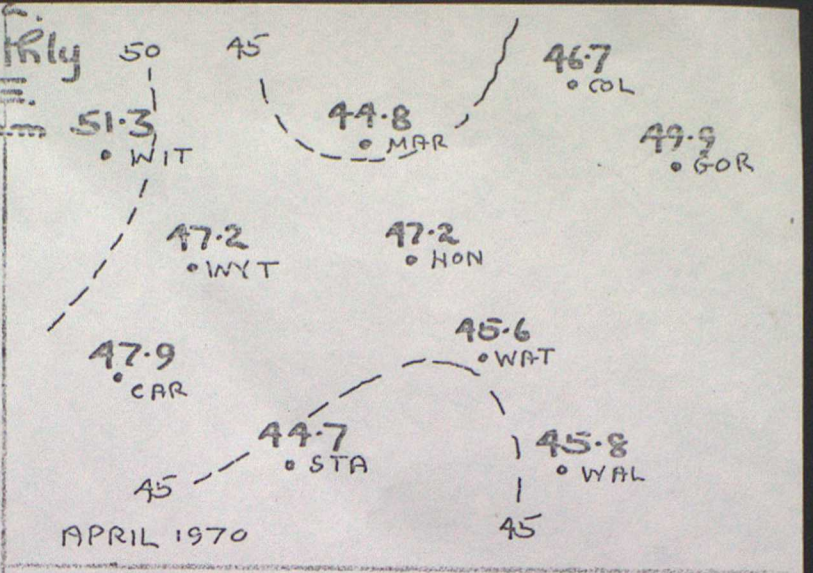


Fig. 2.
Monthly P.E.



MARCH 1970



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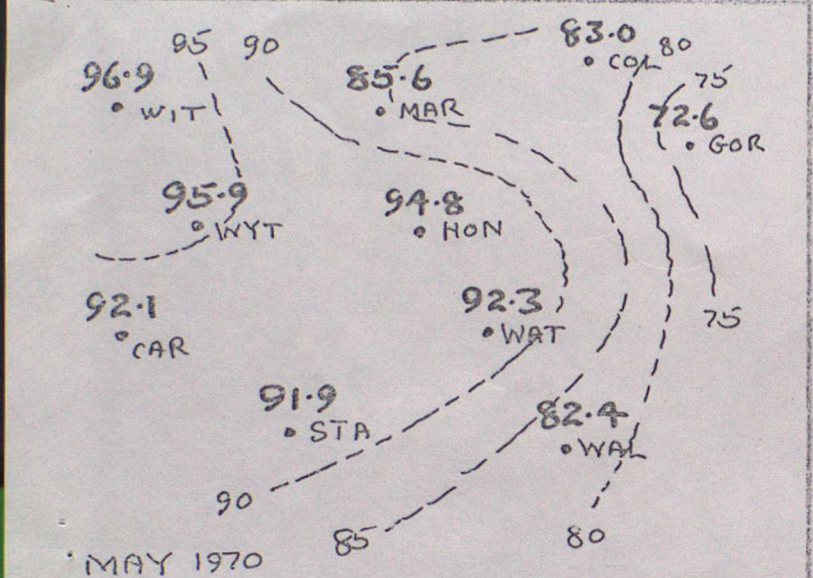
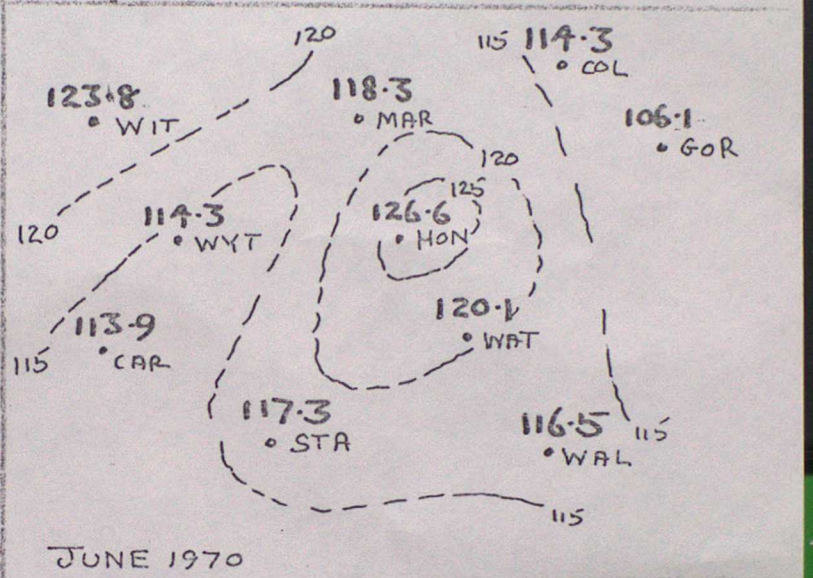


MAY 1970



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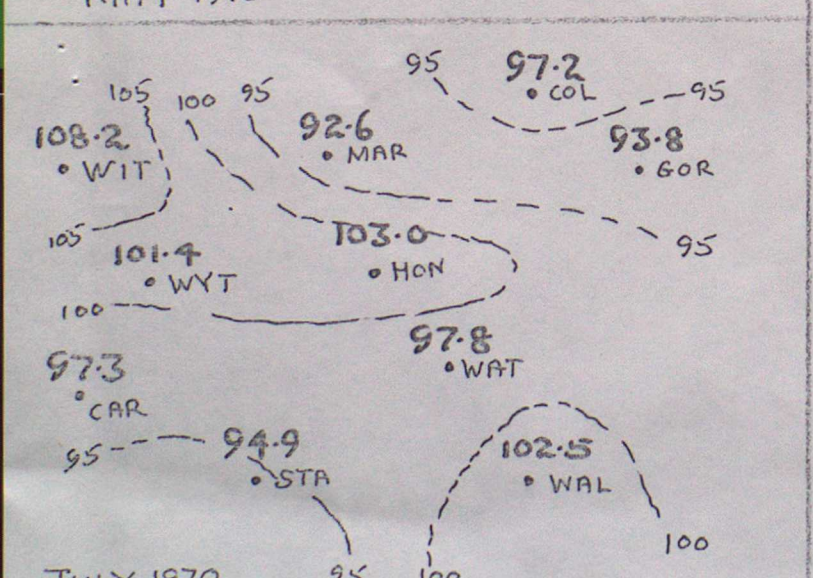

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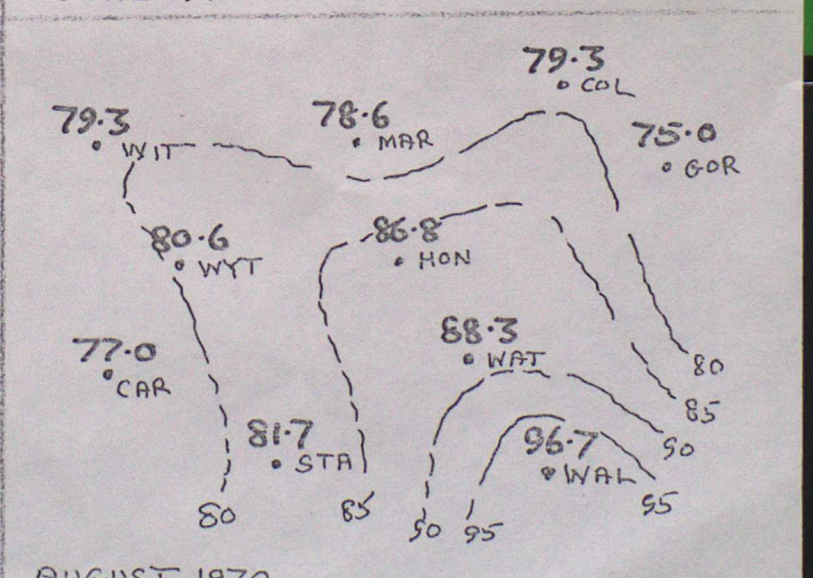

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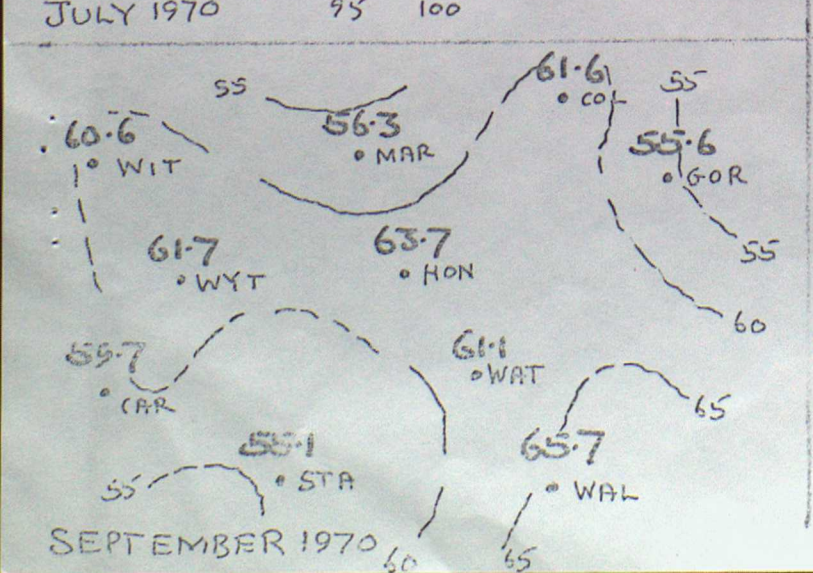
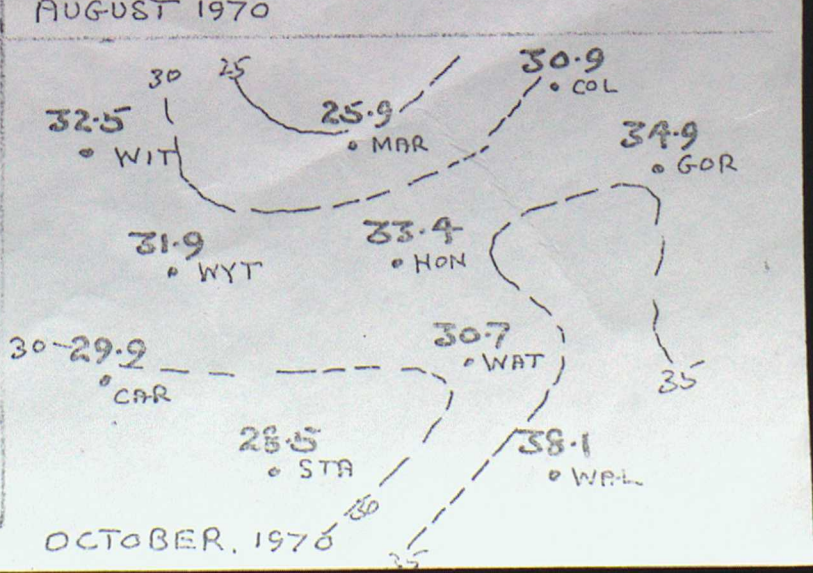


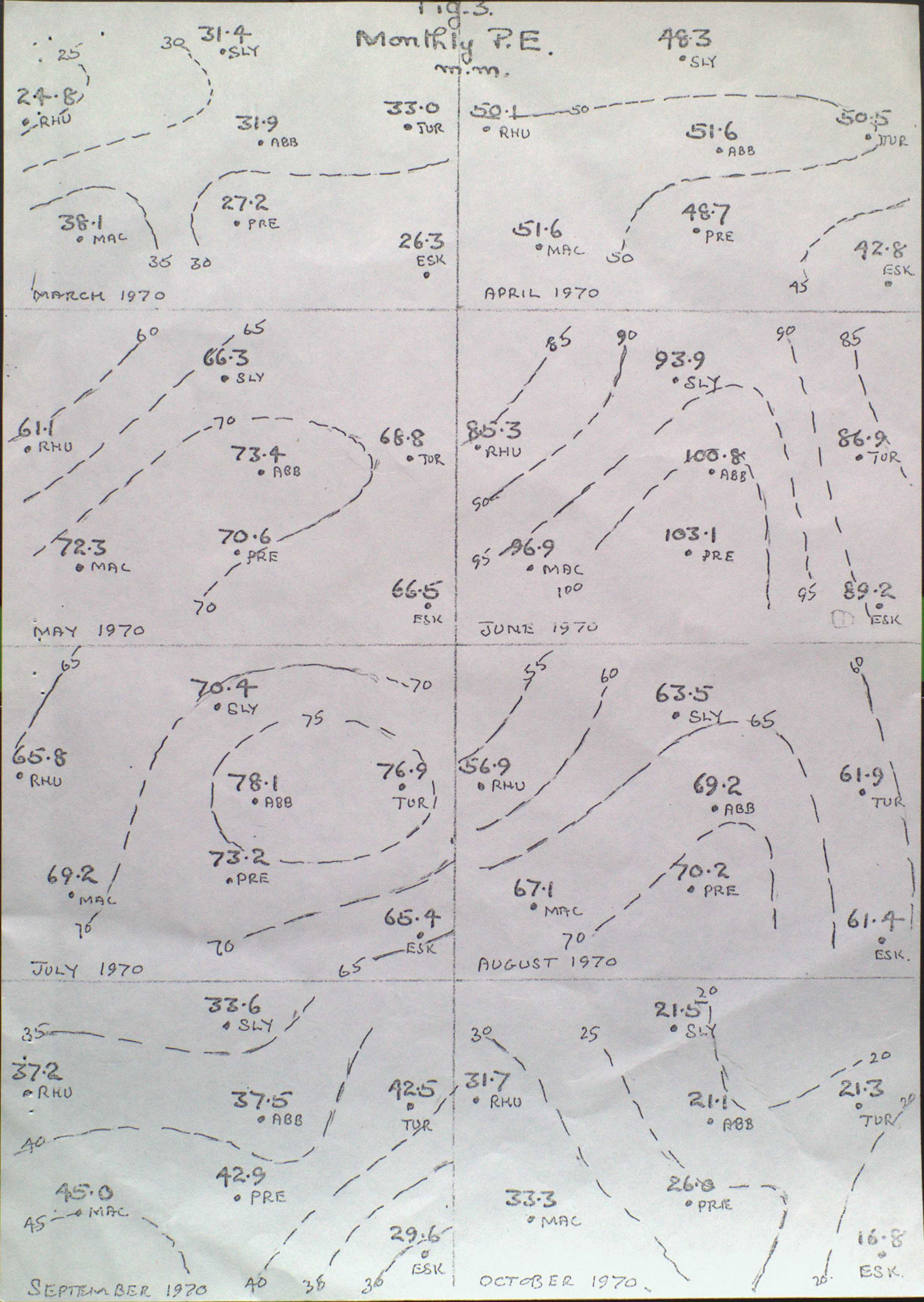
SEPTEMBER 1970



OCTOBER, 1970

Fig 3.

Monthly P.E. m.m.



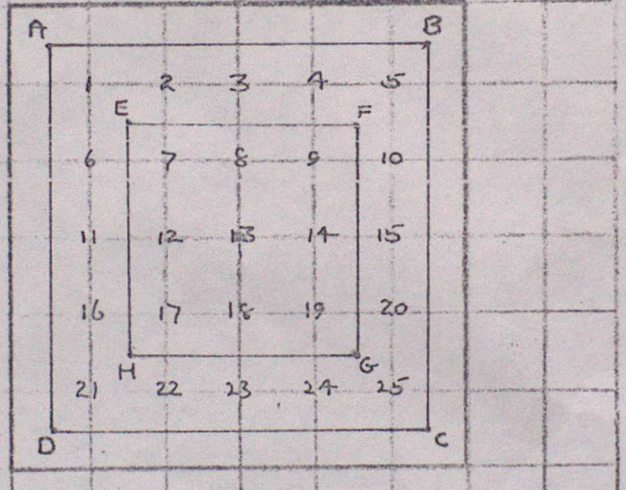


Fig 4. 20 Km grid.

Table. 1.

Penman Estimates of P.E. in m.m.

1970	WIT.	MAR.	COL.	GOR.	HON.	WAT.	WYT.	CAR.	STA.	WAL.	Averages
MAR	31·0	26·9	29·8	34·1	31·0	26·1	28·0	24·9	26·8	27·2	28·6
APR	51·3	44·8	46·7	49·9	47·2	45·6	47·2	47·9	44·7	45·8	47·1
MAY	96·9	85·6	83·0	72·6	94·8	92·3	95·9	92·1	91·9	82·4	88·7
JUN	123·8	118·3	114·3	106·1	126·6	120·1	114·1	113·9	117·3	116·5	117·1
JUL	108·2	92·6	97·2	93·8	103·0	97·8	101·4	97·3	94·9	102·5	98·9
AUG	79·3	78·6	79·3	75·0	86·8	88·3	80·6	77·0	81·7	96·7	82·3
SEP	60·6	56·3	61·6	55·6	63·7	61·1	61·7	59·7	55·1	65·7	60·1
OCT	32·5	25·9	30·9	34·9	33·4	30·7	31·9	29·9	28·5	38·1	31·7
Totals	583·6	529·0	542·8	522·0	586·5	562·0	560·8	542·7	540·9	574·9	554·5

Table. 2.

1970	TUR	RHU	MAC	SLY	ABB	PRE	ESK	Averages
MAR	33·0	24·8	38·1	31·4	31·9	27·2	26·3	30·4
APR	50·5	50·1	51·6	48·3	51·6	48·7	42·8	49·1
MAY	68·8	61·1	72·3	66·3	73·4	70·6	66·5	68·4
JUN	86·9	85·3	96·9	93·9	100·8	103·1	89·2	93·7
JUL	76·9	65·8	69·2	70·4	78·1	73·2	65·4	71·3
AUG	61·9	56·9	67·1	63·5	69·2	70·2	61·4	64·3
SEP	42·5	37·2	45·0	33·6	37·5	42·9	29·6	38·3
OCT	21·3	31·7	33·3	21·5	21·1	26·0	16·8	24·5
Totals	441·8	412·9	473·5	428·9	463·6	461·9	398·0	440·1

Table 3.

	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
1	29	45	90	120	98	79	58	26
2	28	44	87	119	93	78	56	25
3	28	44	85	119	92	78	56	25
4	29	45	83	117	94	79	60	28
5	30	47	81	114	95	80	61	31
6	28	46	93	115	103	81	61	29
7	28	46	90	117	100	80	60	29
8	30	46	90	122	97	81	60	30
9	31	47	87	122	95	83	61	33
10	32	47	84	116	95	84	61	34
11	29	47	94	114	102	82	61	32
12	30	47	94	119	102	85	61	33
13	31	47	95	127	103	87	64	33
14	30	47	93	124	102	87	62	35
15	30	46	88	118	99	86	63	36
16	27	46	92	115	98	82	58	31
17	28	46	92	120	98	85	59	31
18	28	46	92	123	98	87	60	31
19	27	46	92	122	98	88	61	32
20	27	46	88	118	98	88	65	35
21	27	45	92	116	95	81	56	28
22	27	45	92	120	96	84	57	28
23	27	45	91	120	97	87	58	29
24	27	45	88	118	99	92	62	32
25	27	46	84	117	100	94	65	37
Average	28·6	45·9	89·5	118·9	97·9	83·9	60·2	30·9
% error	+8	+3	+6	+6	+5	+3	+6	+8
Av 7-9, 12-14, 17-19	29·2	46·4	91·7	121·8	99·2	84·8	60·9	31·9
% error.	+6	+2	+3	+4	+4	+2	+5	+5

Table 4.

	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
1	29	49	65	91	70	62	34	23
2	31	49	66	94	71	63	34	22
3	32	49	67	95	73	65	34	20
4	32	49	68	95	75	65	36	18
5	33	49	68	90	75	63	39	18
6	29	50	69	93	71	64	36	25
7	30	50	70	96	74	66	36	22
8	32	50	70	98	76	67	36	21
9	32	50	70	97	77	67	38	19
10	33	50	70	92	77	65	40	19
11	31	52	72	96	72	66	39	26
12	31	52	73	100	75	68	38	24
13	32	52	73	101	78	69	38	21
14	31	51	72	100	78	69	38	21
15	32	51	71	94	77	66	41	21
16	32	50	73	100	73	68	42	28
17	29	49	73	102	74	69	42	25
18	29	49	71	102	76	71	40	24
19	29	48	70	101	76	71	40	24
20	29	47	69	95	76	67	41	24
21	33	50	72	103	72	70	44	30
22	28	49	71	103	73	71	43	27
23	27	48	70	103	73	71	43	26
24	27	46	68	101	73	71	40	26
25	27	45	68	96	72	67	37	24
Average	30·4	49·3	70·0	97·5	74·3	67·2	38·8	23·1
%error Pt.13	+5	+5	+5	+3	+5	+3	−3	−9
Av 7-9, 12-14, 17-19.	30·5	50·1	71·3	99·7	76·0	68·5	38·4	22·3
%error Pt.13.	+5	+3	+3.	+1	+3	+1	−2	−5