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Interactive comment on "Probable Maximum Precipitation Estimation in a Humid Climate" *by* Zahra Afzali Gorouh et al.

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According to (WMO, 2009, page 66, section 4.2) "The greatest value of Km computed from the data for all stations was 15. It was first thought that Km was independent of rainfall magnitude, but it was later found to vary inversely with rainfall: the value of 15 may be too high for areas of generally heavy rainfall and too low for arid areas." Because of the study area is a wet area, the value of Km for wet areas is too high, and therefore revised approach was used to obtain the appropriate value of Km. In order to calculate the Km, the equation 2 was used. Then the maximum value of Km was considered as Km-envelope and was used to the calculation of PMP24. The Km values in standard approach were obtained from Km curves (WMO, 2009; Hershfield, 1965). These curves obtained from 2700 stations over America, while in revised

approach, frequency factor was obtained from observed rainfall over the study area and stations. The frequency factor in revised approach is more reasonable, for it was obtained based on real occurred rainfall over the study area and the result of corresponding PMP is closer to real occurred rainfall over the study area. Reduction of Km in revised approach is not a reason to refuse standard approach; this shows that the standard approach estimates the PMP with more caution while estimating the appropriate value of Km is leading to decreasing the cost of structures that affected by PMP. The results of both approaches and corresponding values of adjustment coefficients are mentioned in attached tables.

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Table I. Required steps in calculation of PMP by standard approach of Hershfield method

Stations	Aiah Ab	Kord Kooy	Ziarat	Ghaz Mahalleh	Shast Kelateh	Edareh Gorgan	Gorgan
$\overline{x}_n$	53.6	59.9	36.2	54.4	51.3	47.3	50.9
K_m = frequency factor	17.2	17.0	18.0	17.2	17.3	17.5	17.3
S_n	25.6	21.8	11.9	23.4	15.2	24.2	17.2
Max = Max value of annual series	150.2	104.7	63.5	132.0	92.0	139.0	95.0
$\overline{x}_{n-m}$	50.6	58.5	34.5	52.0	50.0	44.4	49.5
S_{n-m}	19.1	20.6	9.8	19.1	13.6	18.0	15.5
$\overline{x}_{n-m}/\overline{x}_n$	0.944	0.977	0.951	0.955	0.975	0.939	0.973
$\overline{S}_{n-m}/\overline{S}_n$	0.747	0.944	0.831	0.817	0.891	0.744	0.902
C_1 =Adjustment of X_n for maximum observed event	0.961	0.994	0.969	0.973	0.993	0.956	0.991
C_2 = Adjustment of S_n for maximum observed event	0.808	1.023	0.900	0.884	0.965	0.804	0.977
C_3 =Adjustment of X_n for sample size	1.003	0.996	0.996	1.002	1.002	1.004	0.996
C_4 = Adjustment of S_n for sample size	1.027	1.027	1.027	1.027	1.027	1.027	1.027
Adjusted Mean= $\overline{x}_n \times C_1 \times C_3$	51.7	59.3	34.9	53.0	51.0	45.4	50.2
Adjusted $S_n = S_n \times C_2 \times C_4$	21.2	22.9	10.9	21.3	15.1	20.0	17.3
PMP_1= Adjusted Mean + K_m ×Adjusted S_n	416.9	447.0	232.1	418.5	312.2	394.7	349.5
C_5 = Adjustment for fixed observational time intervals	1.13	1.13	1.13	1.13	1.13	1.13	1.13
$PMP_{Point} = PMP_1 \times C_5$	471.1	505.2	562.2	472.9	352.8	446.1	394.9
C_6 = Adjustment for area-reduction	0.7	0.7	0.7	0.7	0.7	0.7	0.7
$PMP_{Areal} = PMP_{Point} \times C_6$	329.8	353.6	183.6	331.0	246.9	312.2	276.5

Fig. 1.

Table II. Required steps in calculation of PMP by revised approach of Hershfield method

Stations	Aiah Ab	Kord Kooy	Ziarat	Ghaz Mahalleh	Shast Kelateh	Edareh Gorgan	Gorgan
$\overline{x}_n$	53.6	59.9	36.2	54.4	51.3	47.3	50.9
S_n	25.6	21.8	11.9	23.4	15.2	24.2	17.2
Max	150.2	104.7	63.5	132.0	92.0	139.0	95.0
Max=Xm	150.2	104.7	63.5	132.0	92.0	139.0	95.0
$\overline{x}_{n-m}$	50.6	58.5	34.5	52.0	50.0	44.4	49.5
S_{n-m}	19.1	20.6	9.8	19.1	13.6	18.0	15.5
K_m	5.216	2.248	2.949	4.182	3.101	5.264	2.932
$K_m^* = K_{m\text{-envelope}}$	5.260	5.260	5.260	5.260	5.260	5.260	5.260
$PMP = \overline{x}_n + K_m^* \times S_n$	188.122	174.396	98.551	177.606	131.268	174.391	141.358
C_1 = Adjustment for fixed observational time intervals	1.130	1.130	1.130	1.130	1.130	1.130	1.130
$PMP_{Point} = PMP \times C_1$	212.6	197.1	111.4	200.7	148.3	197.1	159.7
C_2 = Adjustment for area-reduction	0.73	0.73	0.73	0.73	0.73	0.73	0.73
$PMP_{Areal} = PMP_{Point} \times C_2$	155.18	143.86	81.29	146.51	108.28	143.85	116.61

Fig. 2.