

Long-term performance evaluation of the latest Multi-Source Weighted-Ensemble Precipitation (MSWEP) over the highlands of Indo-Pak (1981-2009)

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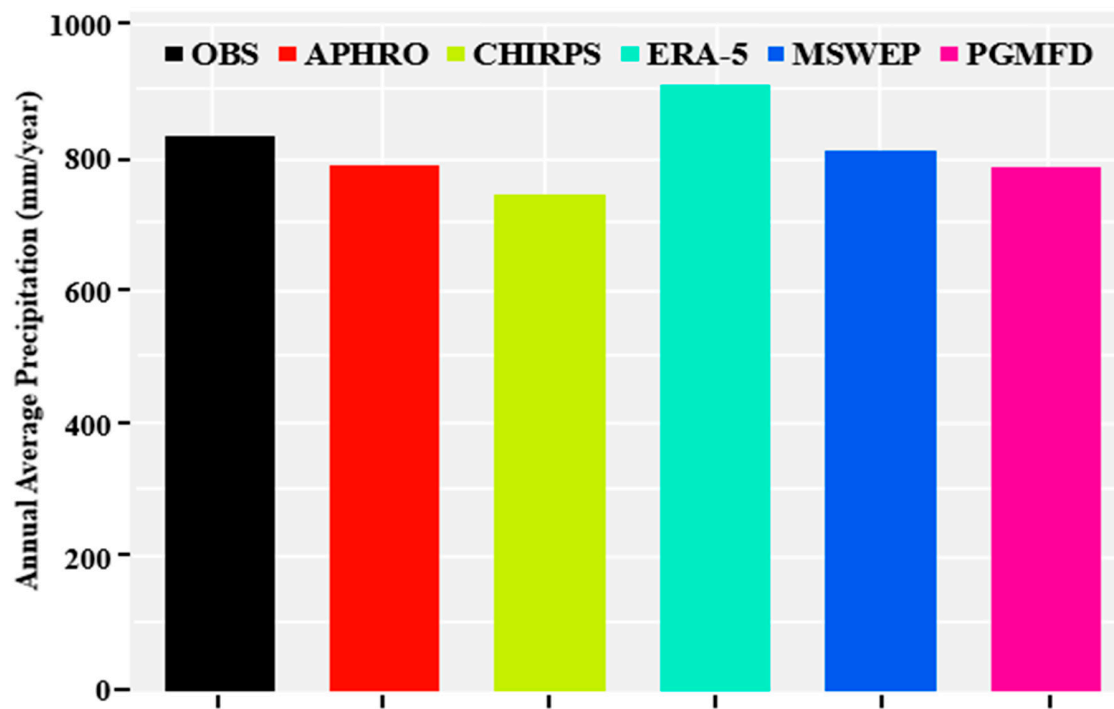


Figure S1. Annual average precipitation in JRB measured from five GPPs with reference gauges.

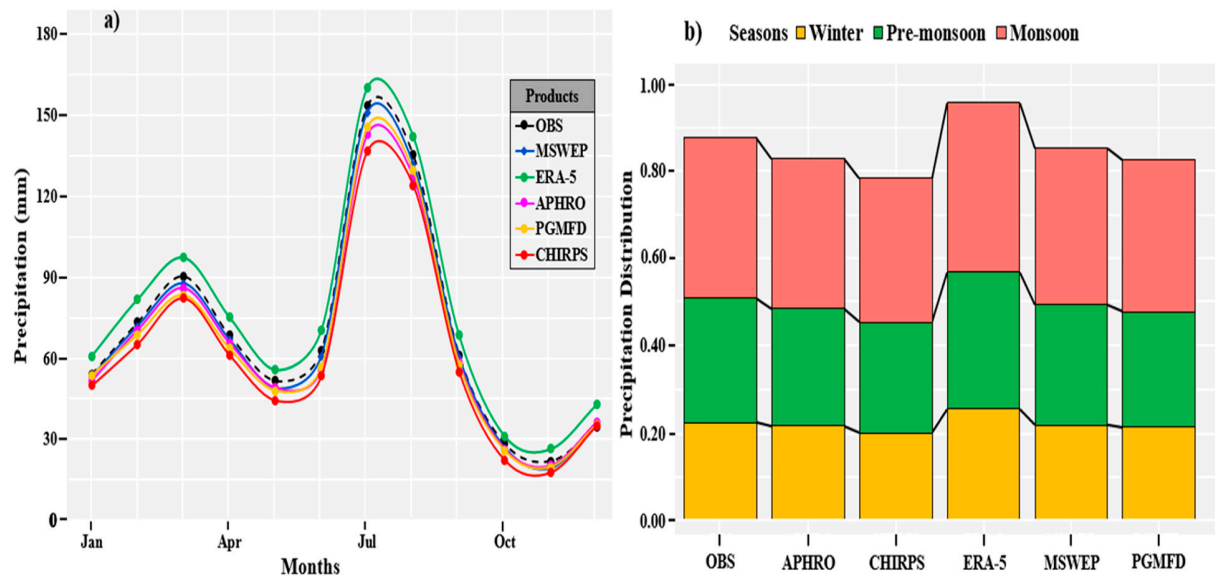


Figure S2. (a) Temporal precipitation distribution estimates derived from five GPPs and reference gauges at monthly scale. (b) Seasonal precipitation distribution derived from five GPPs and reference gauges in JRB during the entire study period.

Table S1. Geographical information of in-situ gauging stations used in the current study.

S.no	Stations	Latitude (dd)	Longitude (dd)	Elevation (m)
1	Mangla	33.15	73.69	335.00
2	Planderi	33.73	73.76	1690.91
3	Rawlakot	33.87	73.99	1944.82
4	Muzaffarabad	34.37	73.48	904.54
5	Gharidopata	34.16	73.83	1018.07
6	Kotli	33.50	73.90	600.23
7	Narran	34.90	73.65	2426.20
8	Balakot	34.55	73.35	1006.00
9	Gujjar Khan	33.26	73.30	463.53
10	Murree	33.90	73.40	1898.24
11	Astore	35.20	74.51	5432.14
12	Bagh	33.97	73.79	1089.48
13	Burzil	34.91	75.09	4103.22
14	Baramula	34.34	74.25	1668.27
15	Srinagar	34.08	74.83	1593.54
16	Pulwama	33.87	74.88	1669.65
17	Anantnag	33.68	75.14	1621.52
18	Gulmarg	34.00	74.33	3676.13
19	Pahalgam	34.03	75.33	2397.04
20	Wular lake	34.43	74.67	1944.26
21	Gad Wali	33.64	75.37	2353.41
22	Dras	34.52	75.31	3721.87

Table S2. The statistical metrics for performance evaluation of GPPs in contrast to in-situ gauges data during the entire study period 1981-2009 in five SBs at daily and winter (season) scales.

GPPs		Daily							Winter						
		CC	RMSE	BIAS	rBIAS (%)	POD	FAR	CSI	CC	RMSE	BIAS	rBIAS (%)	POD	FAR	CSI
I	APHRO	0.40	6.35	-1.39	-35.36	0.35	0.60	0.23	0.50	6.77	-0.58	-9.49	0.39	0.64	0.32
	CHIRPS	0.14	6.97	-3.13	-56.98	0.23	0.79	0.15	0.25	7.56	-0.60	-10.10	0.21	0.73	0.19
	ERA-5	0.41	6.23	0.98	28.45	0.38	0.60	0.29	0.50	6.75	0.95	38.83	0.36	0.66	0.30
	MSWEP	0.44	5.15	-1.14	-30.16	0.53	0.54	0.38	0.60	5.21	-0.29	-2.82	0.51	0.53	0.34
	PGMFD	0.30	6.36	-1.98	-40.96	0.33	0.62	0.22	0.33	6.99	0.88	22.52	0.24	0.66	0.20
II	APHRO	0.54	5.54	-1.06	-20.17	0.40	0.50	0.32	0.57	4.56	-1.06	-30.35	0.53	0.40	0.51
	CHIRPS	0.37	5.73	-2.20	-39.95	0.32	0.72	0.21	0.40	5.20	-1.12	-29.32	0.32	0.53	0.38
	ERA-5	0.55	5.46	-0.64	-7.96	0.44	0.49	0.39	0.55	4.52	-0.25	-1.35	0.63	0.44	0.39
	MSWEP	0.55	4.67	-0.51	-17.42	0.61	0.43	0.47	0.68	2.89	-1.02	-29.21	0.67	0.31	0.56
	PGMFD	0.40	5.55	-1.68	-32.74	0.38	0.51	0.32	0.44	4.73	-1.10	-31.91	0.40	0.44	0.41
III	APHRO	0.56	4.60	0.31	3.06	0.50	0.42	0.42	0.52	4.98	1.84	54.10	0.51	0.52	0.42
	CHIRPS	0.38	5.31	0.25	4.02	0.40	0.56	0.30	0.32	5.79	2.23	54.06	0.30	0.63	0.30
	ERA-5	0.60	4.49	2.81	61.64	0.52	0.43	0.48	0.60	4.96	1.85	69.95	0.54	0.40	0.48
	MSWEP	0.62	3.74	0.30	2.65	0.67	0.36	0.53	0.64	3.06	1.43	43.97	0.63	0.33	0.54
	PGMFD	0.49	4.62	0.32	3.93	0.46	0.45	0.34	0.38	5.18	1.86	55.72	0.28	0.53	0.29
IV	APHRO	0.62	3.80	-0.62	-15.87	0.60	0.33	0.54	0.65	2.26	0.27	8.34	0.74	0.20	0.65
	CHIRPS	0.45	4.93	-1.52	-31.37	0.48	0.39	0.40	0.54	2.77	0.60	12.63	0.45	0.39	0.56
	ERA-5	0.61	3.76	0.98	28.45	0.58	0.28	0.62	0.69	2.00	0.92	37.23	0.81	0.21	0.66
	MSWEP	0.71	3.05	-0.41	-12.76	0.73	0.25	0.64	0.78	1.06	0.25	7.55	0.86	0.17	0.76
	PGMFD	0.56	3.82	-0.96	-20.98	0.56	0.32	0.36	0.55	2.34	0.63	19.04	0.55	0.24	0.63
V	APHRO	0.74	2.68	-0.32	-10.17	0.66	0.23	0.64	0.62	4.33	0.90	19.08	0.54	0.29	0.60
	CHIRPS	0.59	3.28	-0.98	-24.97	0.53	0.27	0.47	0.49	4.61	1.50	35.87	0.32	0.46	0.50
	ERA-5	0.78	2.42	0.79	10.71	0.69	0.20	0.66	0.63	4.30	1.27	55.81	0.63	0.30	0.59
	MSWEP	0.81	2.10	-0.31	-8.52	0.80	0.16	0.71	0.73	2.19	0.87	17.76	0.73	0.26	0.63
	PGMFD	0.70	2.75	-0.49	-11.87	0.60	0.24	0.53	0.50	4.30	0.75	26.33	0.49	0.31	0.57

Table S3. The statistical metrics for performance evaluation of GPPs in contrast to in-situ gauges data during the entire study period 1981-2009 in five SBs together with pre-monsoon and monsoon seasons.

GPPs	Daily								Winter						
	CC	RMSE	BIAS	rBIAS (%)	POD	FAR	CSI	CC	RMSE	BIAS	rBIAS (%)	POD	FAR	CSI	
I	APHRO	0.45	6.48	-2.55	-24.22	0.26	0.68	0.21	0.39	6.73	-1.67	-40.12	0.42	0.57	0.29
	CHIRPS	0.23	7.07	-2.82	-49.96	0.18	0.82	0.14	0.25	7.69	-3.05	-48.58	0.18	0.71	0.19
	ERA-5	0.50	5.71	0.99	29.89	0.28	0.60	0.25	0.41	6.36	-0.33	-4.40	0.43	0.56	0.31
	MSWEP	0.50	4.89	-2.30	-23.41	0.45	0.51	0.35	0.40	6.30	-1.20	-32.63	0.46	0.54	0.33
	PGMFD	0.34	6.49	-2.78	-34.28	0.20	0.69	0.20	0.29	6.81	-2.00	-43.89	0.25	0.61	0.23
II	APHRO	0.57	4.56	-1.75	-15.59	0.48	0.46	0.46	0.58	4.54	-0.85	-25.72	0.58	0.41	0.50
	CHIRPS	0.33	5.18	-2.41	-40.36	0.37	0.63	0.37	0.43	5.16	-1.80	-28.61	0.40	0.55	0.41
	ERA-5	0.58	4.51	-0.04	-0.97	0.51	0.43	0.48	0.60	4.10	0.88	30.34	0.61	0.39	0.52
	MSWEP	0.66	3.40	-1.63	-13.03	0.60	0.35	0.54	0.62	4.00	-0.63	-15.95	0.62	0.38	0.54
	PGMFD	0.48	4.71	-1.97	-24.28	0.38	0.47	0.44	0.51	4.61	-0.96	-27.99	0.46	0.44	0.45
III	APHRO	0.56	5.38	-1.97	-19.52	0.44	0.60	0.31	0.48	4.64	0.56	11.98	0.51	0.50	0.39
	CHIRPS	0.29	6.20	-2.50	-42.51	0.29	0.75	0.28	0.33	5.65	-0.25	-3.99	0.29	0.63	0.38
	ERA-5	0.52	5.25	1.94	59.84	0.42	0.52	0.35	0.60	4.09	0.73	28.75	0.52	0.50	0.43
	MSWEP	0.58	3.84	-1.90	-15.24	0.52	0.43	0.44	0.61	4.00	0.55	10.95	0.55	0.47	0.53
	PGMFD	0.41	5.60	-1.98	-28.47	0.31	0.54	0.30	0.43	5.48	-0.10	12.61	0.35	0.53	0.35
IV	APHRO	0.59	3.78	-1.48	-11.91	0.56	0.31	0.61	0.78	2.75	-0.34	-2.83	0.72	0.24	0.72
	CHIRPS	0.35	4.15	-2.42	-38.31	0.46	0.52	0.42	0.61	2.88	-0.96	-15.33	0.56	0.35	0.62
	ERA-5	0.60	4.00	0.97	32.73	0.63	0.35	0.58	0.78	2.30	0.66	37.64	0.76	0.18	0.73
	MSWEP	0.72	3.31	-1.48	-11.87	0.67	0.26	0.68	0.80	2.21	-0.34	-2.78	0.78	0.17	0.75
	PGMFD	0.58	3.70	-1.95	-20.43	0.49	0.34	0.56	0.70	2.78	-0.58	-3.89	0.69	0.26	0.67
V	APHRO	0.64	2.54	-1.02	-6.98	0.70	0.20	0.71	0.68	4.24	-0.57	-14.03	0.68	0.30	0.64
	CHIRPS	0.41	3.25	-1.88	-29.93	0.55	0.37	0.62	0.52	5.11	-1.50	-24.12	0.46	0.42	0.42
	ERA-5	0.66	3.01	0.97	39.92	0.73	0.26	0.72	0.62	3.62	1.19	58.72	0.71	0.29	0.64
	MSWEP	0.79	1.54	-0.80	-1.38	0.81	0.15	0.75	0.69	3.61	-0.40	-10.12	0.72	0.27	0.62
	PGMFD	0.64	2.98	-1.15	-14.12	0.58	0.24	0.67	0.64	3.35	-1.16	-15.78	0.59	0.35	0.59