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Supplement of

Probabilistic seasonal outlook for the rainy season over India by monitoring the onset dates using GPM IMERG satellite-based precipitation

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Table S1*: Contingency table to generate relative operating characteristic (ROC) curves and quantify prediction (perturbation) uncertainty.*

Probability of Occurrence	**Exceeds Threshold**	**Does Not Exceed Threshold**
Event Observed (Yes)	Detection	Non-Detection
Event Not Observed (No)	False Alert	Correct Rejection

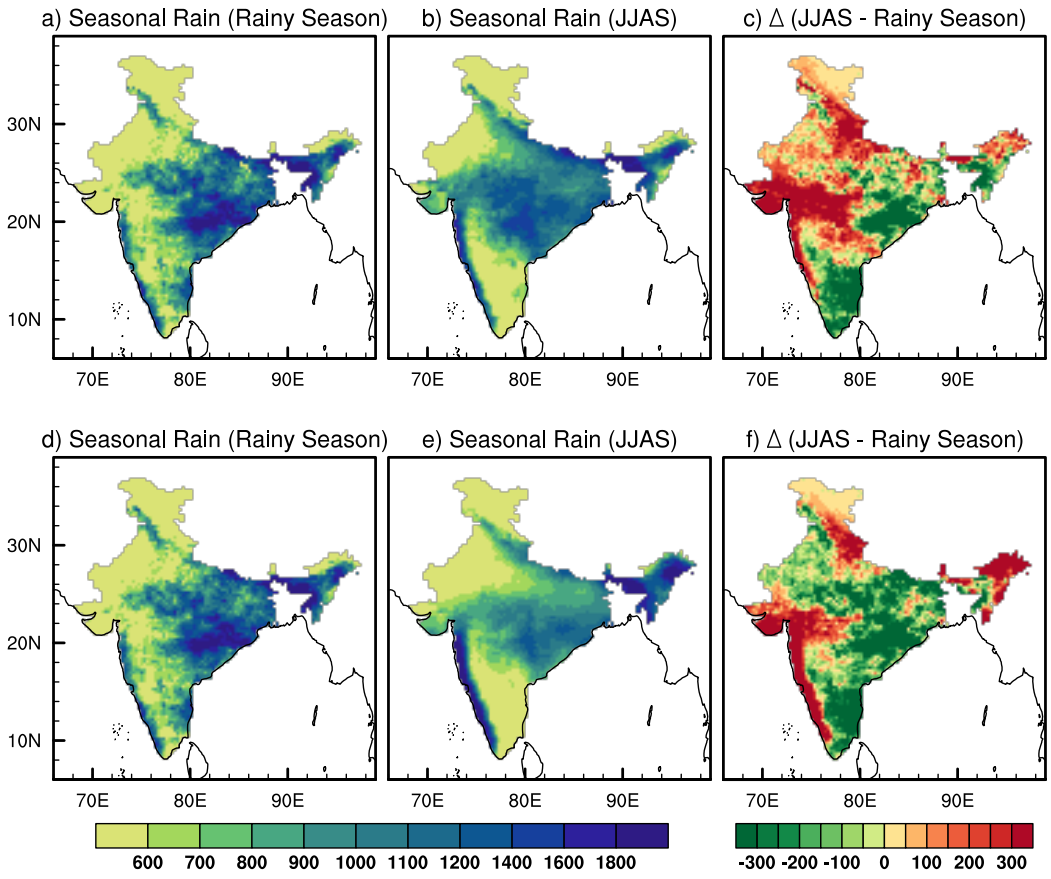

Figure S1: *The climatological seasonal accumulated rainfall (mm) of the a, d) rainy season b, e) southwest monsoon (June-September) from a, b, c) IMERG Late and d, e, f) IMERG Final and c, f) difference between the JJAS and rainy season.*

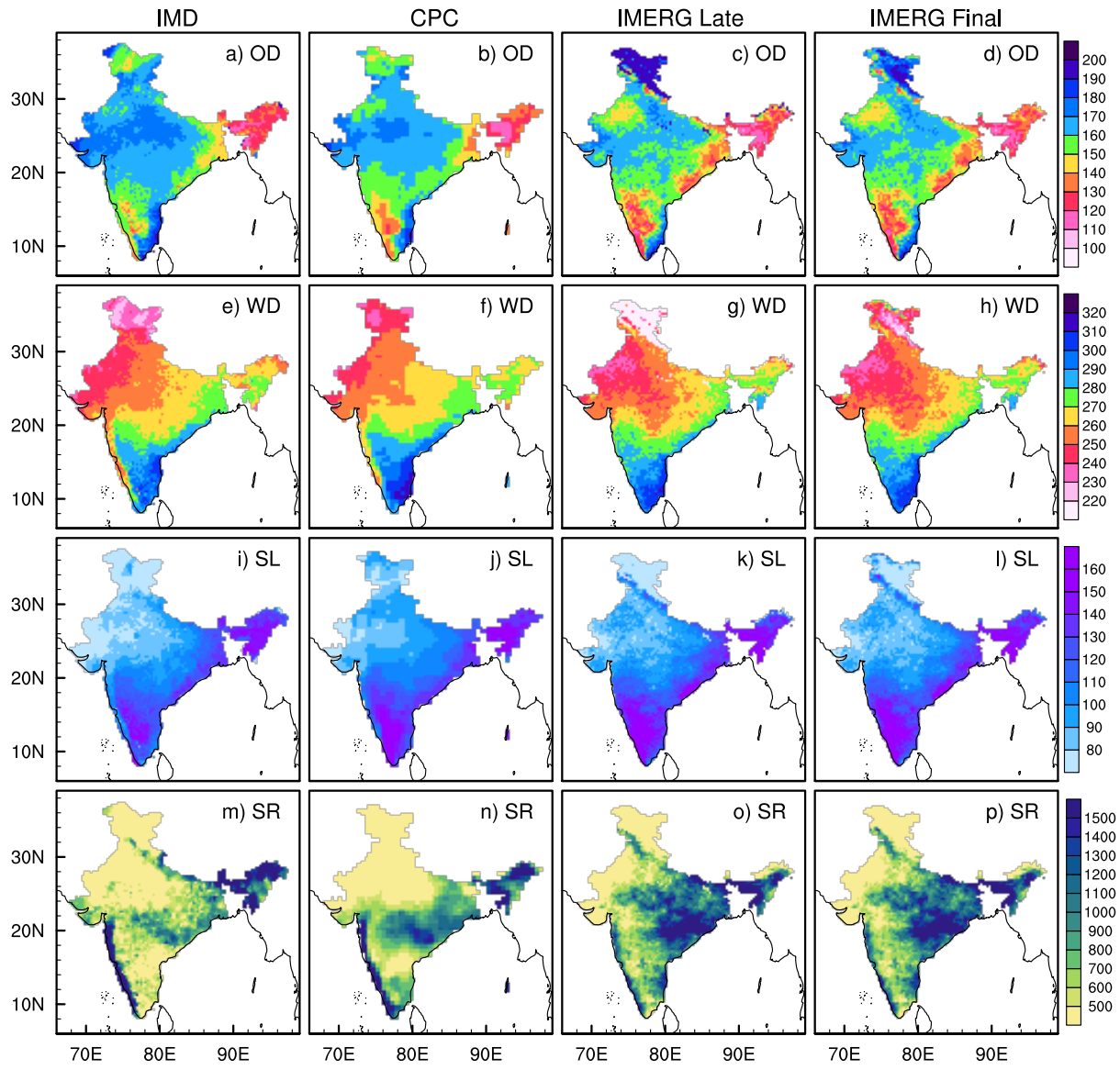

Figure S2: *The climatological mean a, b, c, d) onset date (OD, Julian day), e, f, g, h) withdrawal date (WD, Julian day), i, j, k, l) seasonal length (SL, days), and m, n, o, p) seasonal accumulated rainfall (SR, mm) of the rainy season from a, e, i, m) IMD, b, f, j, n) CPC, c, g, k, o) IMERG Late, and d, h, l, p) IMERG Final.*

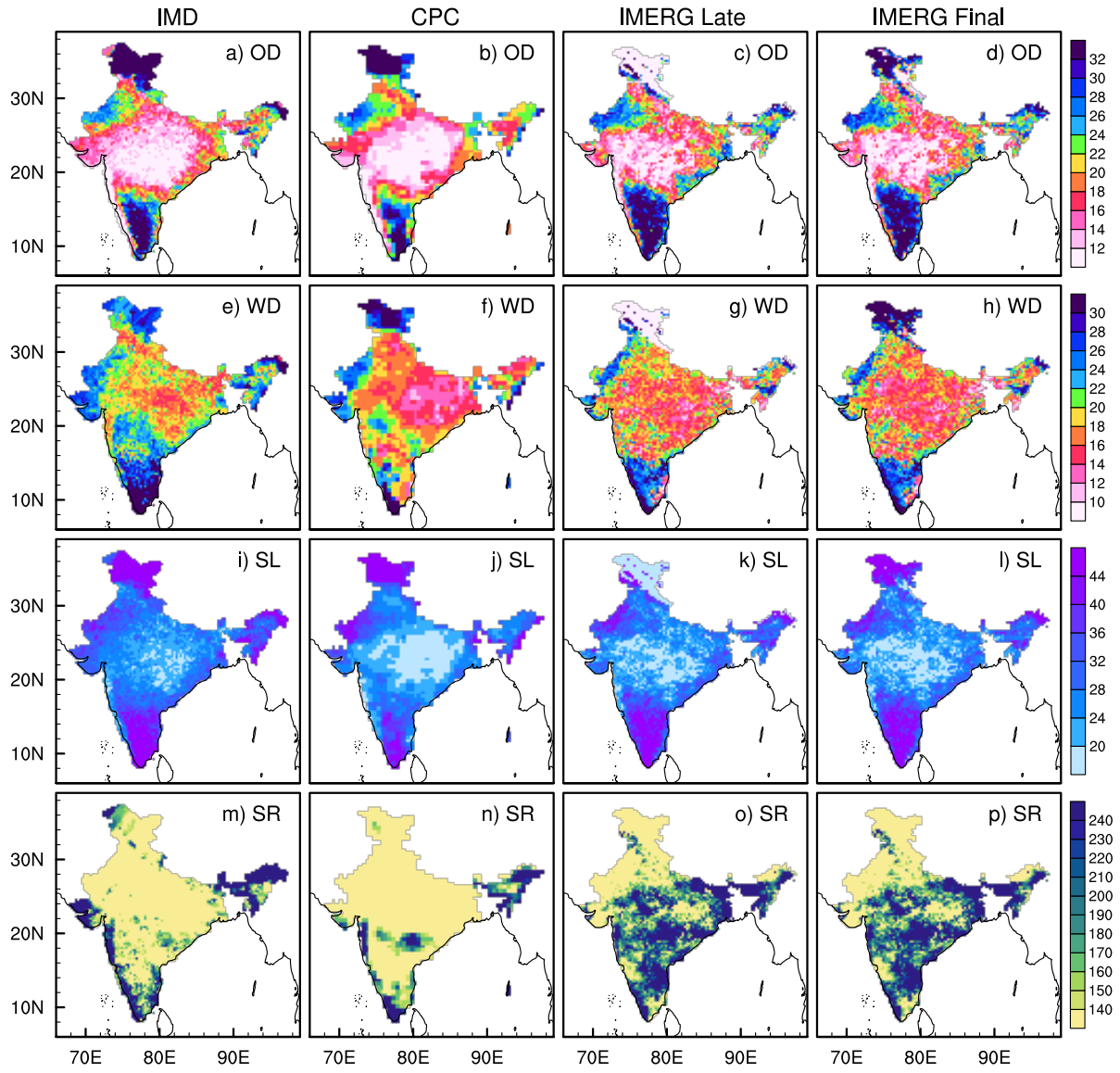

Figure S3: *The standard deviation of a, b, c, d) onset date (OD, Julian day), e, f, g, h) withdrawal date (WD, Julian day), i, j, k, l) seasonal length (SL, days), and m, n, o, p) seasonal accumulated rainfall (SR, mm) of the rainy season from a, e, i, m) IMD, b, f, j, n) CPC, c, g, k, o) IMERG Late, and d, h, l, p) IMERG Final.*

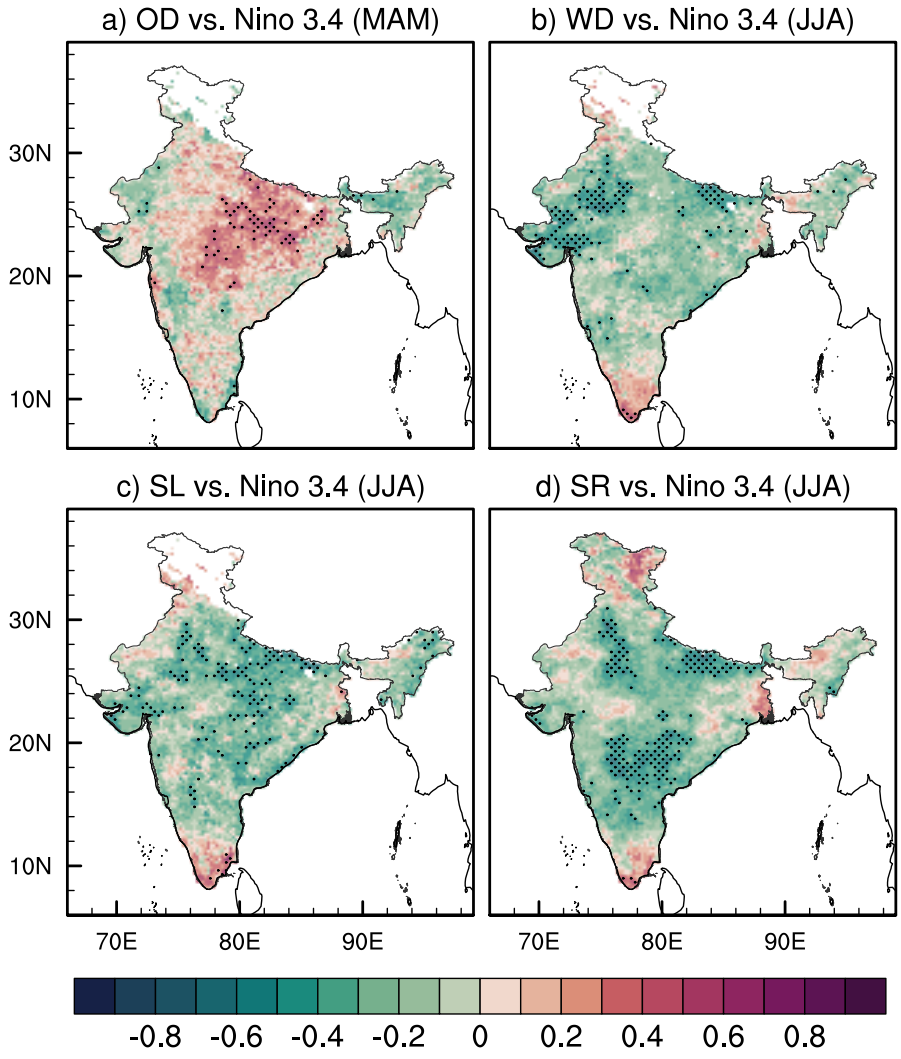

Figure S4: *The correlation coefficients of MAM Niño3.4 indices with anomalies of (a) onset date (OD), and JJA Niño3.4 SST index with anomalies of (b) withdrawal date (WD), (c) seasonal length (SL), and (d) seasonal accumulated rainfall (SR) of the rainy season. The stippling indicates statistical significance at a 5% significance level according to the t-statistic. However, all panels in this figure fail the Benjamini and Hochberg (1995) test.*

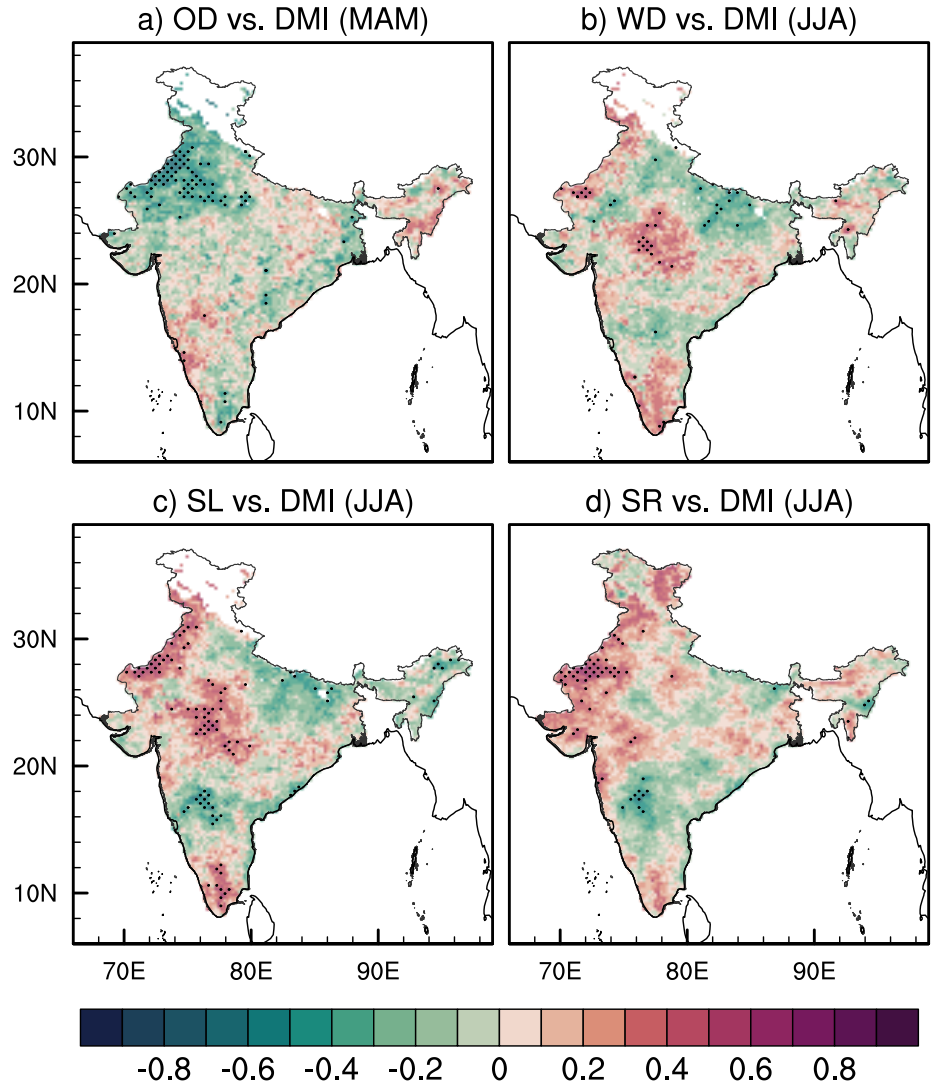

Figure S5: *The correlation coefficients of MAM dipole model index (DMI) with anomalies of (a) onset date (OD), and JJA DMI with anomalies of (b) withdrawal date (WD), (c) seasonal length, and (d) seasonal accumulated rainfall (SR) of the rainy season. The shading indicates statistical significance at a 5% significance level according to the t-statistic. However, all panels in this figure fail the Benjamini and Hochberg (1995) test.*