Uncovering consistencies in Indian rainfall trends observed over the last half century

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This document includes electronic supplementary material and high resolution figures of the open access paper:

Electronic Supplementary Material

High resolution and large size version of the figures 1, 2 and 3 of the main manuscript are provided at the end of this document.

Table S1 List of the 29 variables, variables 1-14

	Period				
	Winter	Pre-monsoon	Monsoon	Post-monsoon	Year
Rainfall depth	1	2	3	4	5
Number of rainy days	6	7	8	9	10
Maximum daily rainfall	11	12	13	14	

Table S2 List of the 29 variables, variables 15-26

	Months			
	June	July	Aug	Sep
Rainfall depth	15	16	17	18
Number of rainy days	19	20	21	22
Maximum daily rainfall	23	24	25	26

Table S3 List of the 29 variables, variables 27-29

| Date		
Wet season onset	Wet season peak	Wet season retreat
27	28	29
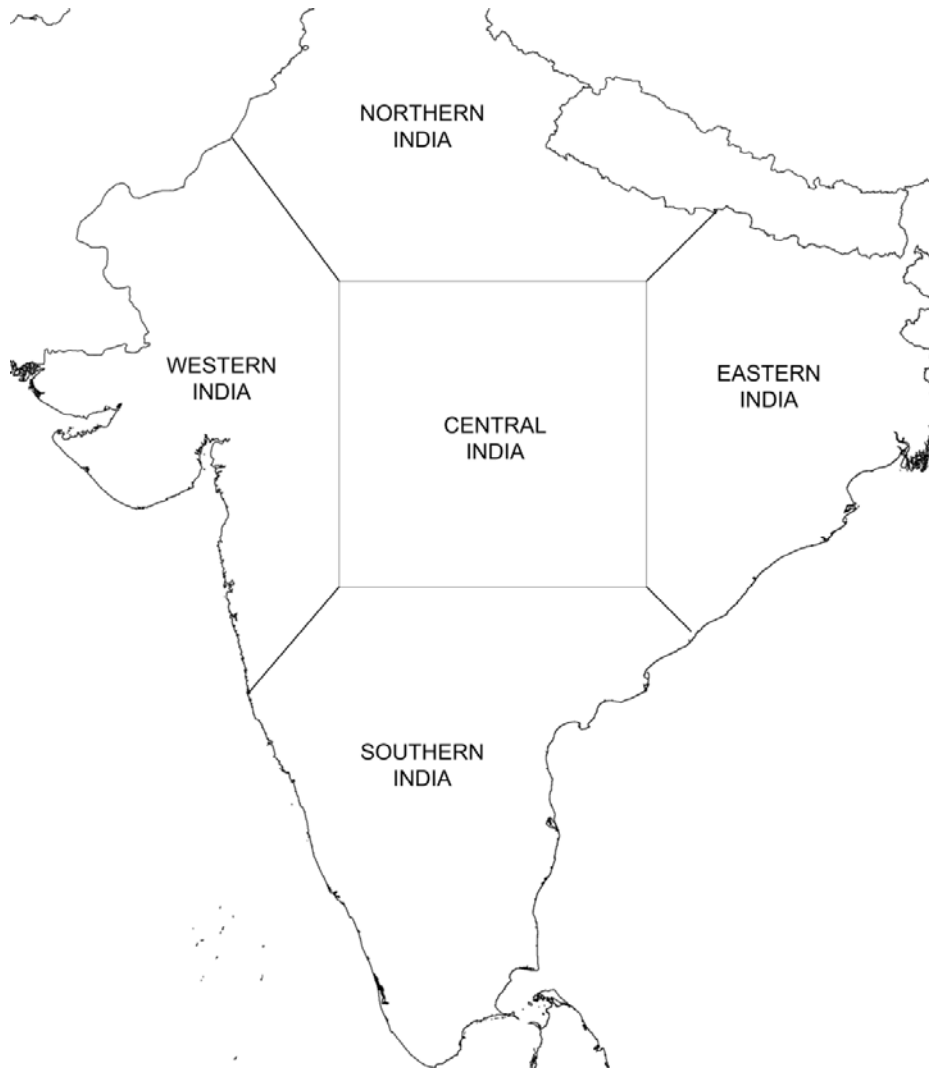
Fig. S1 The 5 areas used to classify spatial pattern of rainfall trends in previous studies referred in table 1 of the main manuscript
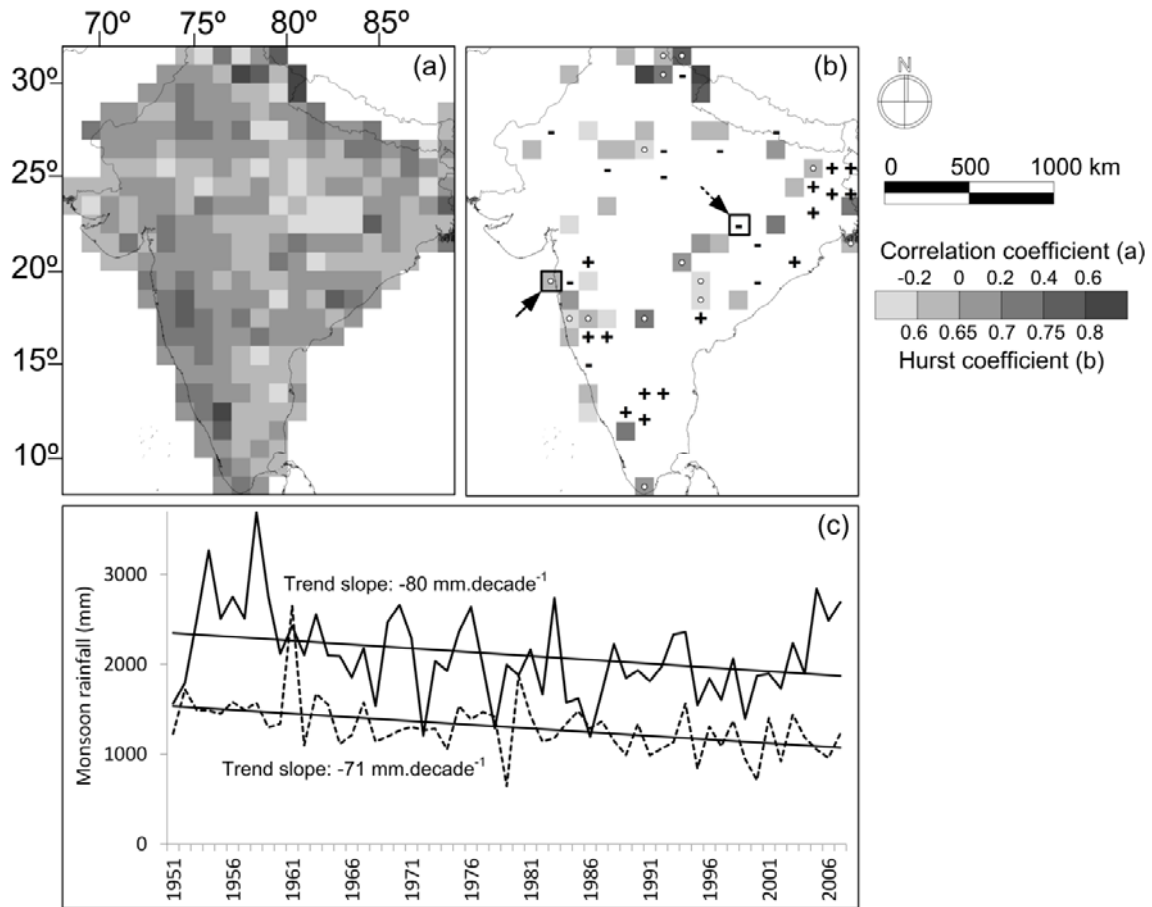
Fig. S2 Auto-correlation coefficients and effect of scaling behavior on local trend significance for trends in monsoon rainfall depth. a: first-order auto-correlation coefficients obtained from the pre-whitening methodology (Hamed et al. 2009). b: Significant Hurst coefficients according to the modified Mann-Kendall test (Hamed 2008). Positive and negative signs correspond to 5% significant rising and declining trends, respectively. White dots represent 5% significant trend, according to the original Mann-Kendall test, which are insignificant according to the modified test. c: time series corresponding to arrowed framed cells in b. Solid (dotted) curves correspond to solid (dotted) arrows.

The solid curve in fig S2c is 5% significant according to the original Mann-Kendall test. Applying the modified Mann-Kendall test (Hamed 2008) to this time series, we obtained a Hurst coefficient of 0.64 and a new significance level (30%) above the 5% threshold. Therefore, this trend is insignificant at the 5% level, according to the modified Mann-Kendall test. A graphical illustration of the scaling behavior is the slightly concave shape of the solid curve which could be part of a multi-decadal cycle rather than a unidirectional long-term trend, hence the absence of significant trend according to the modified test. The dotted curve has an absolute slope lower than that of the solid curve but remains significant at the 5% level, according to both the original and modified tests. Consistently, no scaling effect was found for this curve (Hurst coefficient = 0.5) which does not exhibit any apparent multi-decadal variability.
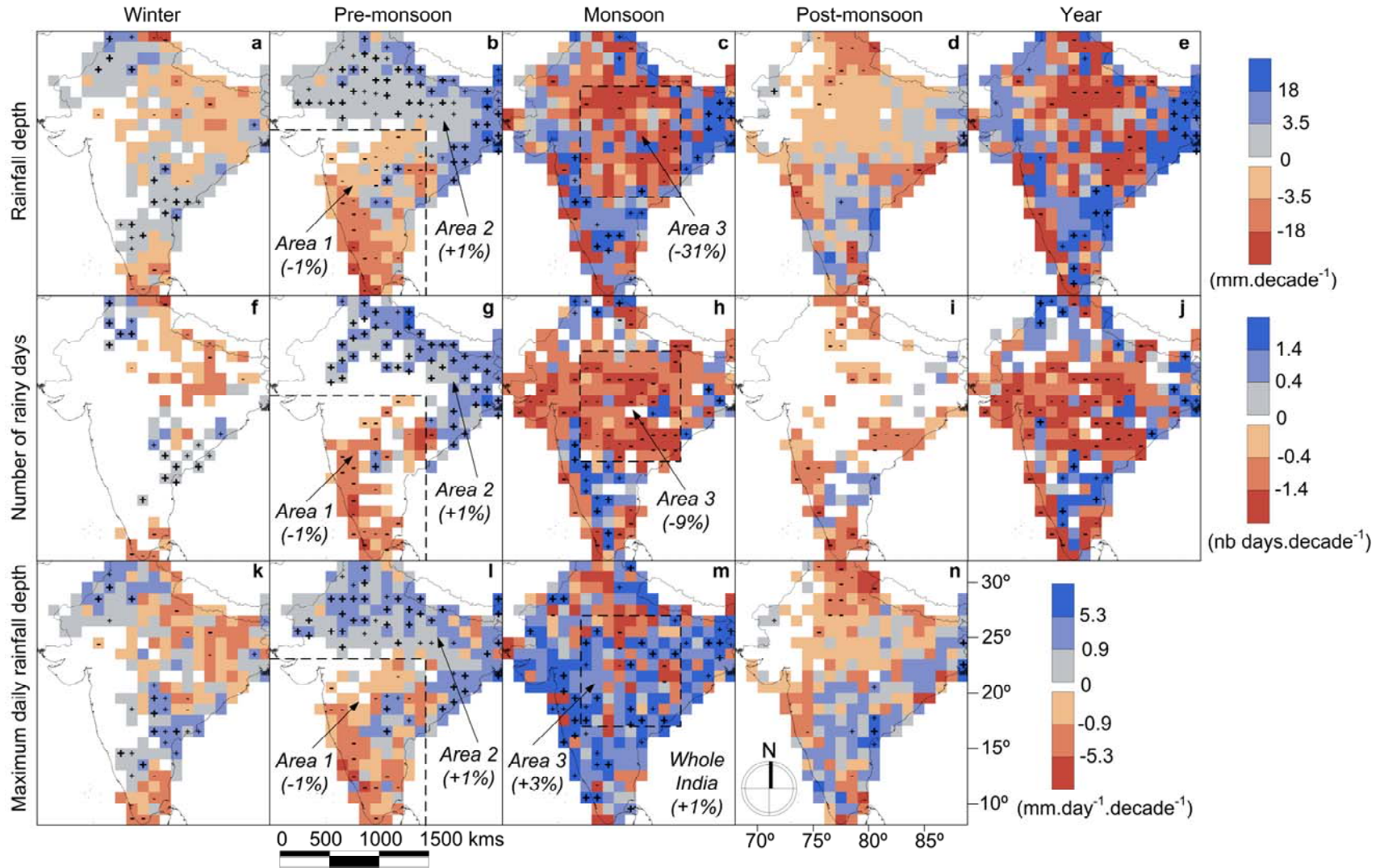
Fig. 1 Trends in seasonal and annual rainfall depths **(a-e)**, number of rainy days **(f-j)** and seasonal maximum daily rainfall **(k-n)** (variables 1 to 14). Signs indicate direction of statistically significant trends at cell level (bold font = 5% significance level. Normal font = 10% significance level). Bracketed percentages provide field significance level and direction of regional trends in respective areas
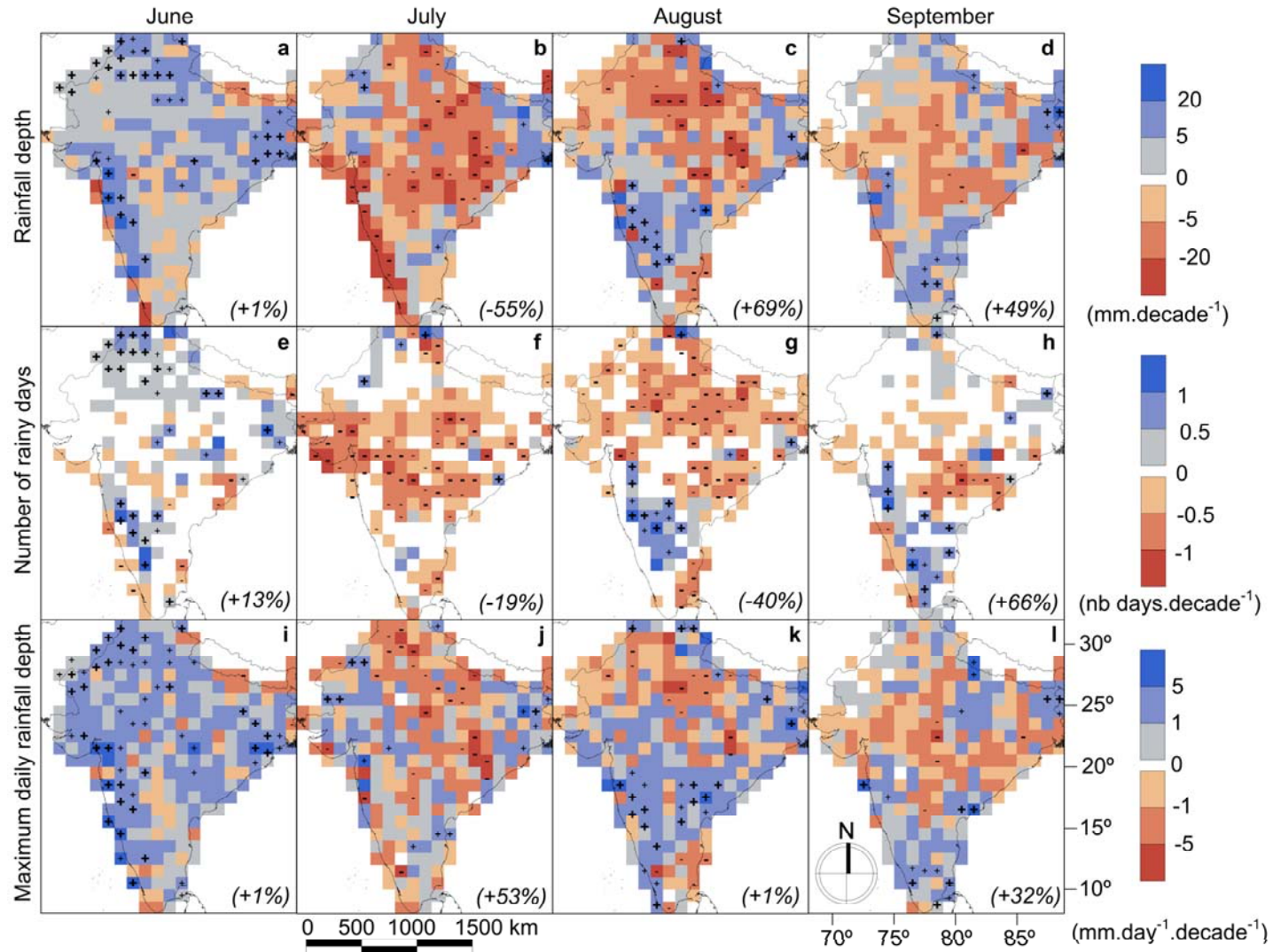
Fig. 2 Trends in monthly rainfall depth (**a-d**), number of rainy days (**e-h**) and maximum daily rainfall (**i-l**) during the monsoon (variables 15 to 26). Signs indicate direction of statistically significant trends at cell level (bold font = 5% significance level. Normal font = 10% significance level). Bracketed percentages provide field significance level and direction of regional trends over whole India
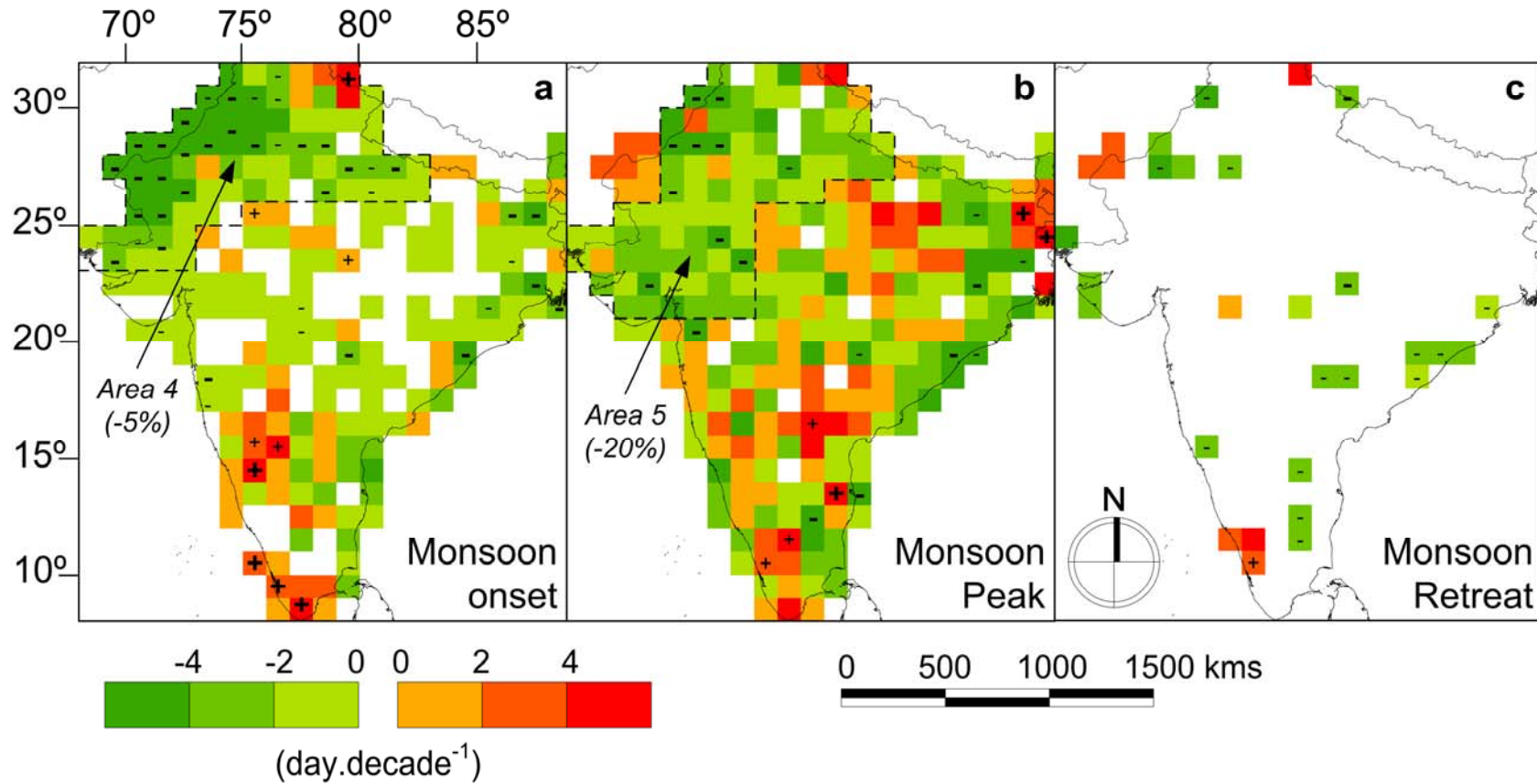
Fig. 3 Trends in the occurrence of the monsoon (variables 27 to 29). Signs indicate direction of statistically significant trends at cell level (bold font = 5% significance level. Normal font = 10% significance level). Bracketed percentages provide field significance level and direction of regional trends in respective areas