Impact of Climate Change on combined Flood and Drought events in India

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Introduction

- The severity and frequency of drought and flood would be affected due to climate change in different parts of the world.
- However, the characteristics of combined flood and drought events are not known.

Methodology

IMD gridded daily precipitation data

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Calculation of daily WAP values

$$WAP = \frac{\sum_{n=0}^{N} a^n P_n}{\sum_{n=0}^{N} a^n}$$

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Daily SWAP (standardising WAP values)

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Frequency of Drought and flood days in each year

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Fitting Drought and Flood frequency values in univariant distribution of each period

Fitting Drought and Flood frequency values to copula bi-variant distribution of each period

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Calculating the 5-,10-,25- year return period values

Calculate the combined return period in the current period corresponding to 5-,10-,25- year return period values of the base period

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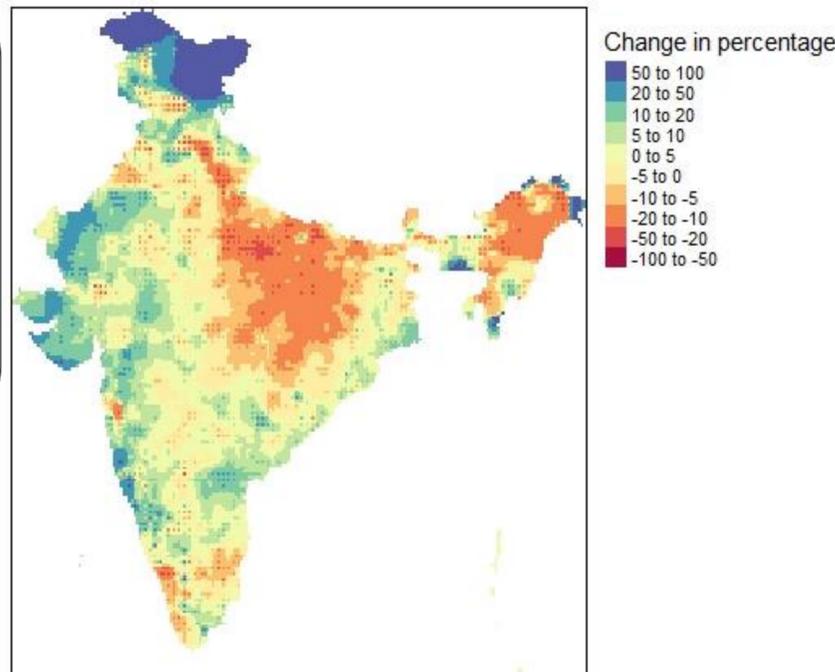
Spatial plots for percentage change of 5-,10-,25- return period values

Fig. 1: Percentage of annual precipitation of current period corresponding to base period

Change in percentage
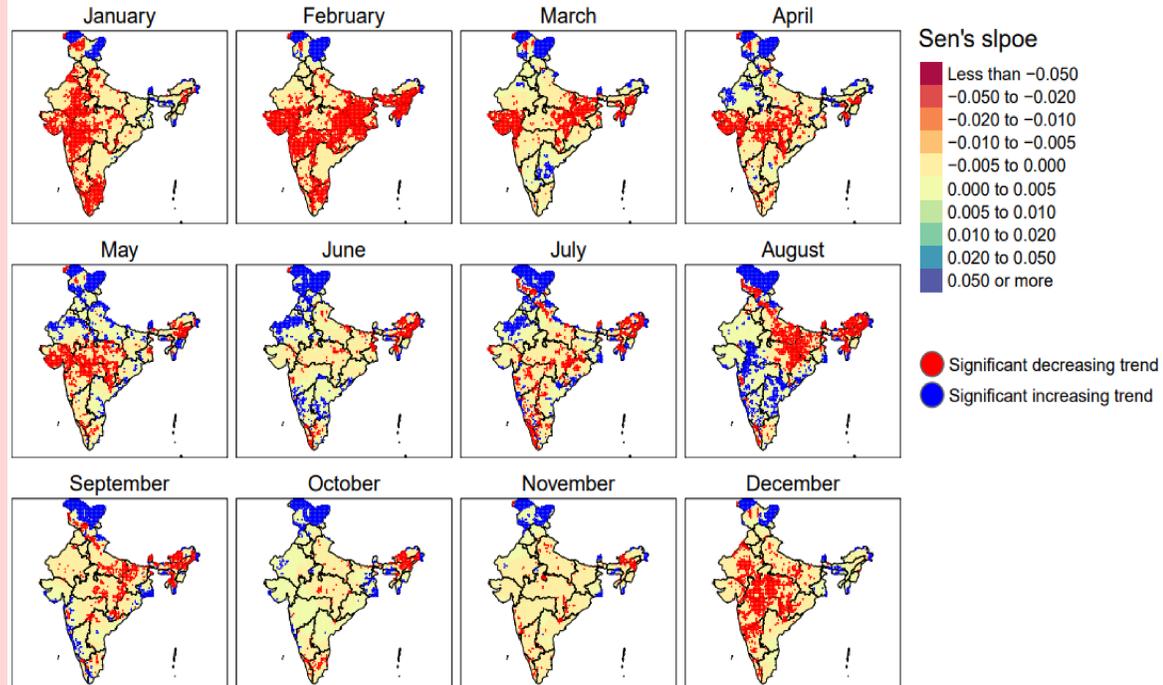
Fig. 2: Trend of monthly SWAP values (1901-2018)

Sen's slpoe

Significant decreasing trend
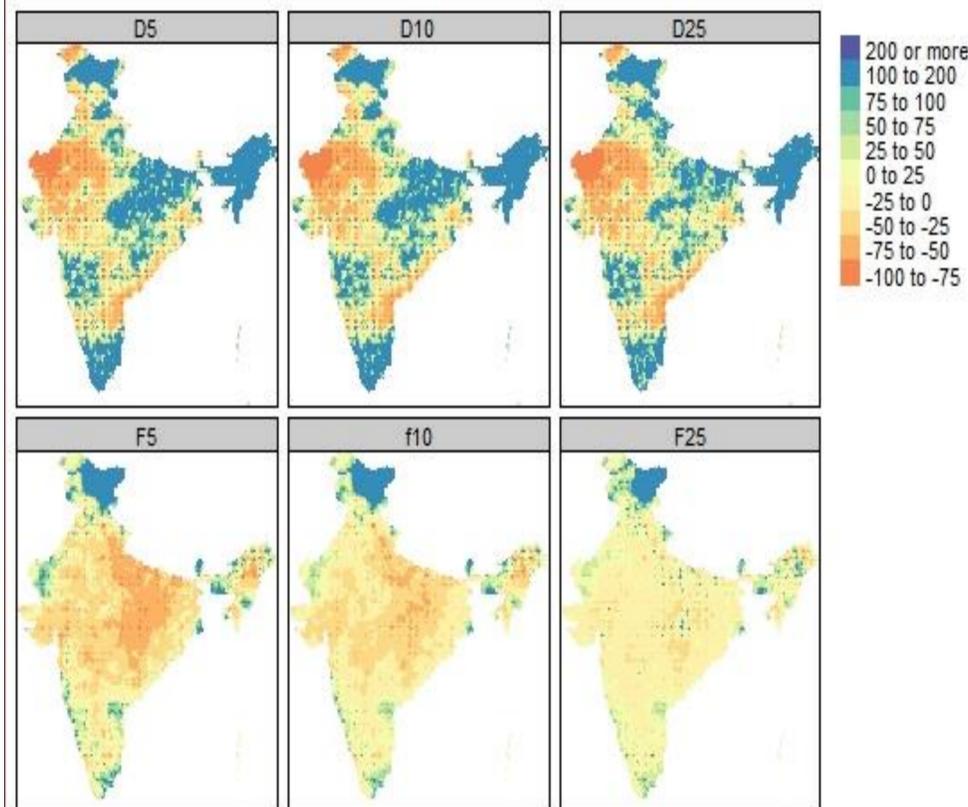
Significant increasing trend

Fig. 3: Percentage change of return period values of drought and flood of current period corresponding to base period, where D indicated drought, F indicates flood, 5,10,25 indicates the respective return period values
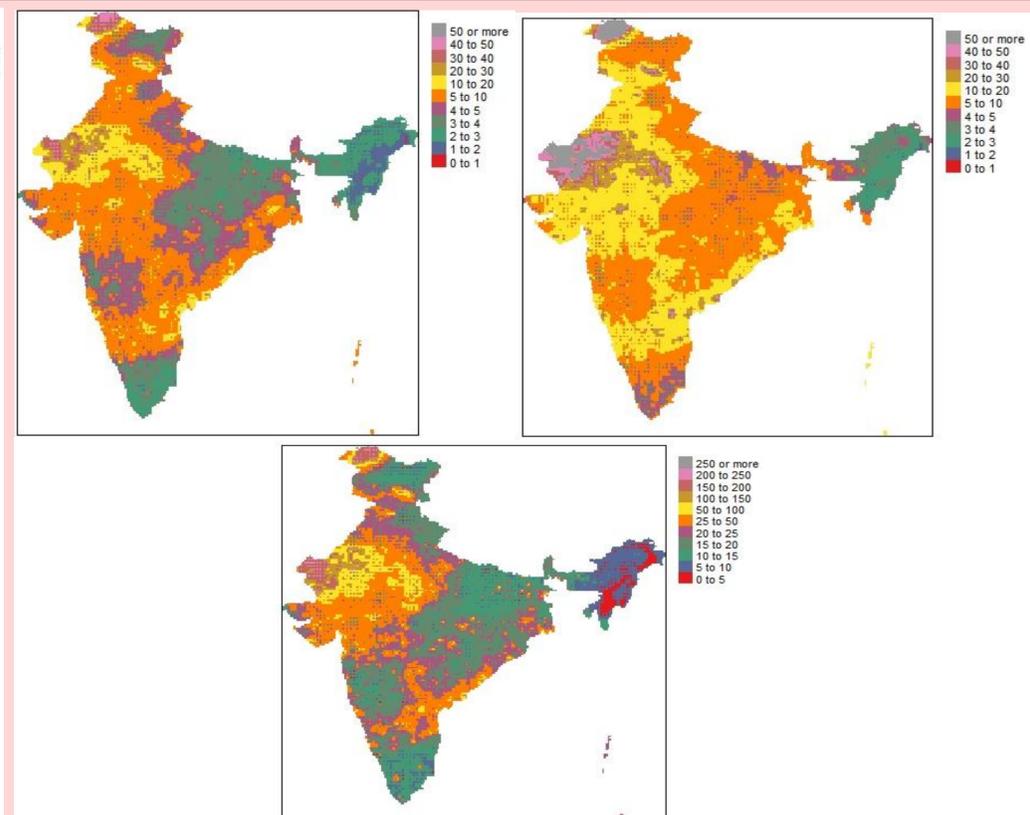
Fig. 4: Joint return period of current period corresponding to base period's 5-, 10-, 25- year return period values

Summary

The table provides information about % of grids in a particular category (S_I = Significant increase, S_d = Significant decrease, T_c = combined return period; T_b = Corresponding return period, Base period = 1901 – 1930, Current period = 1991 – 2018)

	S_I	S_d
% change of annual precipitation	15.29	7.44
% change of drought for 5- year return period value	43.54	40.44
% change of drought for 10- year return period value	43.35	40.6
% change of drought for 25- year return period value	40.99	40.91
% change of flood for 5- year return period value	15.32	12.56
% change of flood for 10- year return period value	11.38	4.96
% change of flood for 25- year return period value	11.44	2.38

	$T_c > T_b$	$T_c < T_b$
Joint return period corresponding to 5- year return period	60.79	39.21
Joint return period corresponding to 10- year return period	43.48	36.49
Joint return period corresponding to 25- year return period	79.16	20.71

- This study reveals that less intensity drought, flood, and combined flood-drought events are increasing in more grid points.
- The study outcomes will help the decision-makers to make efficient decision to overcome the impacts of the hydroclimatic extremes.

References

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