



in prep

Characterize the Spatial and Temporal Extreme Precipitation Events over West Africa

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MOTIVATION

- Extreme Precipitation Events (EPEs) have significant impacts and precipitations are one of the most essential climatic variables and the key determinants for human security in West Africa (WA) (Behanzin, 2016).
- But, to understand EPEs, early studies and current research predominantly used rain gauge data, as it is often believed that there are the most reliable.
- Unfortunately, little is known about EPEs in WA (Barry et al., 2018; Behanzin, 2015; Engel et al., 2017; Hountondji and Ozer, 2011; Ly et al., 2013; Panthou et al., 2014)
- **No clear scientific consensus has yet been reached on EPEs, leading to a debate on whether extreme EPEs is occurring, will continue or not?**
- Integrated Multi Satellite-based products can offer an opportunity to advanced understand, and overcome the problem for the benefit of society.



Source: Behanzin, 2020

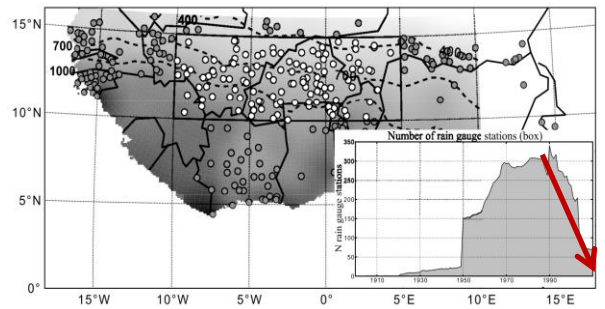


Fig 1. Existing precipitation gauge over WA has been decreasing drastically over 40 years. Source: Panthou et al. (2012)

Years	A	B	C	D	E	F	G	H	I	J	K	L	M
Years	January	February	March	April	May	June	July	August	September	October	November	December	
20 1994	0	0	0	0	45	144.5	192	186	432.5	168.3	23	0	0
21 1995	0	0	0	0	0	0	52.5	173.5	54.5	54.5	31.9	0	0
22 1996	0	0	0	0	0	48.6	110.9	127.5	232.2	105.9	0	0	0
23 1997	0	0	23	18.5	91	78.6	125.6	106.5	241.1	164.9	0	0	0
24 1998	0	0	0	0	0	86.8	20.2	0	160.9	199.8	52	0	0
25 1999	0	0	0	0	0	0	0	0	0	0	33.7	0	0
26 2000	0	0	0	0	0	0	0	0	0	0	2.2	0	0
27 2001	0	0	0	1	30.4	30.8	279	223.4	89.1	89.1	2.2	0	0
28 2002	0	0	0	12	97.8	68.7	197.4	139.2	120.2	120.2	0	0	0
29 2003	0	0	0	0	10.7	82.4	22.1	234.9	126.3	126.3	2.5	1.5	0
30 2004	0	0	0	17.4	63.2	73.1	164.4	166.2	85.3	85.3	0	0	0
31 2005	0	0	0	0	0	110.7	177.4	216.5	133.8	133.8	11.3	0	0
32 2006	0	0	0	0	21.19	0	150.4	198.4	172.7	172.7	12.2	0	0
33 2007	0	0	0	0	63.9	62.6	159.4	293.4	67	67	0	0	0
34 2008	0	0	3.3	0	74.9	139.1	192.7	142.1	126.3	126.3	45.7	0	0
35 2009	0	0	0	7.3	51	152.7	169.5	301.9	118.6	118.6	0	0	0
36 2010	0	0	0	0	11.7	131.9	103.2	229.3	112.4	112.4	91.6	0	0
37 2011	0	0	0	0	50.3	58.3	121.1	190.4	146.9	146.9	18.9	0	0
38 2012	0	1.1	0	0	2.5	66.6	93	169	195	214.6	31	0	0
39 2013	0	0	0	0	117.1	31.5	99	163.2	135.8	135.8	48.5	0	0

Fig.2: Large fraction of existing data are nested with significant gaps/missing data. Source: Excerpt of precipitation tipping bucket record, Karimama, Niger River Basin, Benin. (Behanzin, 2014).

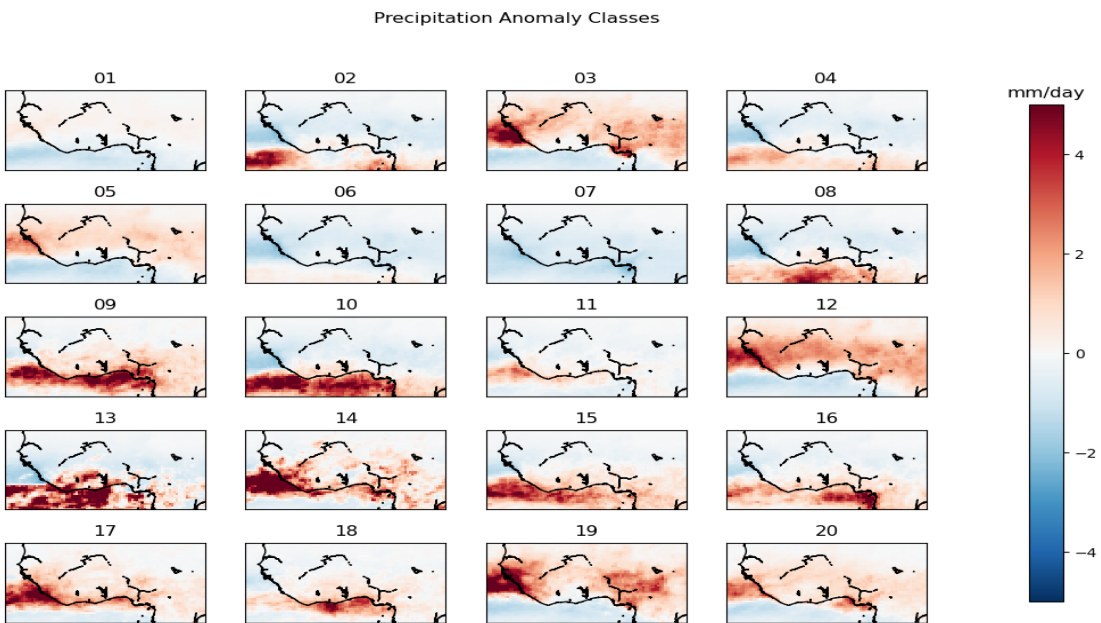
Objective: Use IMERG to characterize the spatial and temporal EPEs over WA

Data	Version	Resolutions		Format	Period
		Spatial	Temporal		
GPM_3IMERG	Final Run L3 V6	0.1 x 0.1	Daily / Monthly	netCDF / GEOTIFF	2000-present

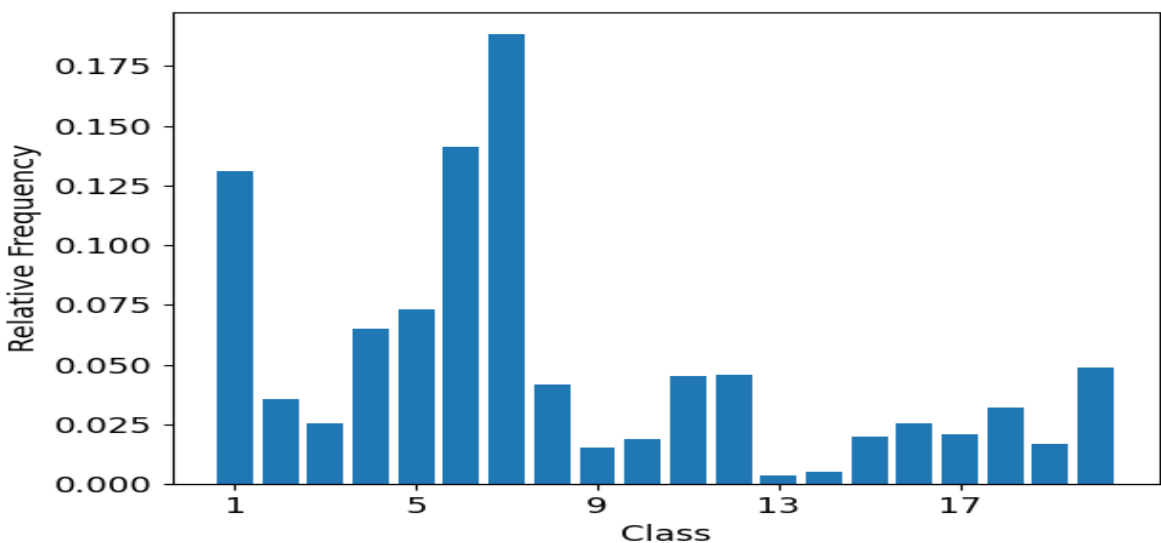
Methodology

- 10 years (so far), i.e. 2001-2010 of daily IMERG data over West Africa are classified by their similarity into 20 classes
- The frequency of classes/patterns is investigated
- The probabilities of transition from a class (pattern) into another are estimated.

Early results: 10 Years daily IMERG Precipitation Patterns for WA



Relative Frequency of Precipitation Anomaly Pattern (classes)



Next steps.

- The distribution of precipitation will be characterized for each pattern using an Empirical Orthogonal Function analysis
- The Transition Probability Matrix will be used to simulate sequences of patterns (e.g. 5 days, 7 days, etc.) and precipitation anomalies will be generated for each pattern
 - Various measures of extreme values (e.g. probability of exceeding a threshold, accumulation, largest n-values, etc.) will be calculated

THANK YOU !!!