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UK | CHINA | MALAYSIA

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Supervisors:

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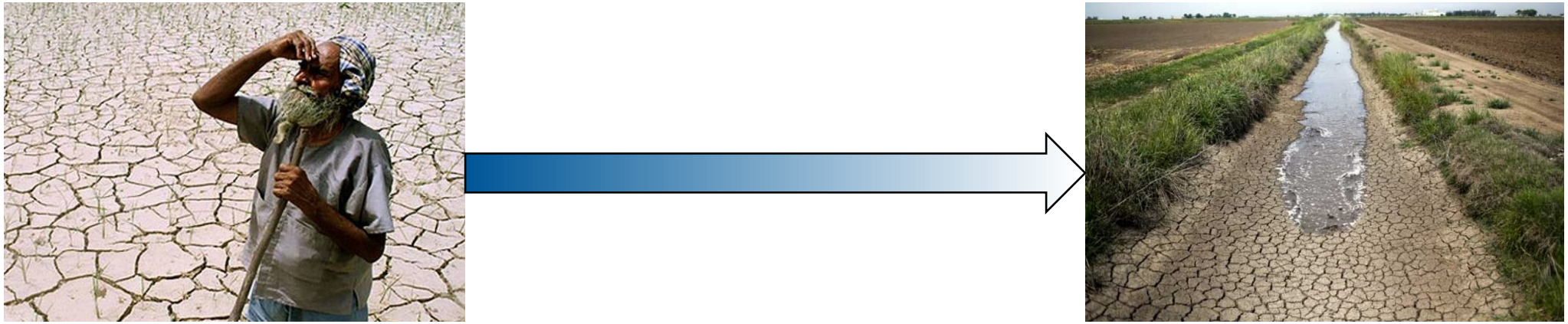
Topic - Investigating factors influencing the transition from meteorological to hydrological droughts

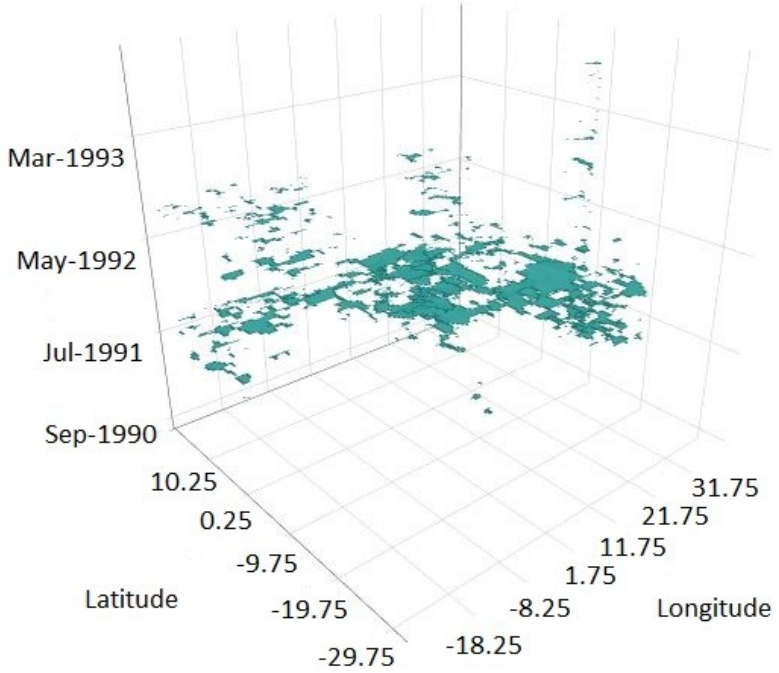
Drought events from 1971 – 2001 and their propagation from meteorological to hydrological drought

- Daily precipitation WFD climate forcing from ISIMIP 2a.
- Daily total runoff based on WFD, under varsoc socioeconomic scenario from ISIMIP 2a simulation round

- Daily to monthly scale



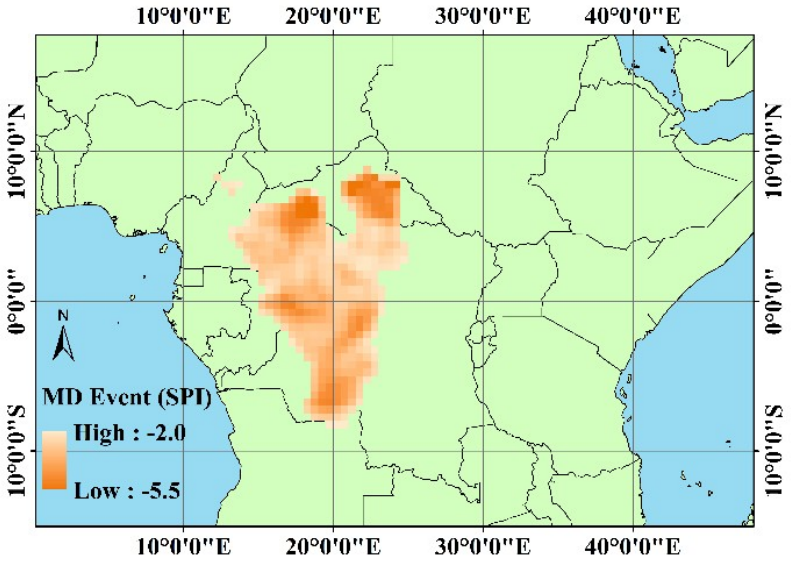
- 101 year precipitation data for meteorological drought (1901–2001)
- 31 years total runoff from 7 different global hydrological models for hydrological drought (1971 – 2001)
- Ensemble of DBH, H08, LPJmL, MATSIRO, PCR-GLOBWB, VIC, WaterGAP2-2c
- Using Standardised precipitation index (SPI) for MD and SRI for HD.

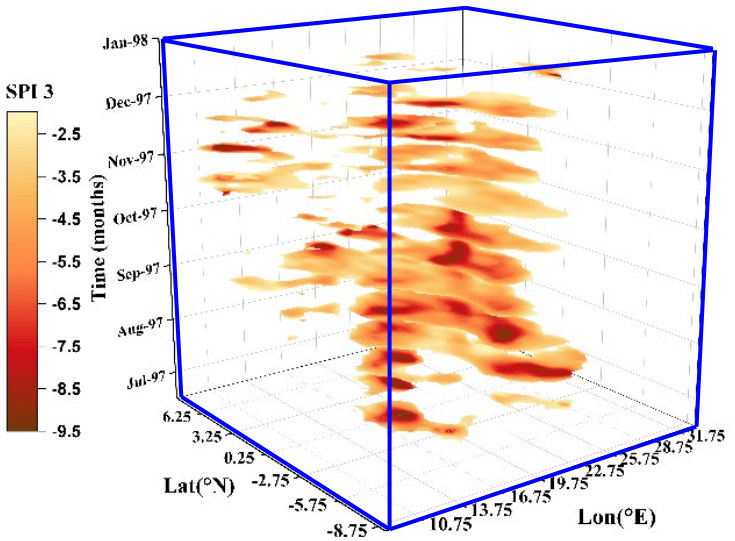


- Clustering algorithm (Lloyd-Hughes, 2012)
- 3D clustering for identification of drought events as 3D structures

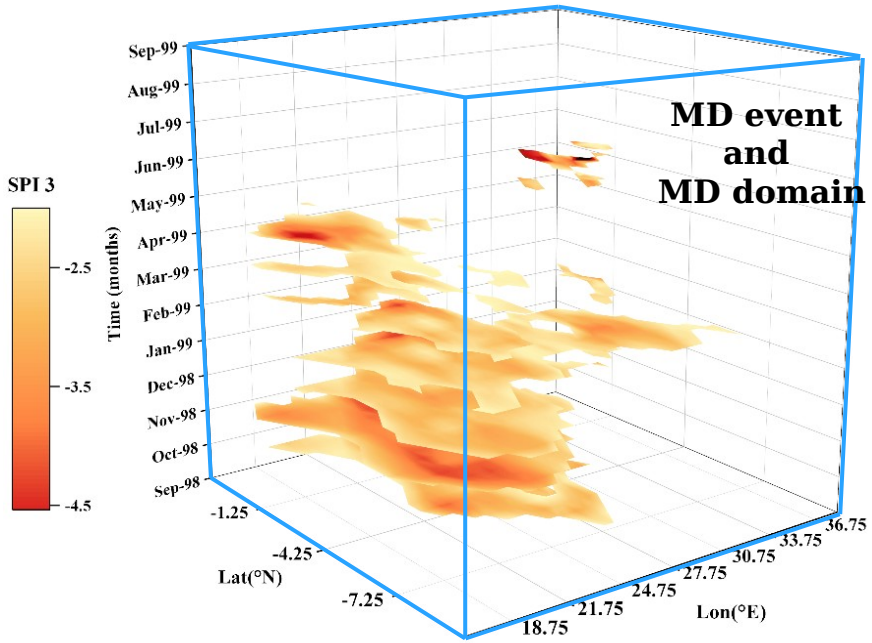
Identification of drought events in 3D (space and time) and drought characteristics

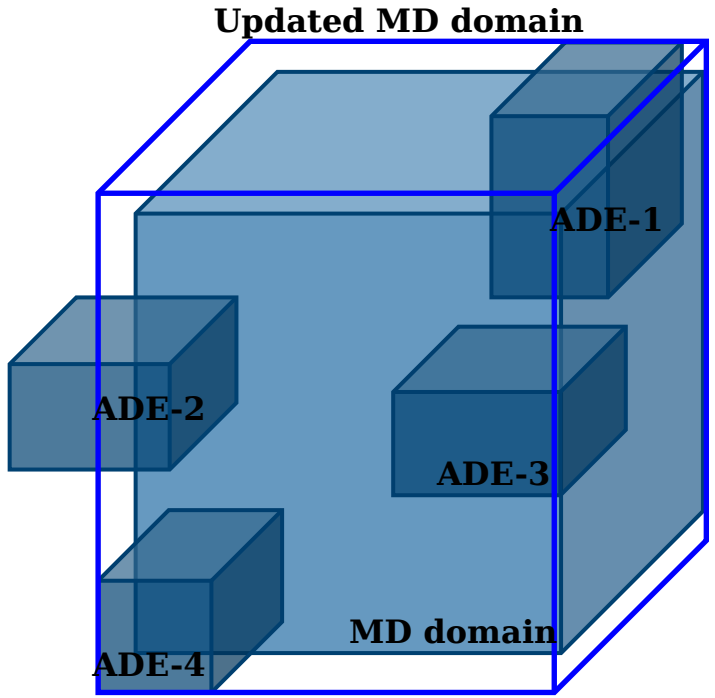
- Onset, termination and drought duration
- Drought area
- Maximum drought area
- Drought intensity
- Minimum drought intensity

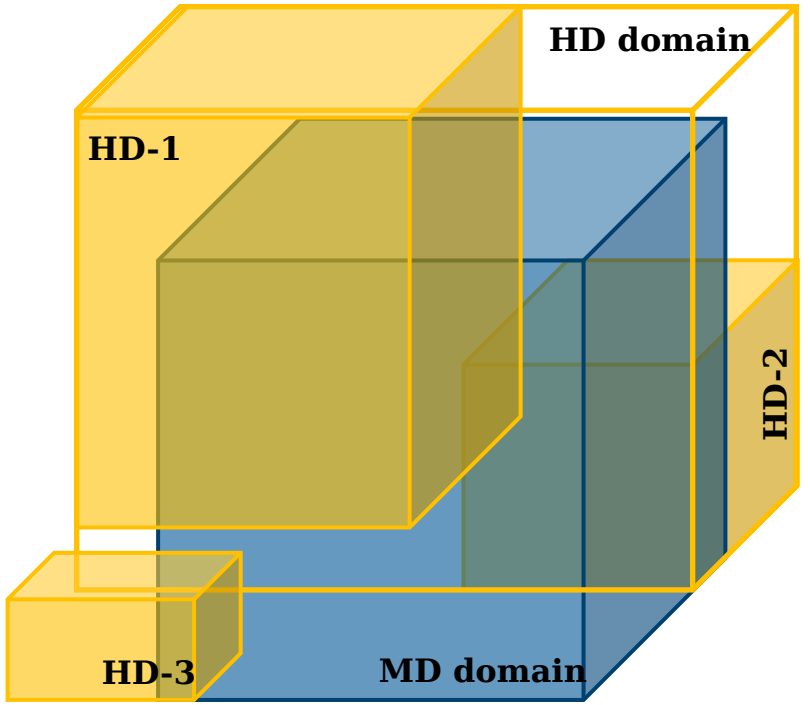


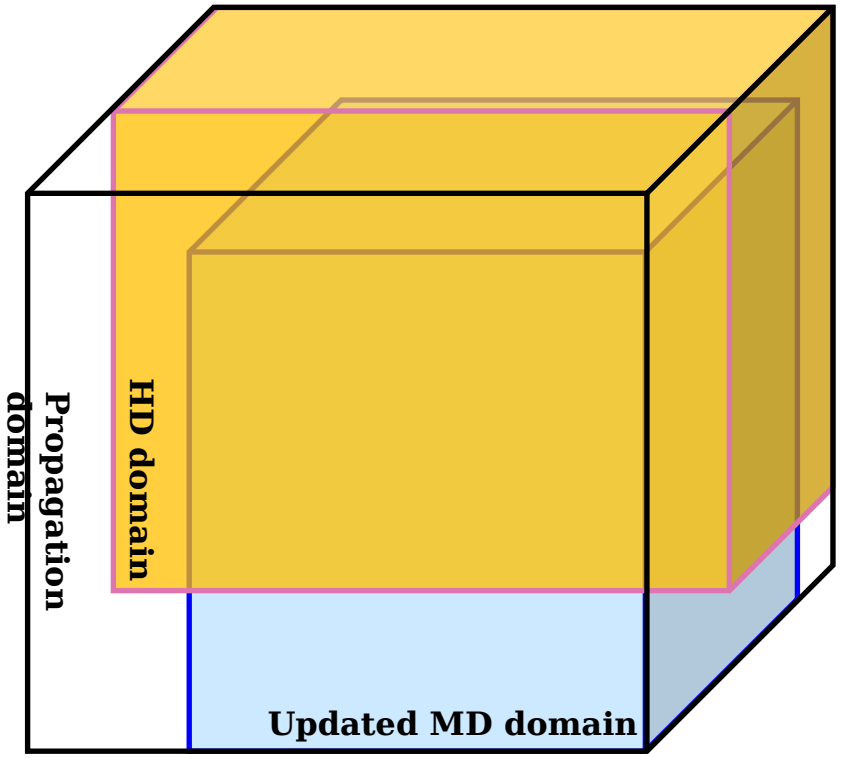


- Proposing a new domain based technique to identify drought propagation

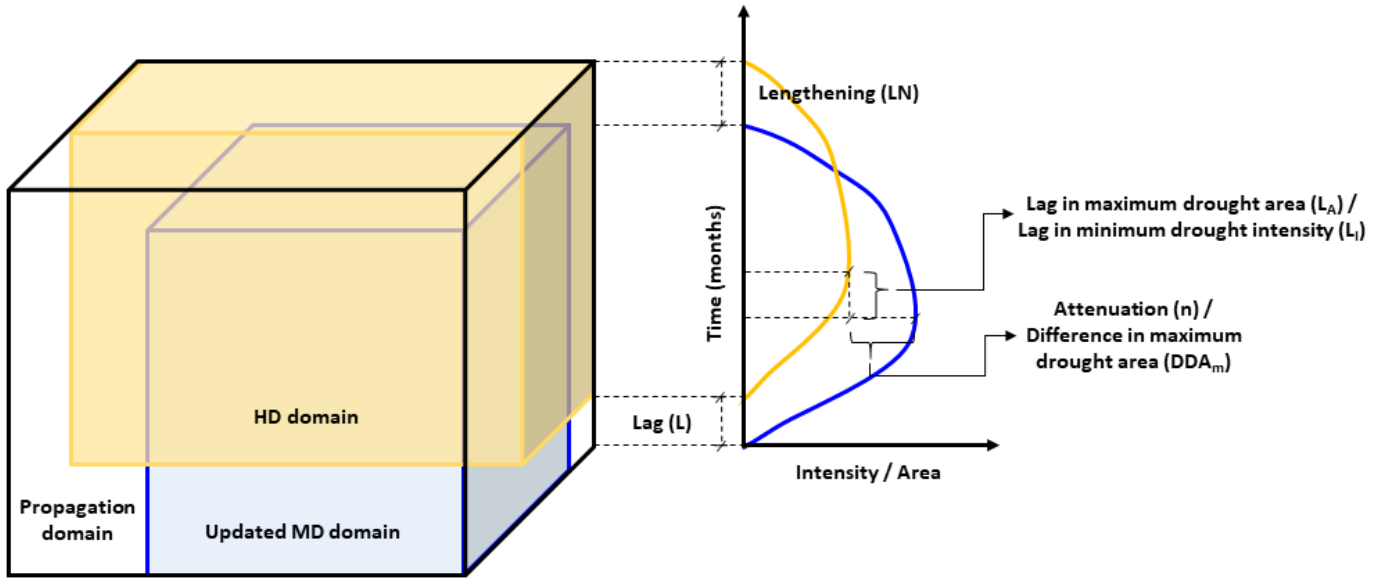

SPI 3
-2.5
-3.5
-4.5
Time (months)
Sep-99
Aug-99
Jul-99
Jun-99
May-99
Apr-99
Mar-99
Feb-99
Jan-99
Dec-98
Nov-98
Oct-98
Sep-98
-1.25
-4.25
-7.25
Lat(°N)
18.75
21.75
24.75
27.75
30.75
33.75
36.75
Lon(°E)
MD event
and
MD domain


Updated MD domain
ADE-1
ADE-2
ADE-3
ADE-4
MD domain

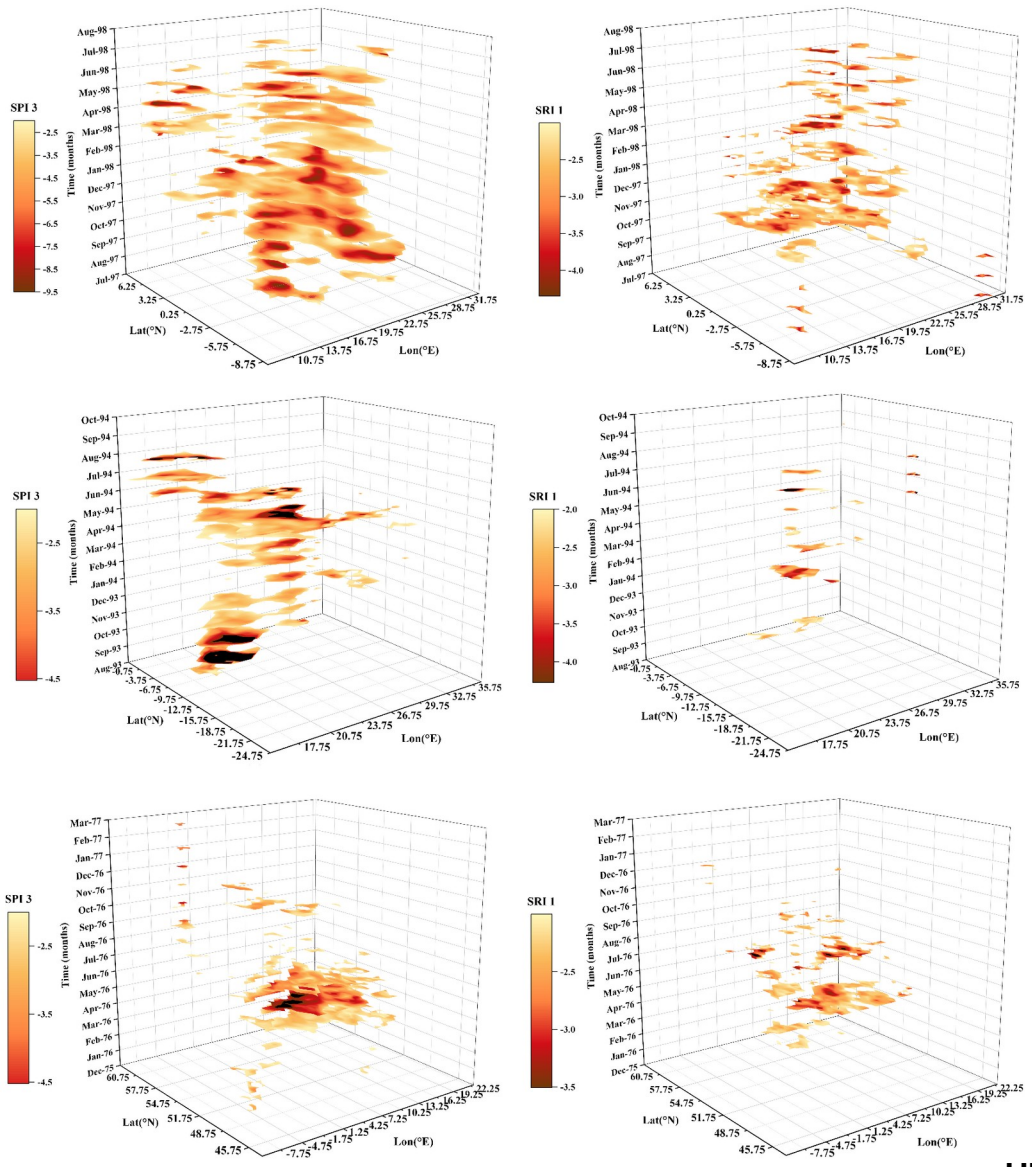

HD domain
HD-1
HD-2
HD-3
MD domain

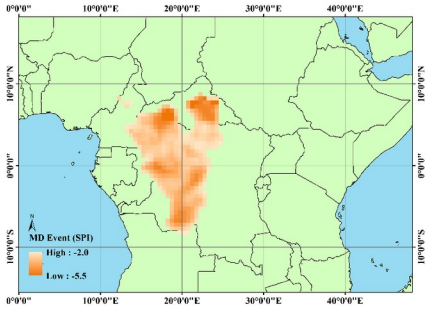

Propagation domain
HD domain
Updated MD domain

Identifying hydrological drought events that result from meteorological drought events, and estimate drought propagation features

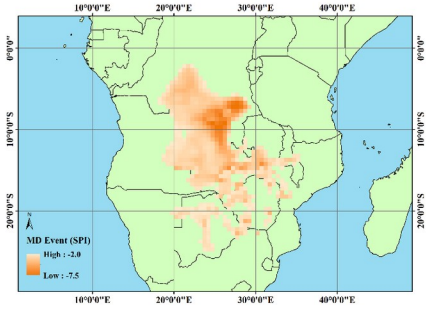


- Lag
- Lengthening
- Difference in maximum drought area
- Attenuation
- Pooling
- Branching

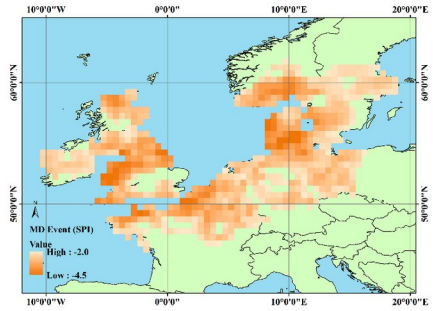




Africa (Jul 1997 – Aug 1998)



Africa (Aug 1993 – Oct 1994)



UK - Europe (Dec 1975 – Mar 1977)

- A total of 1740 MD events and 1493 HD events
- 272 events propagated into 395 HD events
- Identified 20 most severe drought events
- 19 showed propagation
- Dependence on climatic and catchment characteristics
- Pooling and branching of drought events

Location	Meteorological Drought event	Additional drought event	Hydrological Drought events	Drought Duration		Lag	Lengthening
	MD	ADE	HD	MD	HD	L	LN
	Event label	Event label	Event label	Months	Months	Months	Months
Africa (4)	M-894	-	H-784	10	11	2	3
	M-1125	M-1233, M-1239, M-1275	H-1036, H-1082, H-1085	13	14	1	2
	M-1481	-	H-1236	13	14	-	1
	M-1571	M-1568, M-1606	H-1331	13	12	1	-
Asia (7)	M-11	M-38	H-11, H-17, H-26, H-28, H-29, H-31	10	10	-	-
	M-418	-	H-388	12	5	3	-4
	M-502	-	H-466	9	4	4	-1
	M-1277	-	H-1083	9	8	1	-
	M-1433	-	H-1238	15	7	7	-1
	M-1495	-	H-1244, H-1289, H-1299	11	13	-	2
	M-1588	M-1611	H-1356, H-1371	10	12	1	3
Europe (1)	M-252	-	H-246, H-245, H-244, H-284	16	13	3	-
North America (2)	M-674	-	H-570	11	12	2	3
	M-931	-	H-814	8	9	-1	-
South America (5)	M-376	M-371	H-330, H-353, H-370	21	19	1	-1
	M-597	M-637	H-512, H-522, H-524, H-554, H-572	32	33	-	1
	M-637	-	H-554	10	5	4	-1
	M-638	M-681, M-684, M-707, M-712	H-571, H-579, H-585, H-627, H-631, H-670	26	27	1	2
	M-882	M-883, M-873, M-874, M-890, M-897, M-903, M-912, M-913	H-780, H-796, H-800	24	13	6	-5

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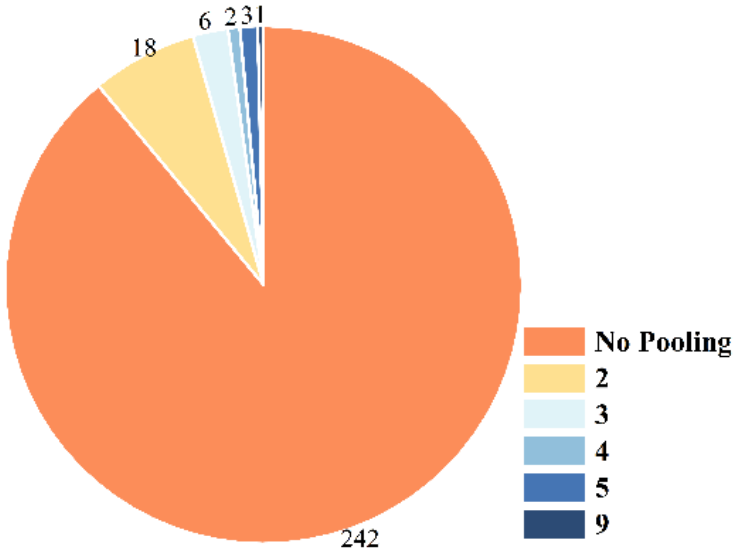
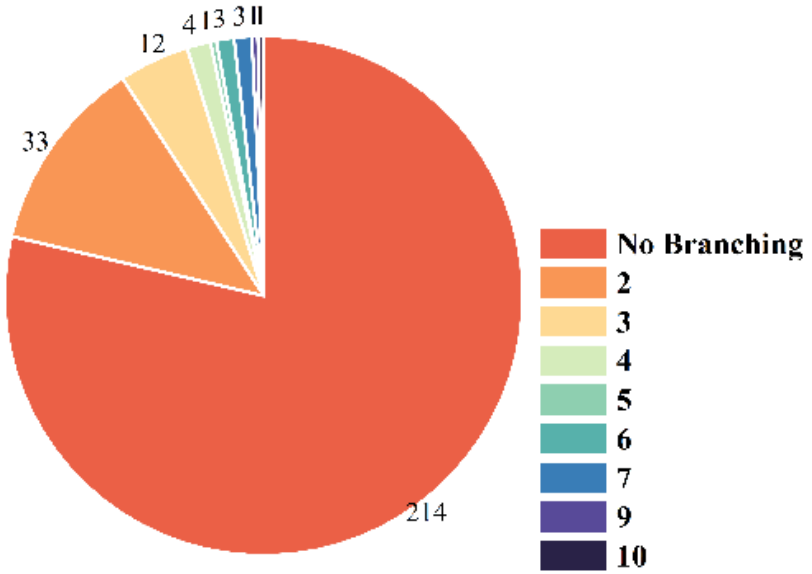


- Most of the MD events (short- and medium-term) did not exhibit propagation while majority of the long-term MD events propagated
- Most of the propagated MD events showed positive lag, negative lengthening, attenuated intensity, and reduced spatial coverage
- Dependence of propagation on climatic variability and catchment characteristics



- All the propagated MD events did not show either pooling or branching, but majority of the propagated MD events showing pooling also showed branching
- All the identified 20 most severe events, were consistent with those reported in scientific and popular literature, and showed propagation except one MD event from Africa

Thank You

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