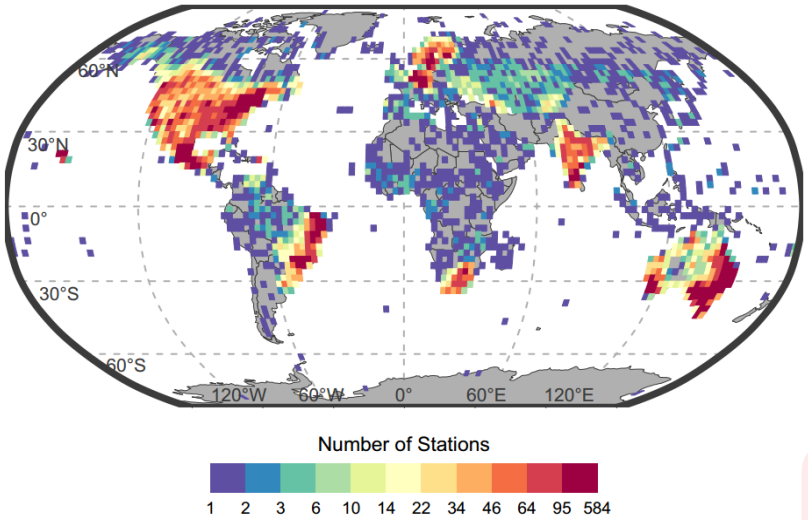
XIV Congreso Internacional de la Asociación Española de Climatología. Tenerife, 2026

Do significant temporal changes exist in past extreme precipitation across Europe? An analysis and comparison using three datasets

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Introduction

Spatial distribution of stations (43585) from GHCN-Daily database with daily precipitation records of at least 20 years on a 2.5° x 2.5° grid

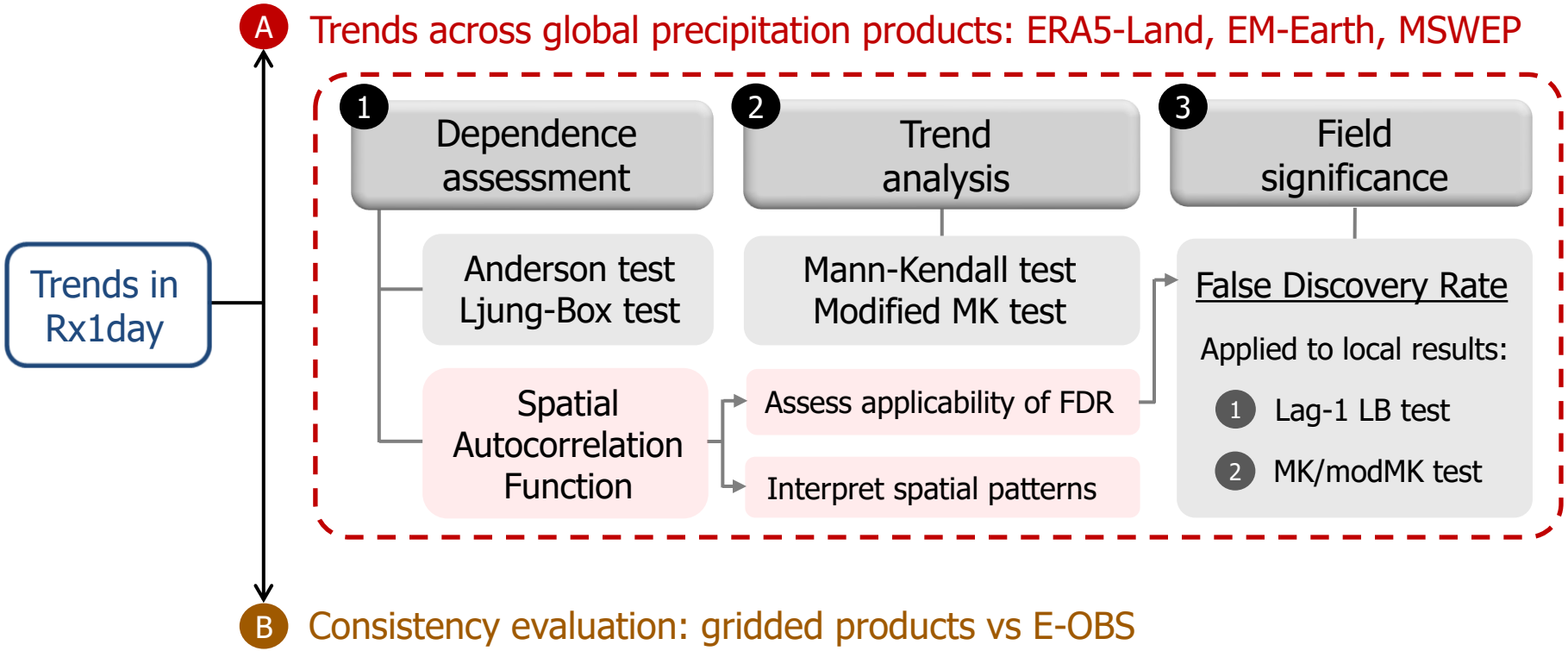


Vargas Godoy et al. (2024): HYADES – A global archive of annual maxima daily precipitation

- Observations from stations are spatially incomplete
- Gridded products fill the spatial gap
- Different products can produce different trends
- High-resolution consistency of extreme precipitation trends across global products remains poorly understood
- Thousands of grid-point tests create a multiple-testing problem
- Spatial dependence complicates interpretation
- Therefore, a multi-product assessment of Rx1day trends that accounts for dependence (temporal and spatial) and multiple testing is needed

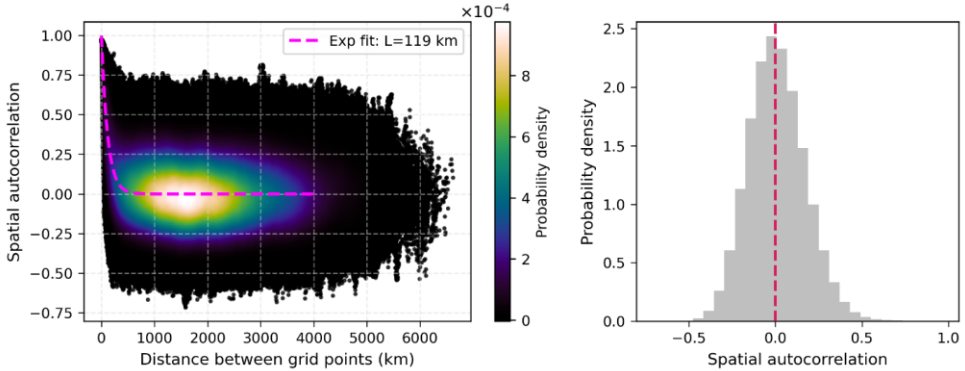
Investigate historical changes in Rx1day at 0.1º resolution over the period 1980-2019 across Europe, using ERA5-Land, EM-Earth V1, and MSWEP V2.8

Methodology



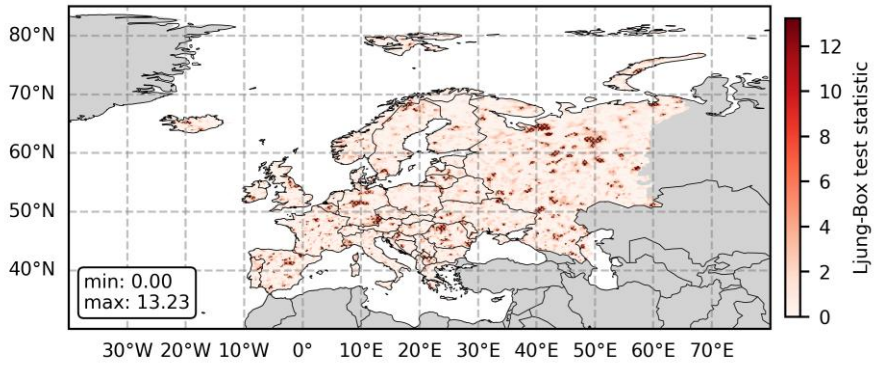
Results: Dependence assessment [1980-2019]

ERA5-Land ($L = 119\ km$)



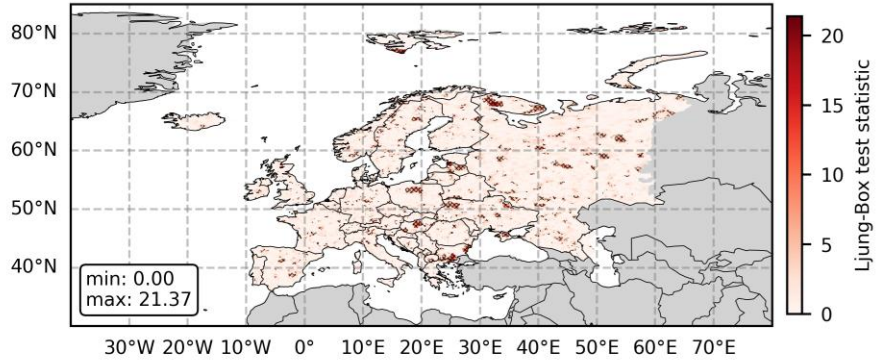
EM-Earth ($L = 123\ km$)

Local significance



MSWEP ($L = 97\ km$)

Local significance

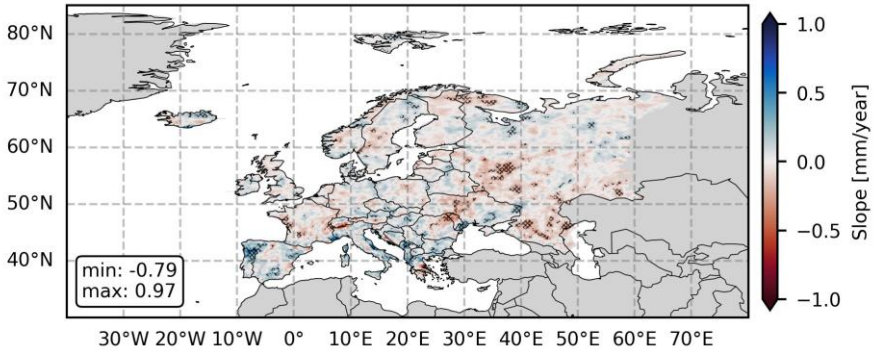


	Anderson	Ljung-Box	
		Local test	Collective test
ERA5-Land	*144495* [a]		
Lag-1	3.2	4.1	0.0
EM-Earth	*144424*		
Lag-1	3.9	4.8	0.0
MSWEP	*144436*		
Lag-1	6.2	6.3	0.0

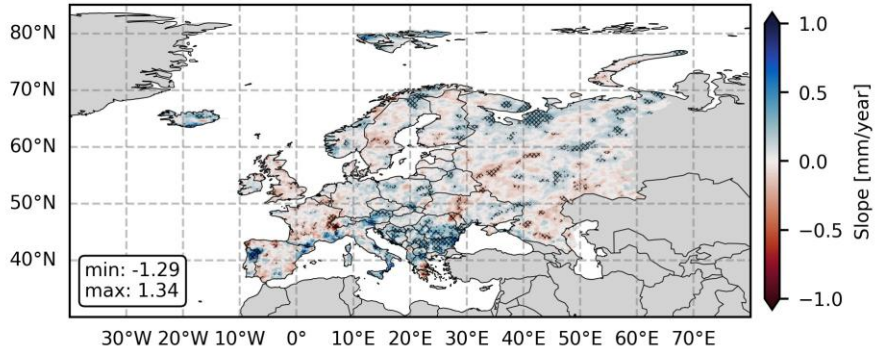
[a] Total number of grid points in the dataset

Results: Rx1day trends in global products over 1980-2019

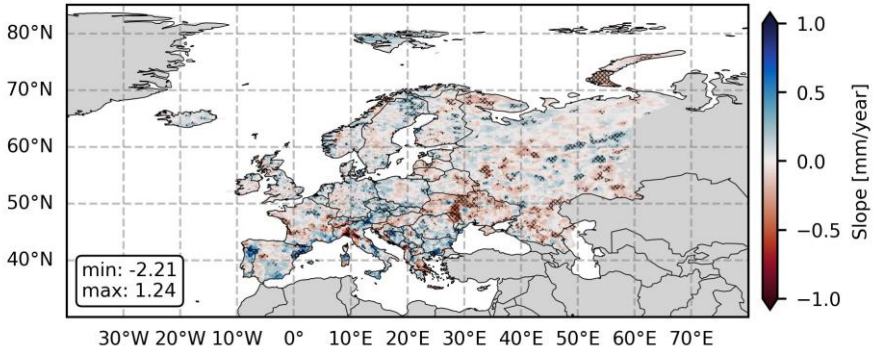
ERA5-Land — *Local significance*



EM-Earth — *Local significance*



MSWEP — *Local significance*

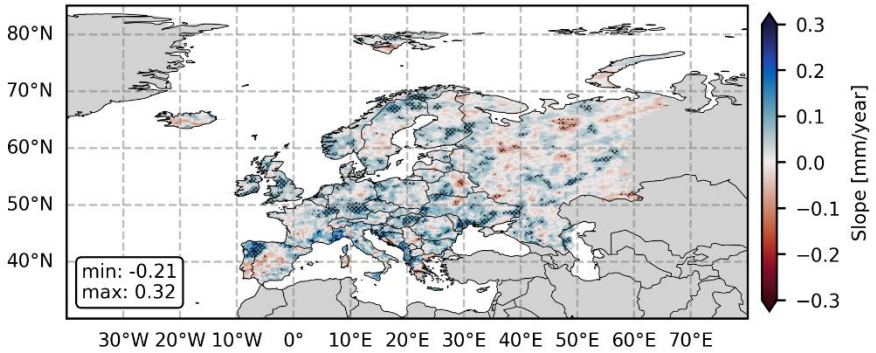


	Local test		Collective test	
	Non-significant	Significant	Non-significant	Significant
ERA5-Land	*144495* [a]			
No trend	1.3	0.0	1.3	0.0
Positive trend	47.3	2.8	50.1	0.0
Negative trend	45.9	2.7	48.6	0.0
EM-Earth	*144424*			
No trend	0.0	0.0	0.0	0.0
Positive trend	53.7	7.3	61.0	0.0
Negative trend	36.7	2.3	39.0	0.0
MSWEP	*144436*			
No trend	0.8	0.0	0.8	0.0
Positive trend	46.7	5.5	52.2	0.0
Negative trend	41.8	5.2	47.0	0.0

[a] Total number of grid points in the dataset

Results: Rx1day trends in global products over 1950–2019

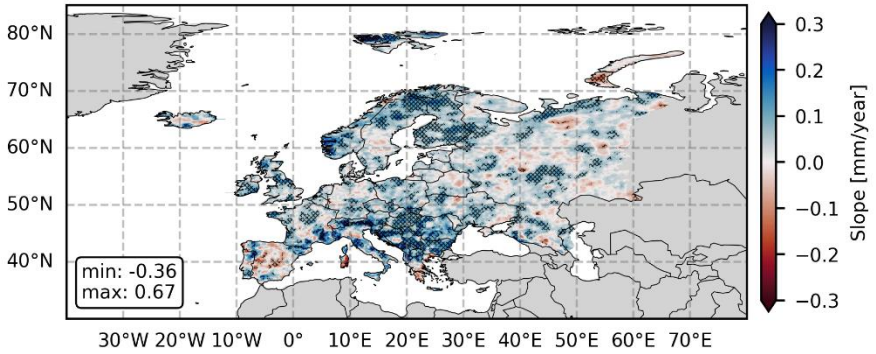
ERA5-Land — *Local significance*



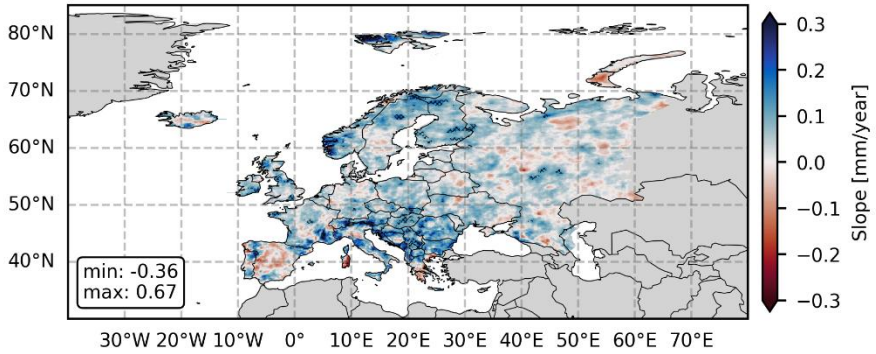
	Local test		Collective test	
	Non-significant	Significant	Non-significant	Significant
ERA5-Land	*144495* [a]			
No trend	1.3	0.0	1.3	0.0
Positive trend	64.3	7.8	72.1	0.0
Negative trend	26.0	0.6	26.6	0.0
EM-Earth	*144424*			
No trend	0.0	0.0	0.0	0.0
Positive trend	61.2	19.5	78.5	2.2
Negative trend	18.5	0.8	19.3	0.0

[a] Total number of grid points in the dataset

EM-Earth — *Local significance*

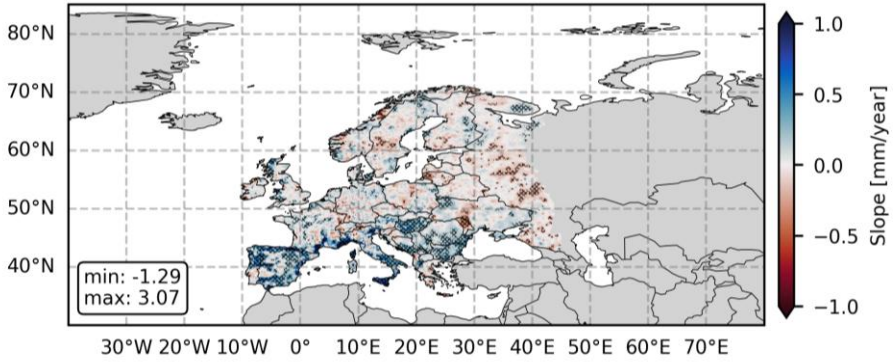


Collective significance

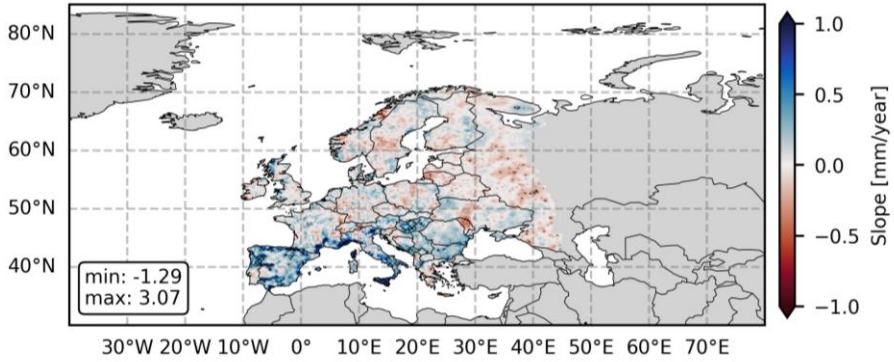


Results: Rx1day trends in the E-OBS reference dataset

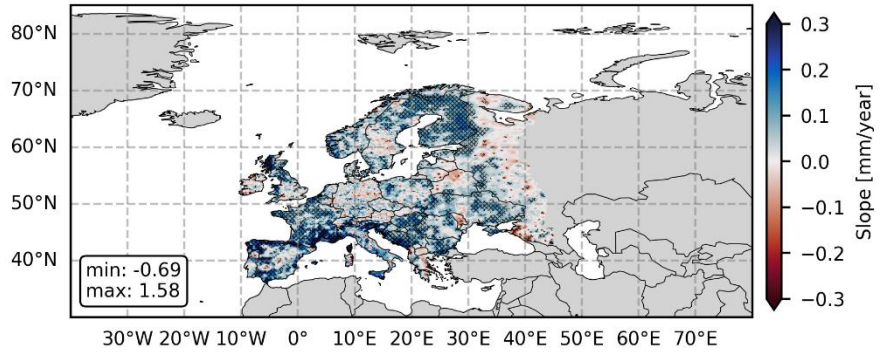
1980-2019 *Local significance*



Collective significance



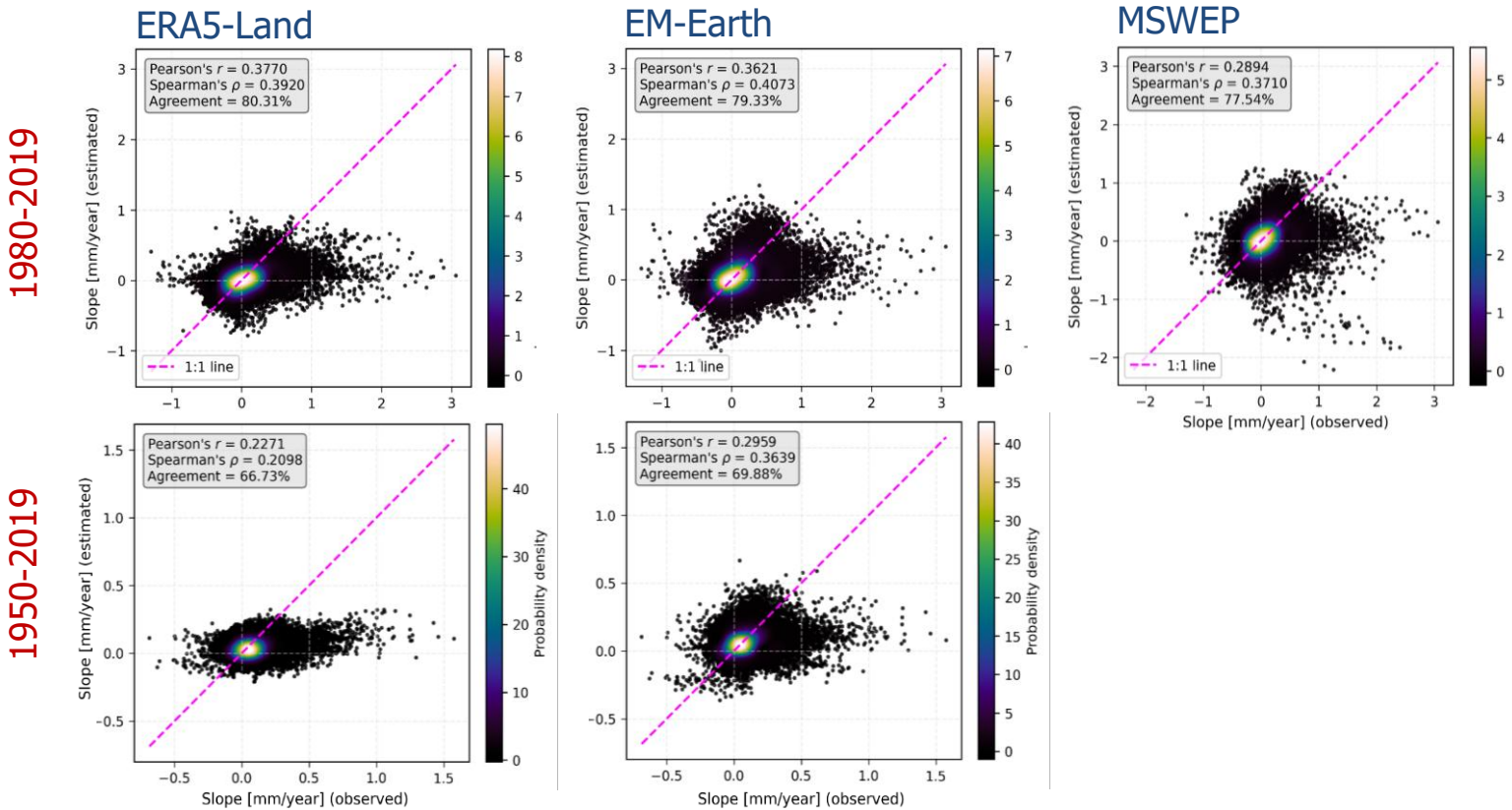
1950-2019 *Local significance*



	Local test		Collective test	
	Non-significant	Significant	Non-significant	Significant
E-OBS 1980-2019 (98717) [a]				
No trend	1.4	0.0	1.4	0.0
Positive trend	44.6	12.8	54.3	3.1
Negative trend	36.8	4.4	40.8	0.4
E-OBS 1950-2019 (98486)				
No trend	2.0	0.0	2.0	0.0
Positive trend	47.7	31.0	60.3	18.4
Negative trend	17.9	1.4	18.8	0.5

[a] Total number of grid points in the dataset

Results: Consistency with Rx1day trends in E-OBS



Conclusions

- At the European scale, increasing Rx1day trends dominate over the period 1980-2019 and across global products; significant increasing trends also exhibit this dominance
- This Rx1day intensification is also detected in the extended period 1950-2019, but it is more pronounced
- Trends represented by the global products show reasonable consistency with E-OBS, with EM-Earth being the product whose trends most closely resemble those observed. Nevertheless, all three global products tend to underestimate the magnitude of the observed trends

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Cambio climático, riesgos y territorio: 99 Avances y respuestas científicas



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