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Jet-stream variations in the Mediterranean: their role in rainfall decrease (1950-2000)

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■ Abstract

■ The precipitation decrease is associated with a little shift in latitude of the jet-stream within the Mediterranean region and a change in the location in longitude of its straight sectors and of the Rossby waves.

■ Section 1: Precipitation decreases in the Mediterranean



Regions with significant decreasing precipitation (1950-2000)

Greece in January	>0,1mm	>10mm
Monthly totals of precipitation	52%	51%
Number of rainy days	54%	51%
Daily means	43%	

Significant decrease of the explained variance of rain indices (in %)

See: C. NORRANT and A. DOUGUEDROIT, 2006, Monthly and Daily Precipitation trends in the Mediterranean Basin (1950-2000), Theoretical and Applied Climatology, 83, 1

Section 2: Methods for determining the significant trends associated with the decreasing precipitation

Comparison between the precipitation and the atmospheric circulation at 500hPa (window: 70°N-60°E/20°-30°N) for each of the 5 cases by CCAs (after data simplification by RPCAs)

Circulation patterns of 2 to 4 CCAs roots representing for each of the 5 cases around 50% of explained variance have been retained

The corresponding Weather regimes (with the jet-stream location and waves as main feature) for maximum and minimum monthly or seasonal precipitation have been studied at the daily scale (precipitation and geopotential)

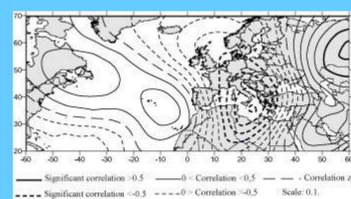
Section 3 : Six TeleCirculation Patterns (TCP)

- Three were known before: - Med/WR (Mediterranean/West Russia)
- - - CEA/WR (Central East Atlantic/West Russia)
- - - NEA/WR (North East Atlantic/ West Russia)
- Three are new ones - NWA/Sahara (North West Atlantic/Sahara)
- NEA/EMed (North-East Atlantic/East Mediterranean)
- NWA/WR (North West Atlantic/ West Russia)

C. NORRANT-ROMAND et A. DOUGUEDROIT , 2013, Significant rainfall decreases and variations of the atmospheric circulation in the Mediterranean (1950-2000), Regional Environmental Change, DOI 10.1007/s10113-013-0521-8

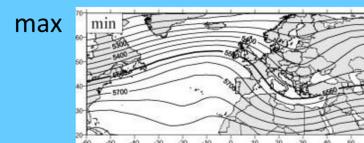
■ Section 6 Greece in January

Two precipitation and geopotential root scores represent the significant trends. The two corresponding TCP are CEA/WR and Med/WR CEA/WR (Central East Atlantic/West Russia)



First root: :15.9% of explained variance (correlated with NAO: 0.51)

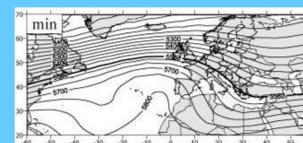
6.1 Weather regime of the most rainy month:



Meridian S-N: EAST of blocking with cyclogenesis in the Aegean Sea)

Circulation	Meridian	Others	Totals
Rainy days	15 (75%)	5 (25%)	20
Mean daily rainfall	4,,0mm/d	2,4mm/d	4,5mm/d
Total	71,7mm	12,3mm	84,1mm
	85,2%	14.8	

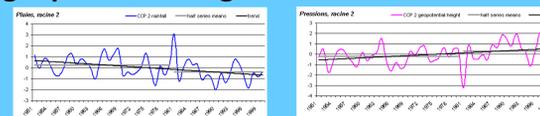
6,1 Weather regime of the less rainy month:



Meridian S-N: West of blockings

Circulation	Meridian	Others	Totals
Rainy days	8 (66,7%)	4 (33,3%)	12
Mean daily rainfall	0,5mm/d	2,3mm/d	1,1mm/d
Total	3,9mm	9,2mm	13,1mm
	29,7%	70,3%	

6,3 Multidecennial evolution of the precipitation and the 500 hPa geopotential height



Scores of precipitation on left and geopotential height on right (first root)

Weather regime	Most rainy months		Less rainy months	
1951-1976	40%	40%	20%	17%
1977-2000	14%	19%	57%	48%

Frequency of circulation patterns (>1/2 standard deviation) with break in 1976 (Precipitation: left,, Geopotential height: right)

Section 7: Conclusion

Significant monthly and seasonal precipitation decrease in the Mediterranean from 1950 to 2000 are connected with changes of weather regimes depending on the jet-stream location.

The most rainy weather regimes of each circulation pattern are more frequent during the first half of the period than during the second half (versus the less rainy weather regimes)