
Intense rainfall and flood event classification by weather type

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Session HS6/NH3 "Forecasting and Mitigation of Flush Flood and Mud Flow"

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Topics of the presentation

- ☆ Objectives
- ☆ Classification of weather types
- ☆ Presentation of hydrometeorological data
- ☆ Analysis of intense rainfall events by weather type
- ☆ Analysis of flood events by weather type
- ☆ Statistical tests
- ☆ Conclusions

Objectives

- ☆ A study in the framework of AFORISM/EPOCH programme
- ☆ “A comprehensive flood forecasting system for flood risk mitigation and control”
- ☆ Can the knowledge of the prevailing weather pattern, help to estimate the probability of occurrence of intense rainfall and flood events ?
- ☆ Can the general classification of events per weather type, explain a significant part of the variance of the rainfall and runoff process ?
- ☆ If the answers are positive the weather type classification could contribute to the forecasting of future rainfall and runoff process

INTENSE RAINFALL AND FLOOD EVENT CLASSIFICATION BY WEATHER TYPE

Classification of weather types

Definition and classification of weather types in Greece (by Maheras)

Criteria	The location of centers of anticyclones The main trajectories of cyclones Some special synoptic situations in surface and 500 mb level
Seasons	Wet (October - April) Dry (May - September)
Weather types	5 anticyclonic (A1, A2, A3, A4, A5) 6 cyclonic (SW1, SW2, NW1, NW2, W1, W2) 2 mixed (MT1, MT2) 3 characteristic (DES, MB, DOR)
Time period	Maheras developed a daily calendar of weather types in Greece for the period 1950-1990

INTENSE RAINFALL AND FLOOD EVENT CLASSIFICATION BY WEATHER TYPE

Classification of weather types

Main trajectories of cyclonic weather types



INTENSE RAINFALL AND FLOOD EVENT CLASSIFICATION BY WEATHER TYPE

Presentation of hydrometeorological data

Study area and measuring stations

Evinos River Basin (885 km²)

3 rain recording stations

1 stage recording station

20 years of continuous operation (with few gaps)

Selection of intense rainfall and flood events

Daily depth > 25 mm or Hourly depth > 7 mm

Daily discharge > 100 m³/sec at one day at least

Data set POINT RAINFALL AREAL RAINFALL

Total number of rainfall events : 293 358

At rainy season (Oct - Apr) :	200	220
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At dry season (May - Sep) :	93	138
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108 flood events

Meteorological data

Weather maps at surface and 500 mb level

Daily calendar of weather types in Greece (as developed by Maheras)

Meteorological data

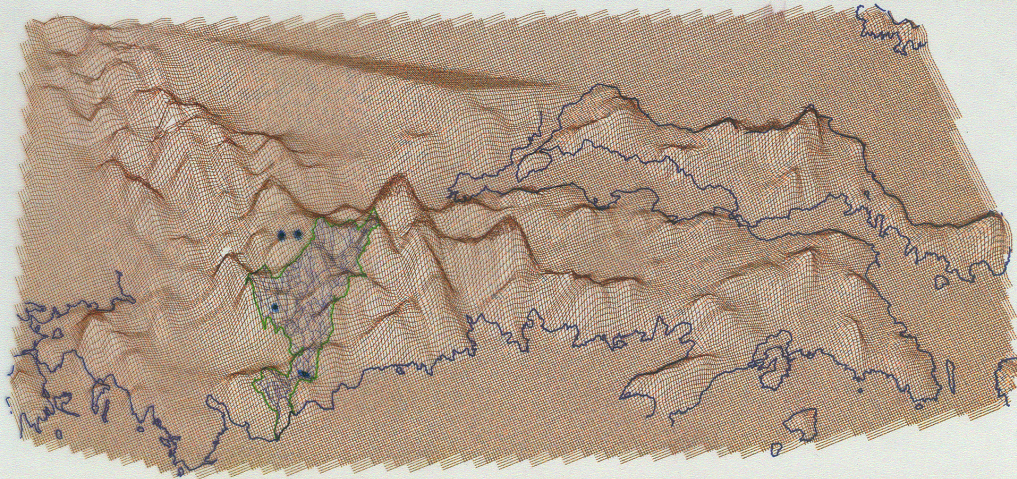
Weather maps at surface and 500 mb level

Daily calendar of weather types in Greece (as developed by Maheras)

INTENSE RAINFALL AND FLOOD EVENT CLASSIFICATION BY WEATHER TYPE

Presentation of hydrometeorological data

Location of stations

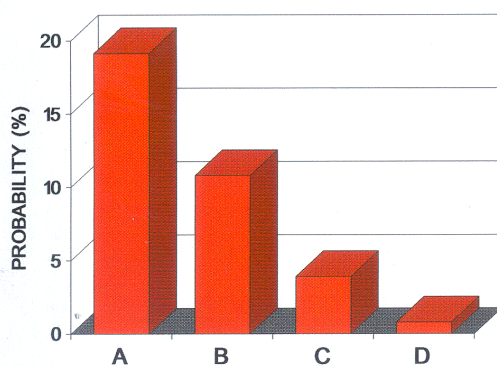


INTENSE RAINFALL AND FLOOD EVENT CLASSIFICATION BY WEATHER TYPE

Analysis of intense rainfall events by weather type

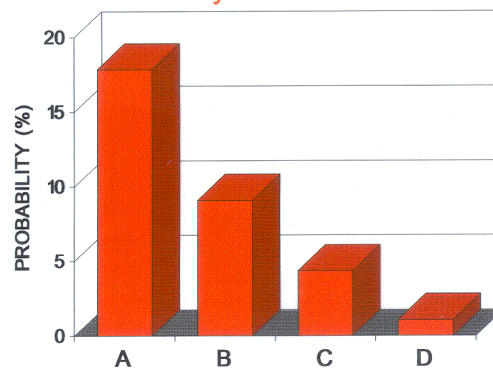
Probability of occurrence of intense rainfall events per weather type

Wet season



A : W1, W2, NW1, SW1
B : SW2, NW2
C : MT2, DOR
D : A1-A5, MT1, DES, MB

Dry season

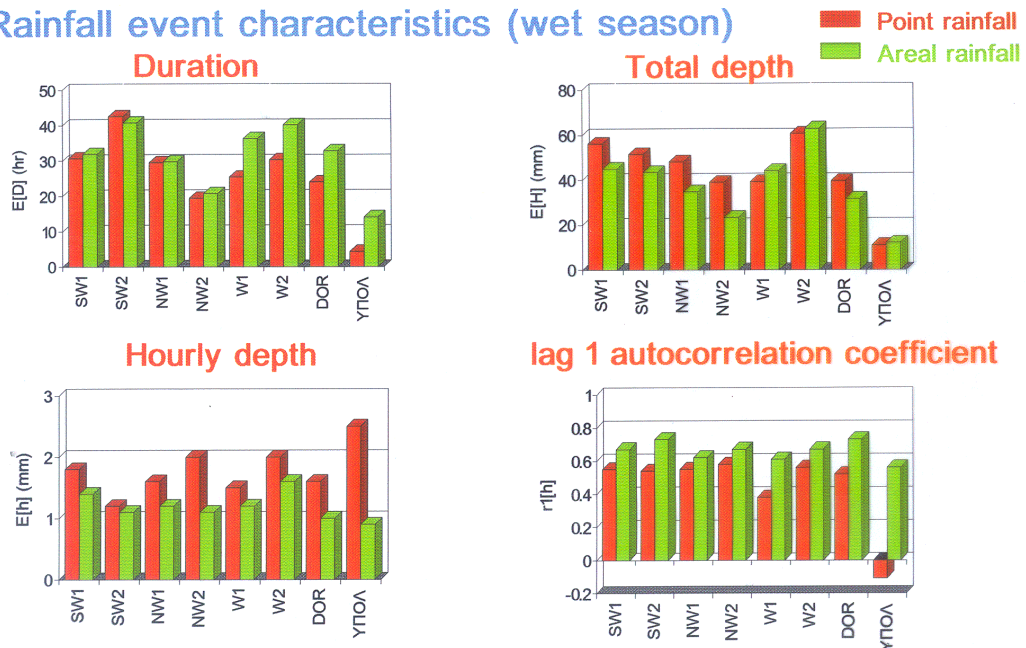


A : W2, NW1, DOR
B : SW1, SW2
C : W1, NW2, MT1, DES, MB
D : A1-A5, MT2

INTENSE RAINFALL AND FLOOD EVENT CLASSIFICATION BY WEATHER TYPE

Analysis of intense rainfall events by weather type

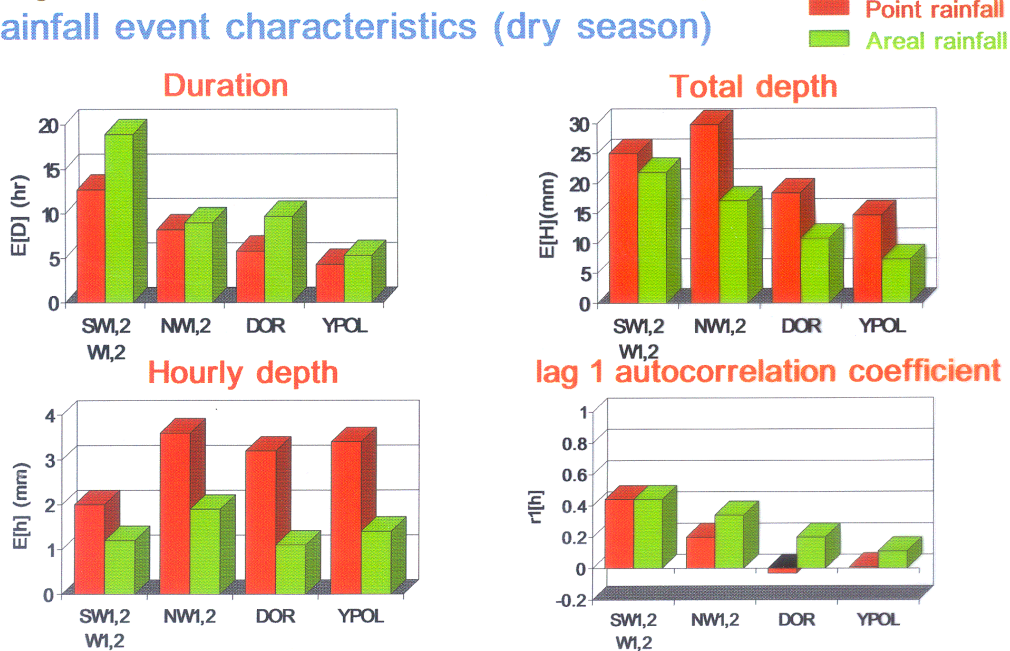
Rainfall event characteristics (wet season)



INTENSE RAINFALL AND FLOOD EVENT CLASSIFICATION BY WEATHER TYPE

Analysis of intense rainfall events by weather type

Rainfall event characteristics (dry season)

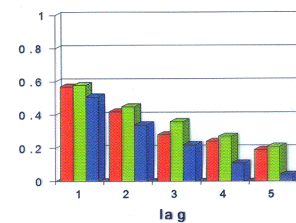
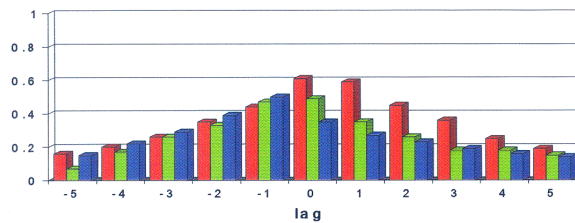


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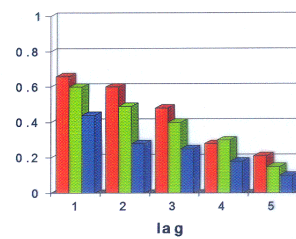
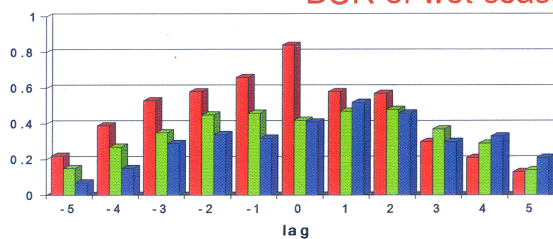
Analysis of intense rainfall events by weather type

Cross correlation and autocorrelation of hourly depths

SW2 of wet season



DOR of wet season



ANIADA - KRIKLO
ANIADA - DRYMONAS
KRIKLO - DRYMONAS

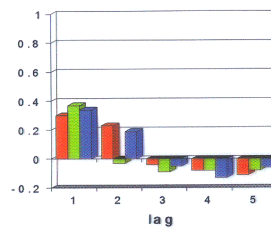
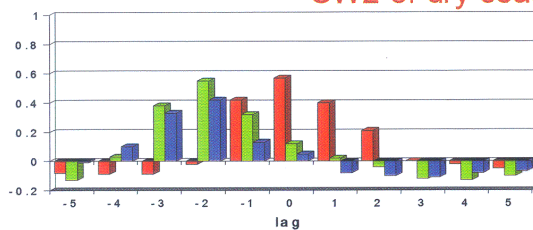
ANIADA
KRIKLO
DRYMONAS

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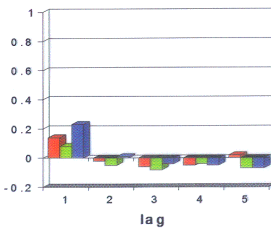
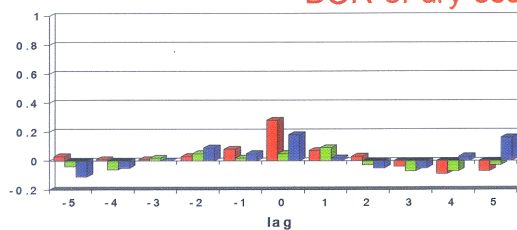
Analysis of intense rainfall events by weather type

Cross correlation and autocorrelation of hourly depths

SW2 of dry season



DOR of dry season



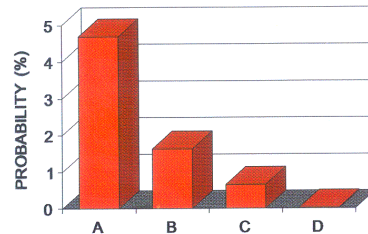
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ANIADA
KRIKLO
DRYMONAS

INTENSE RAINFALL AND FLOOD EVENT CLASSIFICATION BY WEATHER TYPE

Analysis of flood events by weather type

Probability of occurrence of flood per weather type



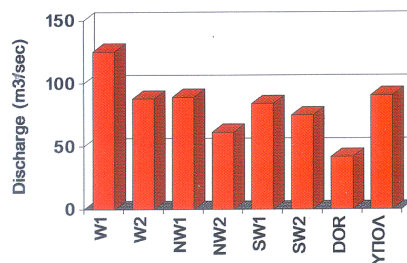
A : W1, W2, NW1, SW1

B : SW2, NW2

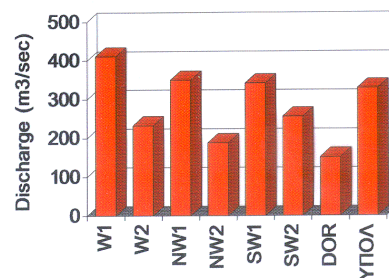
C : MT2, DOR

D : A1-A5, MT1, DES, MB

Mean daily discharge



Peak daily discharge



INTENSE RAINFALL AND FLOOD EVENT CLASSIFICATION BY WEATHER TYPE

Statistical tests

Remarks for evaluation

The probability of occurrence of intense rainfall and flood events is different for each weather type

The intense rainfall and flood event characteristics are different for each weather type

A large amount of variance of rainfall event characteristics, is explained from the concept of weather types

Statistical test

Statistical test to check the hypothesis that the portions of events in two populations, are equal

Kruskal -Wallis statistical test to verify the hypothesis that two samples belong to the same population

Analysis of variance

Results

Statistically significant differences in probability of occurrence of intense rainfall and flood events

No significant differences in the rainfall and flood event characteristics among the weather types of the wet season. Slight significant differences among the weather types of the dry season



INTENSE RAINFALL AND FLOOD EVENT CLASSIFICATION BY WEATHER TYPE

Statistical tests

Analysis of variance

PERCENTAGE OF VARIANCE WHICH IS EXPLAINED BY :	WEATHER TYPE		DURATION
	POINT RAINFALL	AREAL RAINFALL	AREAL RAINFALL
WET SEASON			
DURATION	7	11	
TOTAL DEPTH	3	10	47
MEAN INTENSITY	7	4	6
HOURLY DEPTH	1	1	1
DRY SEASON			
DURATION	18	28	
TOTAL DEPTH	18	22	41
MEAN INTENSITY	8	9	18
HOURLY DEPTH	2	2	2

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Conclusions

- ☆ Statistically significant differences in the probability of occurrence of intense rainfall flood events, among the various weather types.
- ☆ Large variance in all rainfall event characteristics, for all weather types.
- ☆ Significant differences in the stochastic structure and characteristics of the intense rainfall events, between dry and wet season.
- ☆ No statistically significant differences in the rainfall and flood event characteristics among the weather types of the wet season. Slight significant differences among the weather types of the dry season.
- ☆ A small percentage of the total variance of rainfall characteristics, is explained by introducing the concept of weather type. The double percentage is explained merely by the duration of the event.

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