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Session HS4.2 - #11116

# Assessing the impact of seasonal rainfall anomalies on catchment-scale water resources availability

**N. Romano**[1,2], C. Allocca[1], R. Deidda[3], and P. Nasta[1]

[1] Dept. of Agricultural Sciences - University of Naples Federico II, Italy.
[2] The Inter-dept. Center for Environ. Research (C.I.R.AM.), UniNA, Naples, Italy.
[3] Dept. DICAR – University of Cagliari, Italy.

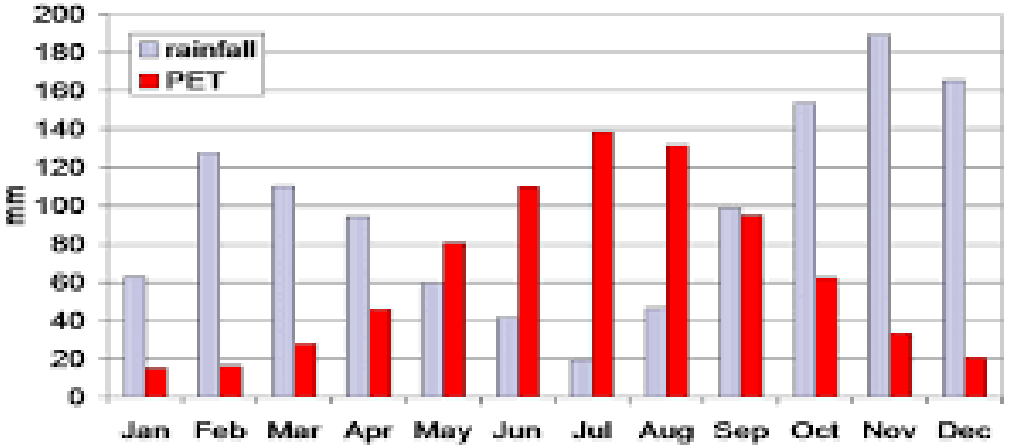
#1
- **Irregularity in the intra-annual rainfall regime and the seasonality of Mediterranean climate**

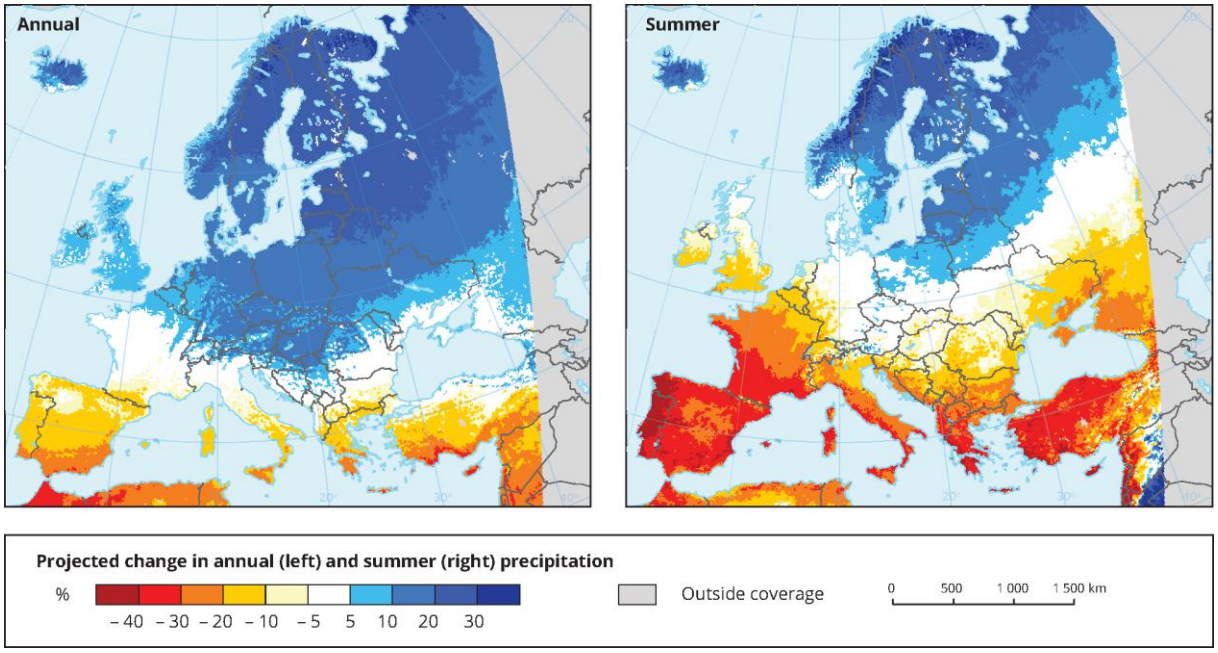
#2
- **Research questions and assumptions for this study**

#3
- **Investigations in the Alento CZO**

#4
- **Presentation and discussion of the results**

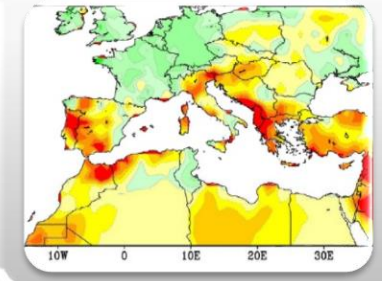
Annual precipitation and PET regimes in the Mediterranean basin are characterized by remarkable seasonal features.




Projected drought in the next decades

Necessity to characterize rainfall seasonality to properly implement reliable scenarios within a stochastic framework




# Research question:

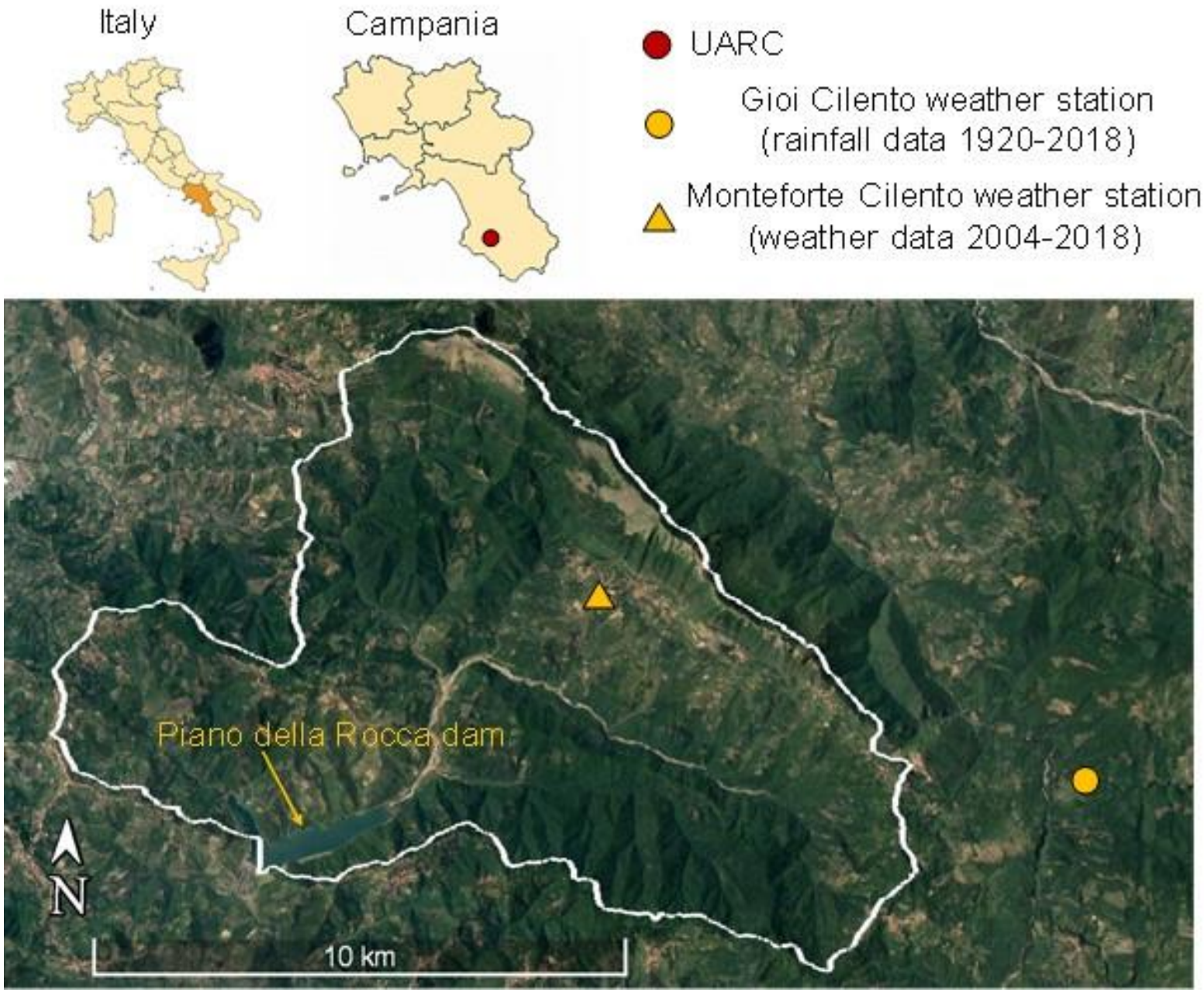
- What is the impact of seasonal rainfall anomalies on annual- and seasonal-average water supply in a Mediterranean catchment?

Seasonality anomalies are assessed by comparing two approaches: 1) a "**static**" approach based on the Standardized Precipitation Index (SPI), and 2) a "**dynamic**" approach that identifies the rainy season by considering rainfall magnitude, timing, and duration.

The effects of seasonal rainfall anomalies on water balance components are quantified using the SWAT model.

We show that the Budyko curve is sensitive to the seasonality regime by questioning the implicit assumption of temporal steady-state between the annual average dryness and evaporative index.

# The case study: Upper Alento River Catchmen (UARC)



# Availability of daily rainfall data (1920-2018)

Fig.1 - Distribution of monthly rainfall amounts within the year.

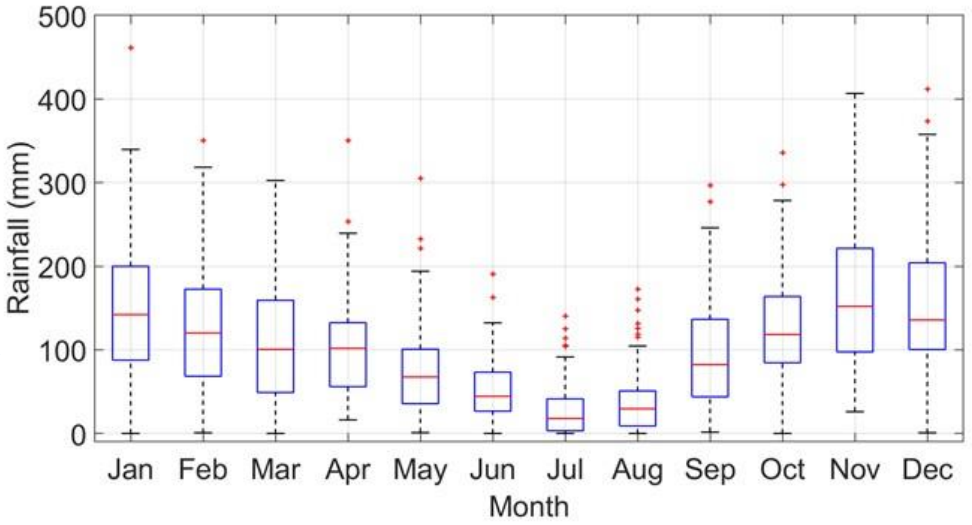
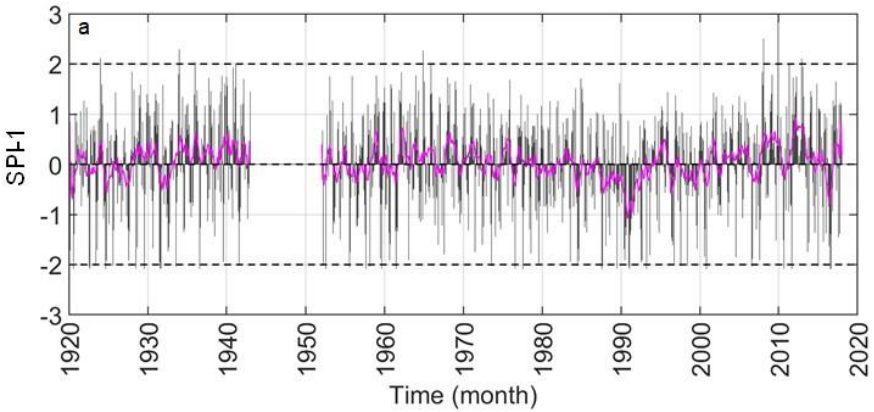
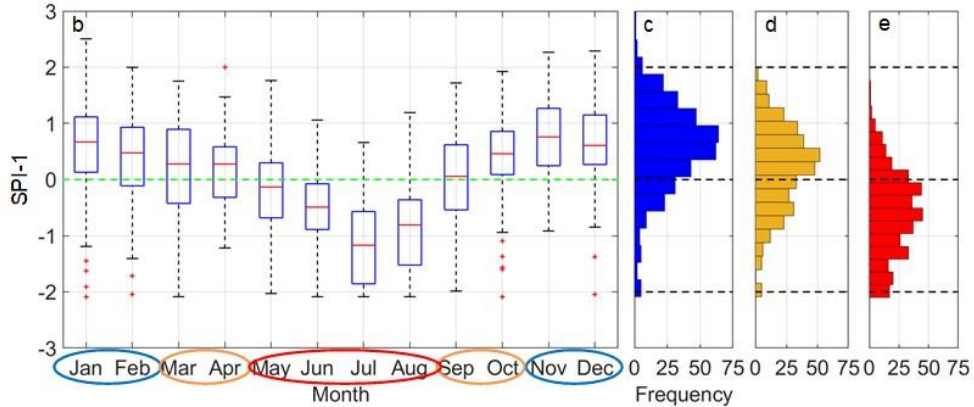



Fig. 2a - SPI-1 of the monthly rainfall amounts.

The magenta line shows the 12-month moving average of the SPI-1 values.



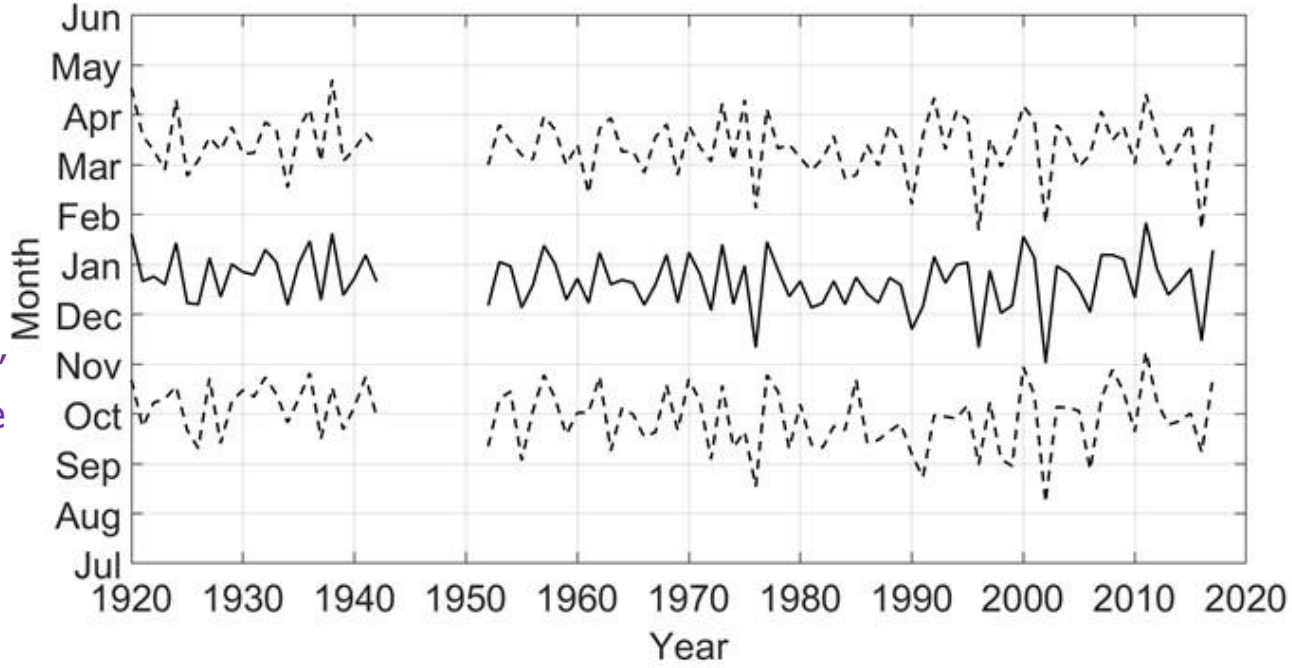

Distribution of SPI-1 values (2b) and corresponding frequency distributions in wet (2c), transition (2d), and dry (2e) seasons.



Seasonality is (dynamically) characterized with a centroid and spread.

The black line is the "centroid" and indicates the timing of the rainy season.

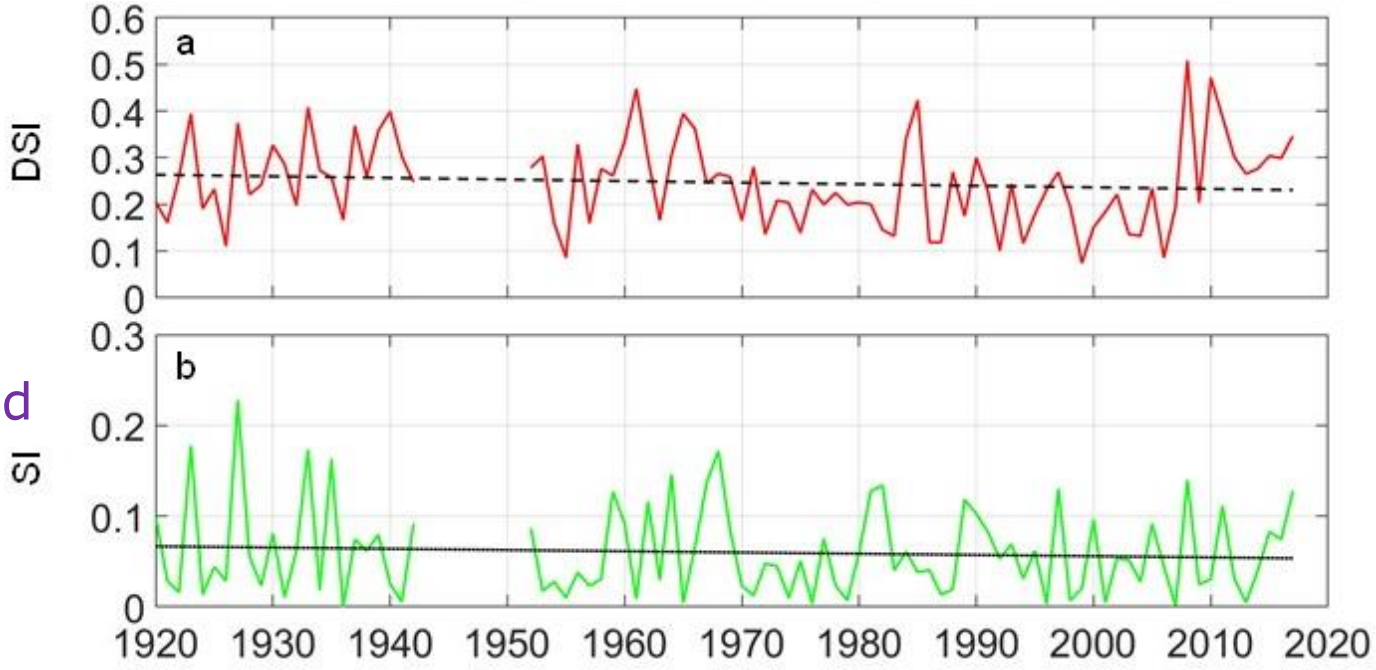
The dashed lines identify the "spread", i.e. the duration of the rainy season.



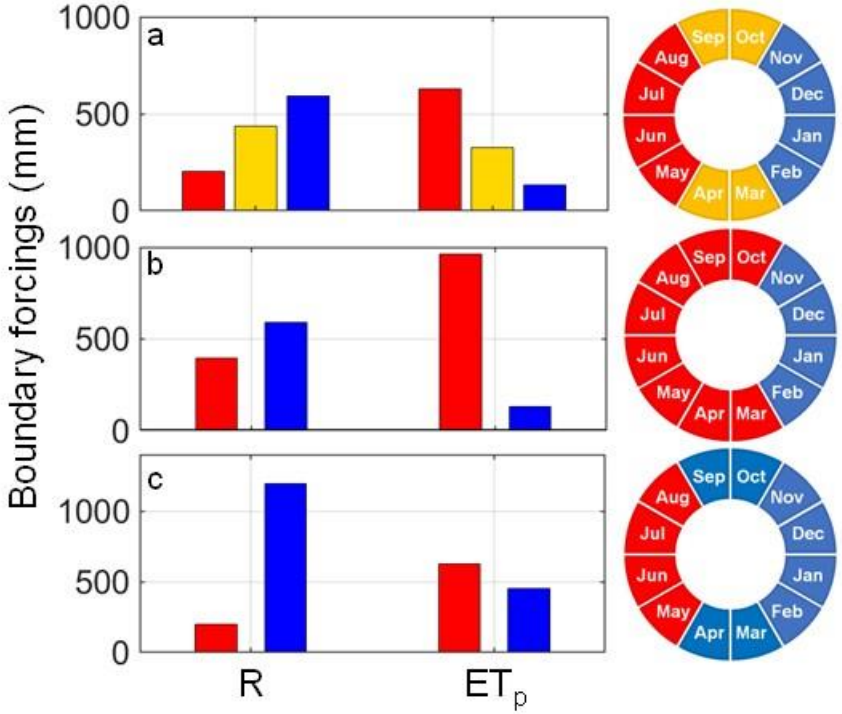

Two seasonality indexes:

**DSI** (Feng et al.,2013),

and **SI** (Walsh and Lawler, 1981).



# Effects of seasonal rainfall anomalies using SWAT: static approach (WY = water yield)




Normal scenario:
three 4-month seasons (dry, transition, wet)

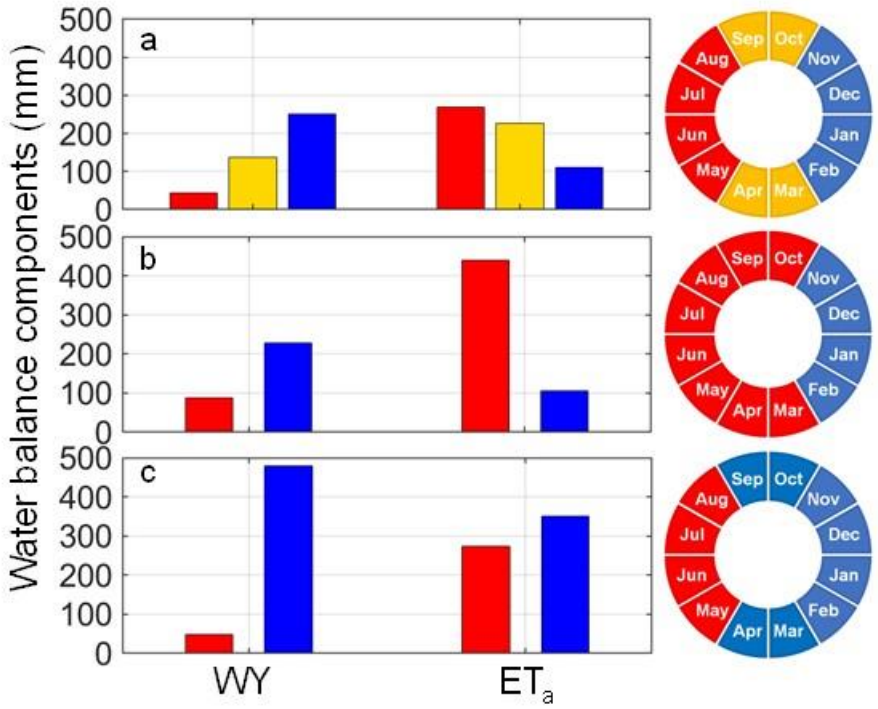
Dry scenario:
8-month dry season and 4-month wet season

Wet scenario:
8-month wet season and 4-month dry season

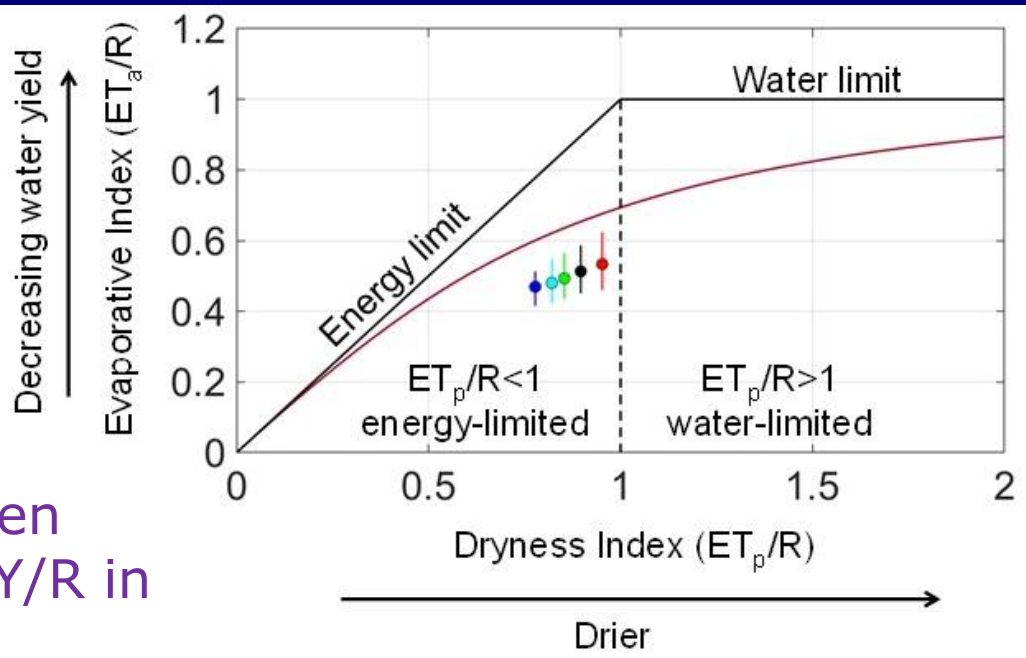
Normal scenario:
three 4-month seasons (dry, transition, wet)

Dry scenario:
8-month dry season and 4-month wet season

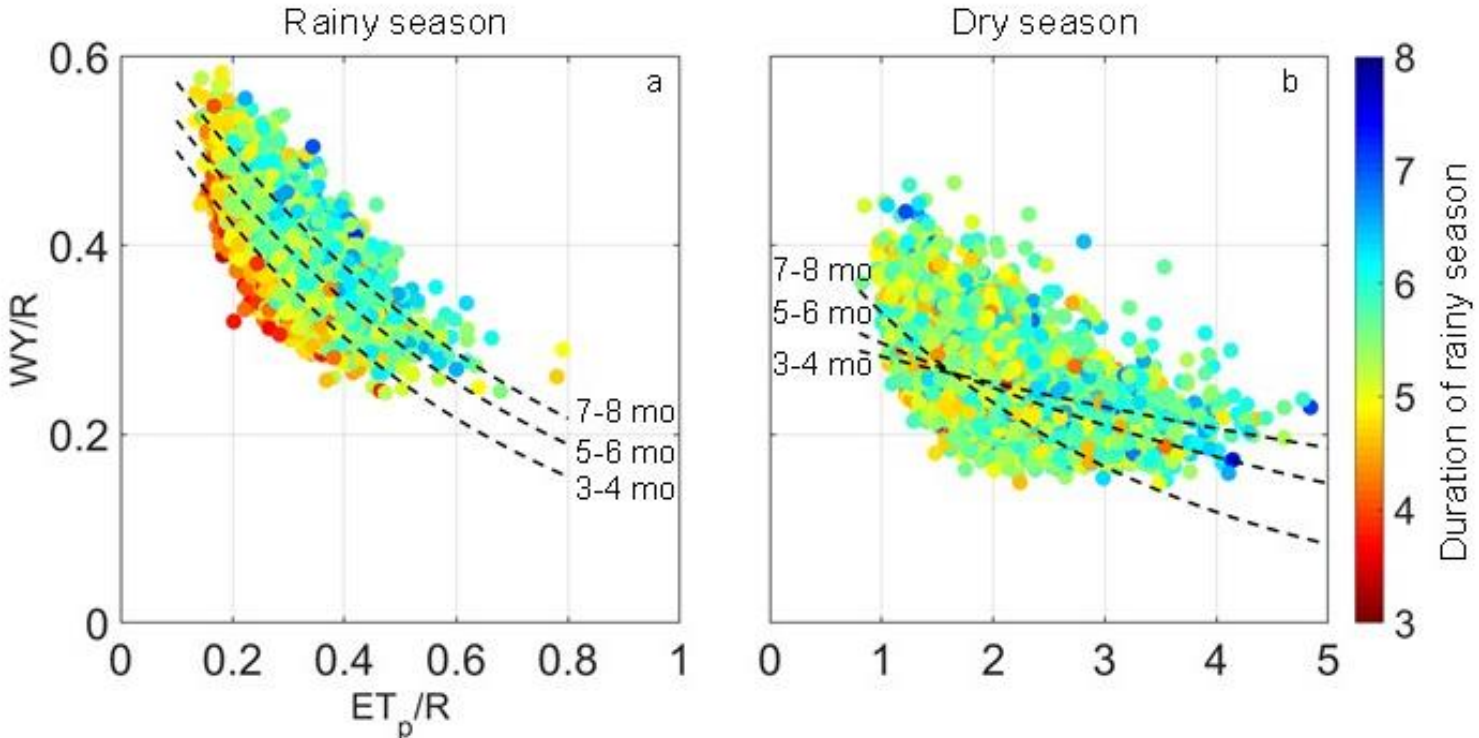
Wet scenario:
8-month wet season and 4-month dry season



Impact of rainfall seasonality in the Budyko curve.




Empirical relationships between dryness index ($ET_p/R$) and WY/R in the rainy and dry seasons.



## Concluding remarks

- ✓ Capturing the relationship between precipitation and catchment-scale water balance components in a Mediterranean context is a scientific challenge in view of expected increasing frequencies in extremes such as droughts and floods induced by climate warming.
- ✓ Although the duration of the rainy season does not exert a major control on water balance in our study catchment, we have been able to identify seasonal-dependent regression equations linking water yield to dryness index over the rainy season.
- ✓ At least for our case study, using the dynamic approach we demonstrated that the Budyko approach is sensitive to rainfall seasonality, thus questioning the implicit assumption of temporal steady-state between annual average dryness and evaporative index.

**References**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