

Long term analyses of the Tirana extreme daily precipitation

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Introduction

- During the last decades, many climate indices have changed around the world, mainly the changes in the extreme weather events.
- ONE of the most popular extreme events are the days of extreme precipitation that often cause flooding of urban areas.
- The last three decades in Albania, the number of days with extreme precipitation were increased and their precipitation amounts, as well.
- TO HAVE a clear picture of the intense/extreme/extraordinary daily precipitation over a long time-period in Tirana, some precipitation indices should be estimate.

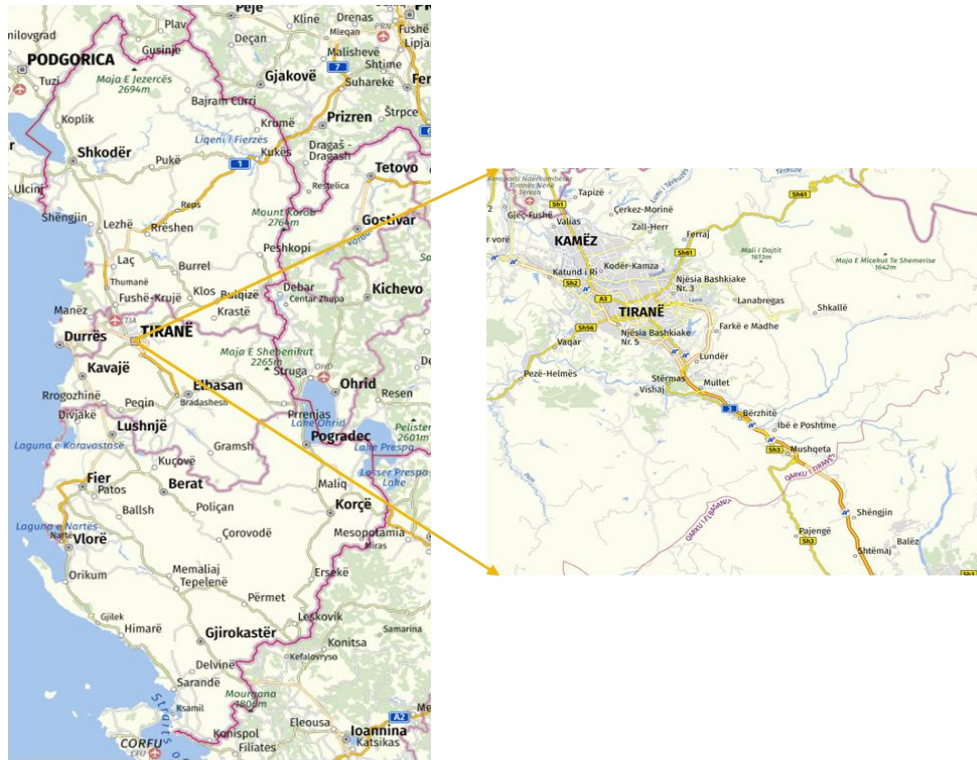
Motivation

- Urban flooding in the capital of Albania are mostly caused by days of sudden intense/extreme precipitation.
- The frequency & severity of this phenomena play a key role in the long-term variation of annual total precipitation.
- To have a long-term clear trend of the phenomenon, a multiannual analyses of some key-indices of precipitation is needed.
- Results may be used as an objective tool to improve flood risk reduction strategies for Tirana and similar urban areas in Albania.

Data used

- The daily precipitation ($R > 1.0\text{mm}$) was used to estimate the annual total precipitation and all precipitation indices.
- The daily data for the period of 1950 – 1990 were available from European Climate Assessment & Dataset and the former Institute of Hydrometeorology of Albania (in the spite of my thesis).
- The data for 2008 – 2021 were available from the AWS Network of Meteoab Center, a private provider in Albania
- In this study, indices of PRCPTOT, Rx1-Y, Rx1-M were estimated for Tirana over a 72-years period.

AWS installed in the center of the Tirana city) as one of the most populated and urbanized cities, of the Albania contry (Map 1).



Map 1 – Tirana, the capital city of Albania is located in $41^{\circ}19'40''$ N and $19^{\circ}49'8''$ E, with an area of 41.8 km^2 , an averaged elevated at 110 m from Sea level, with over than 1 million citizens.

Methodology

- Annual Total Precipitation was estimated by :

$$\text{PRCPTOT}_j = \sum_{i=1}^I \text{RR}_{ij}$$

- Annual maximum 1-day precipitation was estimated by:

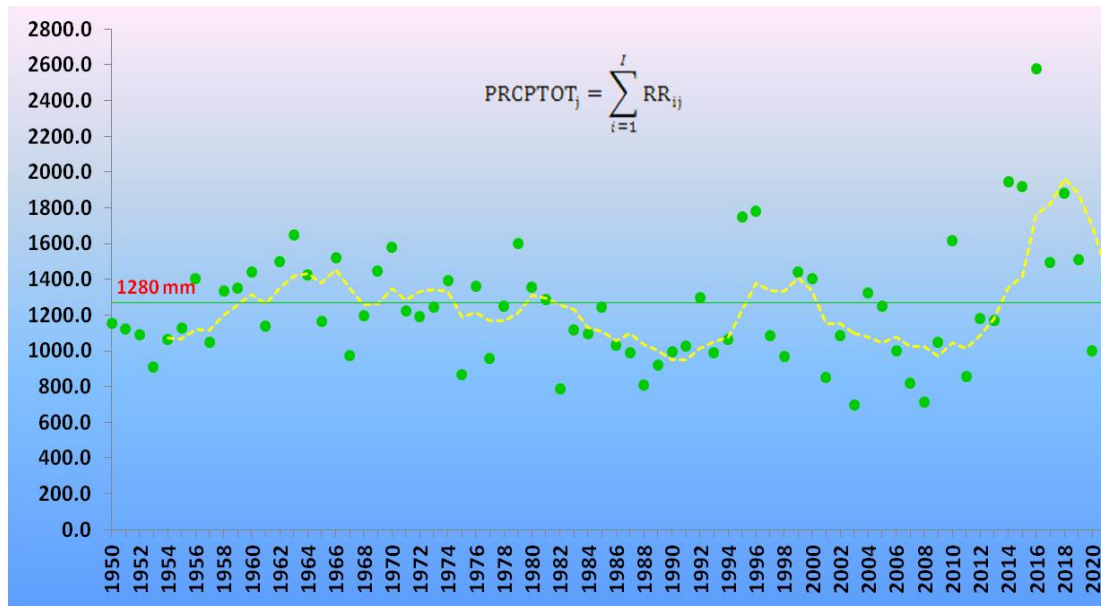
$$\text{Rx1day}_j = \max (\text{RR}_{ij})$$

- Monthly maximum 1-day precipitation was estimated by:

$$\text{Rx1month}_j = \max (\text{Rx1day}_{ij})$$

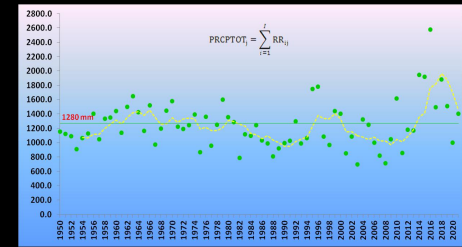
Results – PRCPTOT

- in general, dry years stand superior against the wet ones for 72-ysrs
- PRCPTOT-s stand 59.7% / 40.3% of the years BELOW the normal mean of 1280 mm.



Graph 1 – The 72 yrs variation of the PRCPTOT for Tirana city

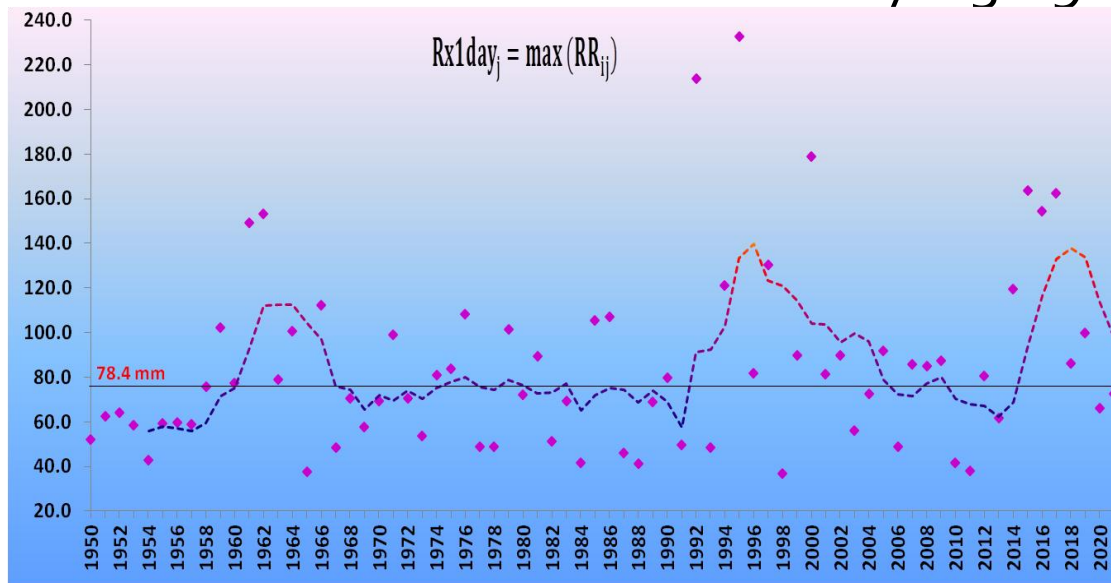
Results – PRCPTOT details



- The graph presents a lot of ups and downs in the PRCPTOT and a 5-yrs moving average was used to SMOOTH extreme values and the PRCPTOT shows that:
 - 1950 – 1979, a low variation in the PRCPTOT
 - 1980 – 1990, a decrease in the PRCPTOT
 - 1991 – 2000, an increase
 - 2001 – 2010, a decrease
 - 2011 – 2019, a clear increase
 - 2020 – 2021, a very clear decrease in the PRCPTOT

Results – RX1-day

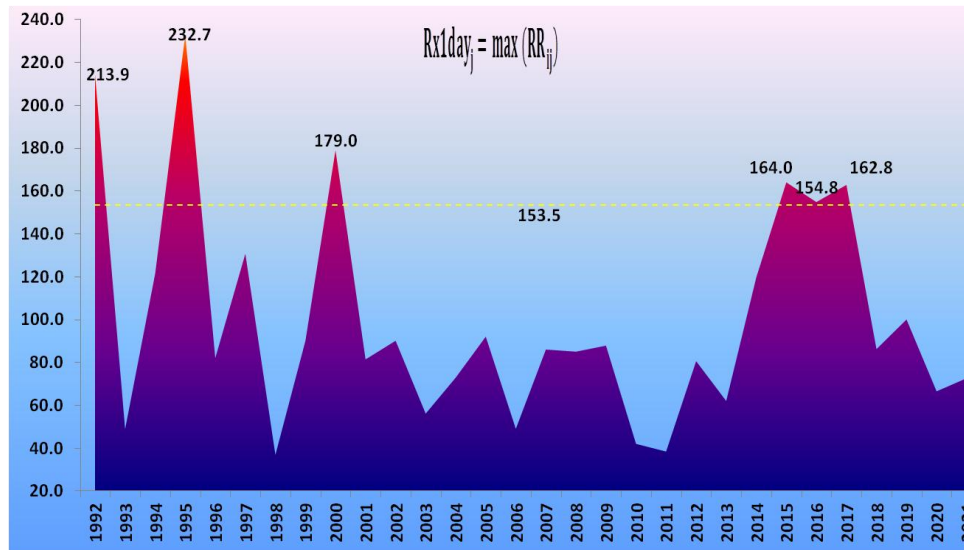
- RX1-day stand 51.4% / 48.6% of the years BELOW the normal mean of 78.4 mm/24h
- 1995 recorded the HIGHEST value of Rx1day = 232.7 mm/24h
- 1998 recorded the LOWEST value of Rx1day = 36.9 mm/24h



Graph 2 – The 72 yrs, annual maximum 1-day precipitation of Tirana

Results – RX1-day 1992 – 2021

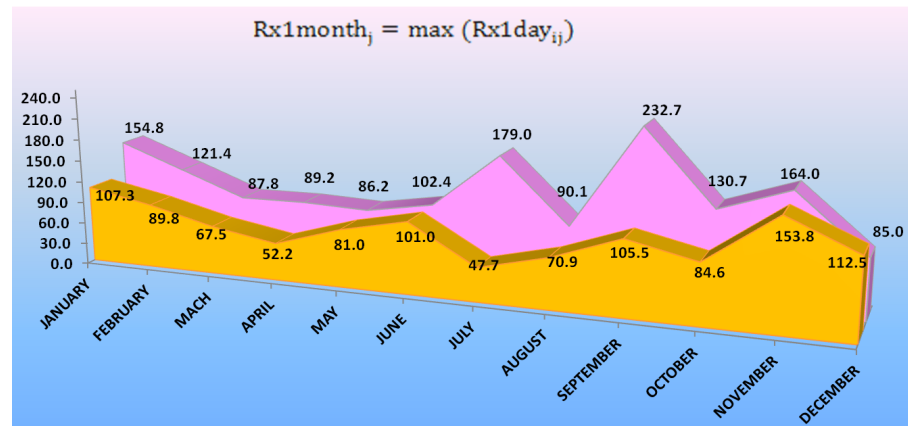
- The marked difference between max/min RX1-day values belong to the last 3-decades.
- A 5-yrs moving average was used to smooth extremes of the last 3-decades and after it results:
 - some periods of low variation
 - three very clear peaks of the Rx1day
 - the abs.max. record of 153.5 mm (Nov.1962) was broken 6 times



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Results – RX1-Month

- To point out the variation of the RX1-day WITHIN the year
 - The RX1-day values were estimated in monthly bases
 - Compared to the respectives of the normal clim. (1961 - 1990)

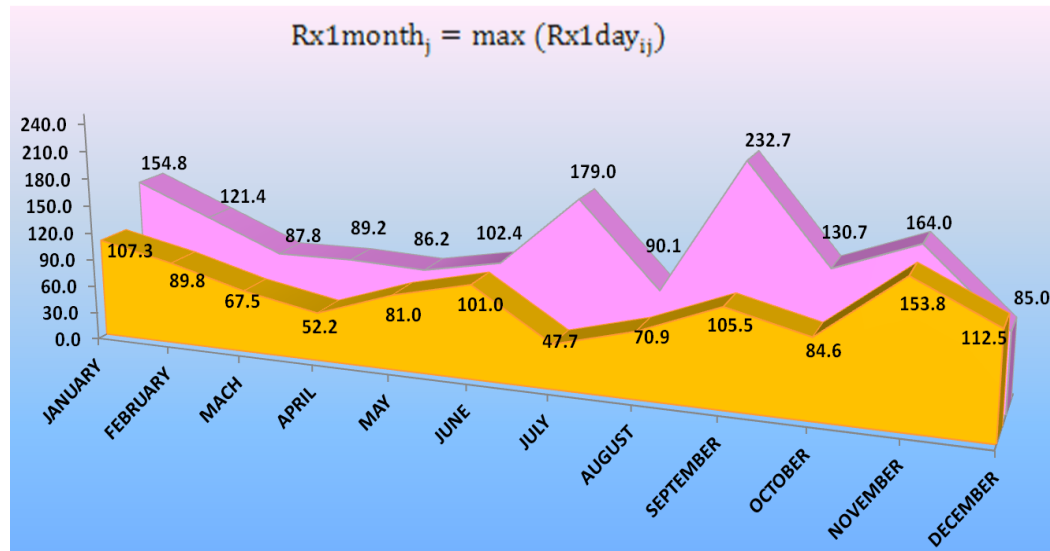


Graph 4 – The RX1-day for the last 3-decades of Tirana

- The Rx1M-s of the last decades (pink) stand ABOVE their respective values of normal clim. (yellow) BESIDES December.

Results – RX1-Month details

- December SAVES the higher value (112.5mm) of the normal climate period against RX1-day = 85.0 mm, the monthly max. of the last three decades.
- Important RESULTS for July & September of the last 3-decades:
 - July: Rx1M = 179.0 mm/24h (3.8 times higher)
 - September : Rx1M = 232.7 mm/24h (2.2 times higher)



Graph 4 – The RX1-day for the last 3-decades of Tirana

Conclusions

- Tirana recorded more dry years than wet ones for 72yrs
- Tirana show a low variation in the PRCPTOT for 1950 – 1979
- Years 1980 – 1990 show a decrease in the PRCPTOT of Tirana
- The last three decades show the highest PRCPTOT variation
- The 24h-precipitation amounts has increased after the 1990

Conclusions

- The record of Tirana daily precipitation **was broken 6 times**
- Since 1995, daily precip. has a **new record of 232.7mm/24h**
- Daily precip. for July, Sept. **increased by 3.8; 2.2 times**
- The highest daily record of the three last decades **shifted** from Nov. (of normal clim.) to September (last 3-decades).
- Tirana of the last 3-decades **FACED more severe and more days of extreme precipitation**

**Thank you
for your attention !**

References

■ References

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