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Research Article

CLIMATE CHANGE IMPACT ON NW ALBANIA REFLECTED ON RAINFALL REGIME

Petrit Zorba[1,a,*], Albana Hasimi[1,b], Elvin Çomo[1,c]

[1]*Polytechnic University of Tirana, Institute of Geosciences, Energy, Water and Environment (IGEWE), Department of Climate and Environment, Tirana, Albania*

**Corresponding Author:*
E-mail: petrit.zorba@gmail.com

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a: ORCID 0000-0002-2844-9104, b: ORCID xxxx-xxxx-xxxx-xxxx, c: ORCID xxxx-xxxx-xxxx-xxxx

ABSTRACT. Climate is a very important element of the environment, which on recent times has been characterized by some change, like in the other part of the world, also in Albania. Those changes are reflected not only by different ongoing of meteorological elements but as well as in their interior character. In this presentation will be shown the results of various rainfall index for an 89 years period analyzed 1931-2019. The area selected is part on NW Albania, as one of most known for flooding over the recent years. Also, on this paper a drought analyze will be presented by SPI index evaluations, that is a very important information related to agricultural users and as well as for hydropower companies operating on that area. Another element to be emphasized is some important change reflected on the increase of the tendency for the amplitudes values of air temperature and some verified change in the rate between the rain and snow during the years in favor of rain, bringing up a decrease of snow events and less space covered by snow.

Keywords: *climate change, SPI index, Albania*

INTRODUCTION

During the recent years are observed extreme weather situations, like flooding, forest fires, but also an increase on the drought situation, creating many problems for the life and economies of farmers on the area of Bushat (NW of Albania) (Fig. 1).

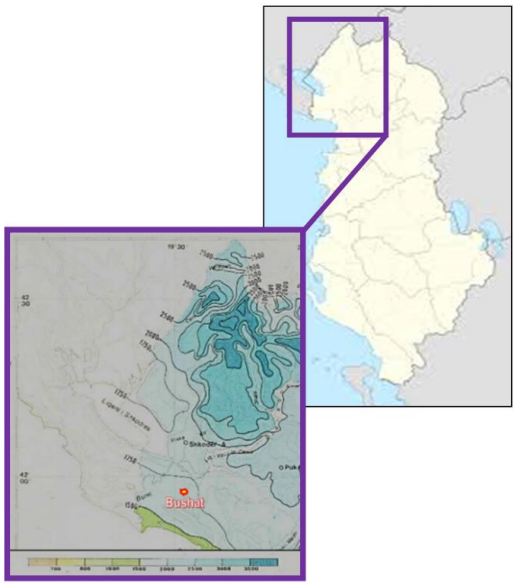

Fig. 1. *The Annual precipitation map of NW part of Lowland in Albania*

MATERIALS AND METHODS

For this study are used the meteorological data of Bushat meteorological station, that are observed in conformity with WMO standards and applied all the necessary criteria for their elaboration. The SPI model has been used by several authors on climate variability evaluations. On such context in this paper are presented the results of SPI model (McKee et al.), applied with the data taken from some meteorological stations, part of NW of Albania. Also a excel platform was composed and used to calculate the SPI index.

For SPI index and other parameters are used the monthly rainfall series for the period 1931-2018 of Bushat, that represents climatically the area of NW Lowland part of Albania. At the figure 1 is presented the ongoing of annual precipitation for a 78 years period. A slight decrease is noted during this multiannual period. Inside the year are observed different types of change, like that of the month of April, with an increase of rainfall shown on figure 3. In other side the standard deviation present a decrease tendency (Fig. 1).

After a control data and all the necessary procedure the calculated values of SPI are presented on the table 1 for the period 1991-2018.

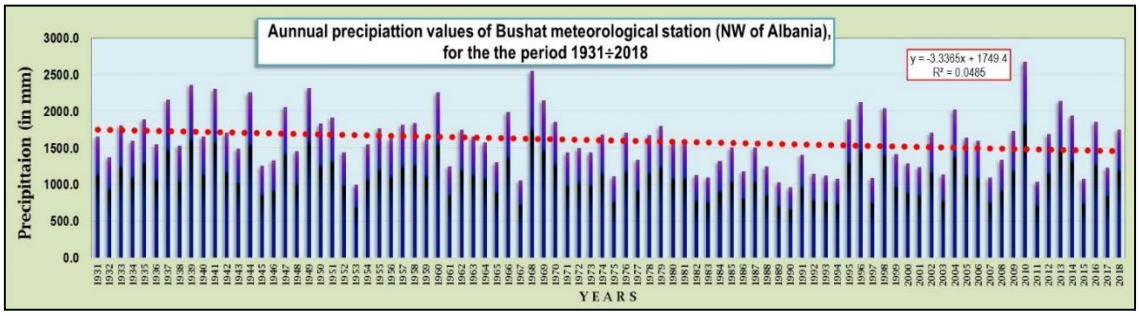

Fig. 2. *The annual precipitation values of Bushat meteorological station*

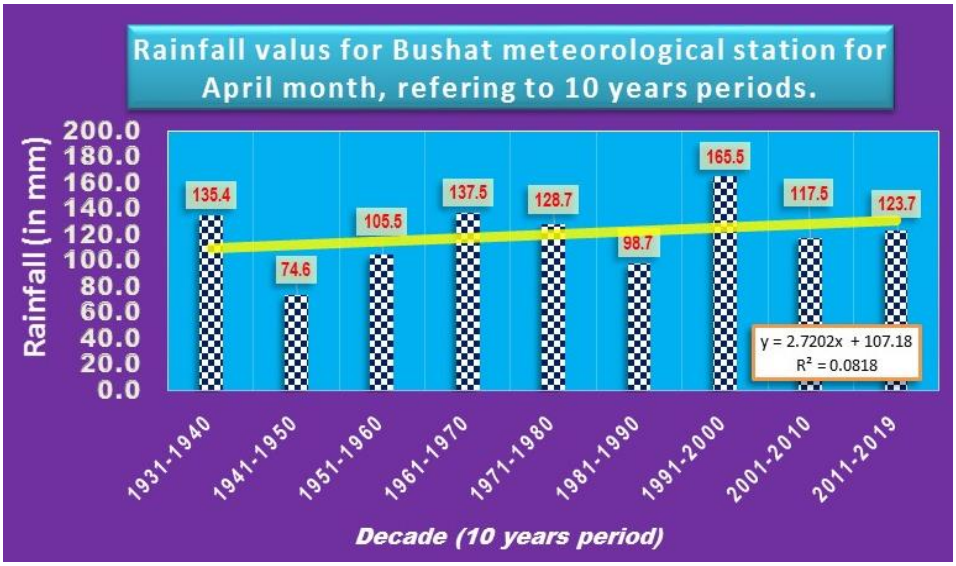

Fig. 3. *The 10 years period of rainfall for April month of Bushat meteorological station*

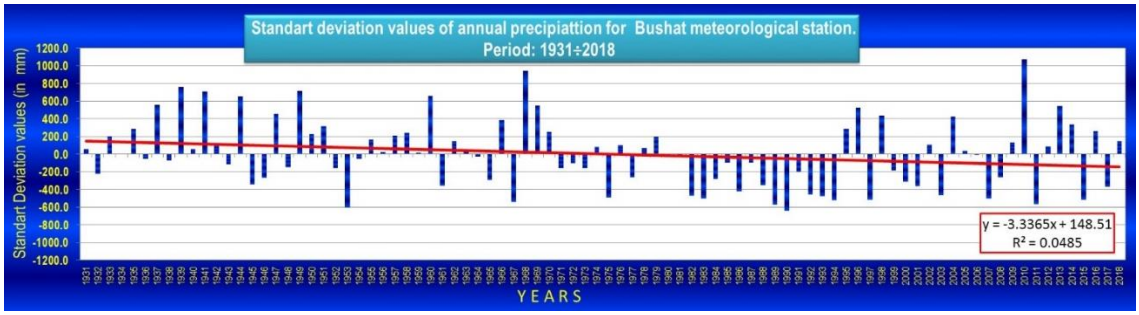

Fig. 4. *The standard deviation of rainfall values of Bushat meteorological station*

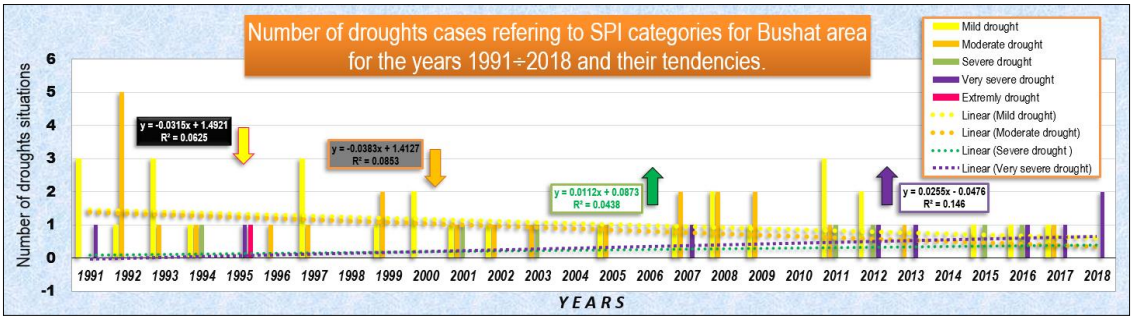

Fig.5. *The tendency of different type of droughts for Bushat meteorological station standard*

Table 1. *The values of SPI index calculated for the period 1991-2018 for the meteorological station of Bushat*

Meteo. Station	SPI	SPI	SPI	SPI	SPI	SPI	SPI	SPI	SPI	SPI	SPI	SPI
BUSHATI	January	February	March	April	May	June	July	August	September	October	November	December
YEAR / Month	1	2	3	4	5	6	7	8	9	10	11	12
1991	-0.99	0.43	-0.46	0.48	0.84	-0.10	0.99	-1.74	-0.38	0.79	0.45	-0.45
1992	-0.98	-0.60	0.36	0.37	-0.55	0.68	-0.65	-0.60	0.24	0.40	0.38	-0.33
1993	-0.47	-0.62	0.33	0.08	-0.07	0.04	-0.38	-0.31	0.21	0.16	0.39	0.19
1994	0.28	0.06	-0.69	0.91	0.20	0.24	-1.02	0.19	-0.14	-0.28	-0.49	0.06
1995	0.45	0.19	0.74	0.33	0.30	-2.14	1.20	1.74	0.69	-1.80	0.15	0.64
1996	-0.17	0.63	0.38	0.50	0.71	-0.94	0.24	0.90	1.21	0.23	0.79	0.41
1997	-0.31	-0.14	-0.49	0.19	-0.15	-0.39	0.26	0.18	-0.55	0.63	-0.20	0.50
1998	0.42	-0.09	-0.18	0.72	1.05	0.27	0.04	1.05	1.36	0.32	0.48	-0.12
1999	0.39	0.34	-0.34	0.67	-0.84	0.31	0.74	-0.18	-0.58	0.23	0.02	0.69
2000	-0.43	0.04	0.42	-0.02	0.16	0.01	1.33	0.31	-0.48	0.06	0.39	0.28
2001	0.12	0.34	0.29	0.40	-0.33	-0.08	-0.23	-0.94	0.47	-1.05	0.32	0.14
2002	-0.60	0.10	-0.48	0.46	0.22	-0.21	1.13	1.24	1.42	0.44	-0.24	0.07
2003	0.65	-0.23	-0.99	-0.06	-1.24	0.01	0.03	-0.21	0.03	0.65	0.00	0.01
2004	0.51	0.64	0.48	0.38	0.69	0.86	0.42	0.87	0.07	0.12	0.74	0.50
2005	0.20	0.59	0.43	-0.27	0.09	0.37	-0.01	1.03	0.57	-0.62	0.59	0.46
2006	-0.24	0.79	0.36	0.50	0.07	0.67	-0.13	1.08	0.54	0.13	0.08	-0.02
2007	0.39	0.42	0.40	-0.69	0.09	-0.50	-1.89	-0.43	0.03	0.04	-0.57	0.28
2008	0.12	-0.67	0.42	0.17	-0.29	0.61	-0.28	-0.80	-0.16	0.31	0.19	0.69
2009	0.56	-0.01	0.11	-0.46	-0.67	0.81	0.06	-0.70	0.20	0.67	0.80	0.62
2010	0.89	1.08	0.45	0.69	0.39	0.85	-0.06	-0.13	0.14	1.41	0.75	0.42
2011	0.12	-0.28	0.01	-0.39	0.18	0.39	0.22	-1.28	-0.32	0.20	-0.71	0.58
2012	0.13	0.59	-1.53	0.96	0.54	-1.20	0.11	-0.33	0.02	0.79	-0.30	0.83
2013	0.98	0.54	1.00	0.40	1.27	0.07	-1.89	0.93	0.67	0.10	0.57	-0.85
2014	0.93	0.10	0.18	0.46	0.26	1.34	1.22	-0.02	0.67	-0.14	0.18	0.47
2015	0.44	0.32	0.54	0.07	-0.19	-0.25	-0.15	0.66	-0.49	0.14	-0.23	-1.40
2016	0.66	0.67	0.53	0.36	0.59	0.99	0.60	-1.09	-0.25	0.72	0.60	-1.93
2017	-0.29	0.23	0.01	-0.16	-0.07	-0.94	0.27	-1.74	0.22	-0.23	0.41	0.69
2018	0.39	0.61	1.27	-1.84	0.94	0.63	0.77	-0.20	-1.64	-0.13	0.49	0.26

RESULTS AND DISCUSSION

Following a decrease in total amount of annual rainfall and as well for the standard deviation, regarding the drought is observed an increase for the category of "very severe" and "extreme" droughts. On the figure 5 are presented the ongoing values of different types of droughts during the last years. For a re-analysis and a double verification of results are used also products of the "Drought Management Centre for Southeastern Europe", that totally have been in concordance with the outputs of this study. One example is shown on the figure 6 for the month of April 2018 characterized with extreme drought as it is also confirmed by the value (-1.84) presented on the table 1 for the same month.

A tendency of decrease by 9-11% of precipitation year by year is clearly observed during the period 1931-2018, that is shown on the figure 2. In mean time less values of standard deviation are noted as presented also in the figure 4.

During the months some change are verified like that of April, when is verified an increase of rainfall, but as well as with increase also for dry situations. On April 2018 only 14.3 mm of rain sign the historic minimum of monthly values from 1931 until 2019. SPI evaluations are presented on the table 1.

Different type of drought are evaluated and presented on the figure Nr.6. Important is to note that drought category of "extreme" and "very severe" signed an increase. To verify and compare the results are used also the product of DMCSEE, as for example that of April 2018 (Fig. 5).

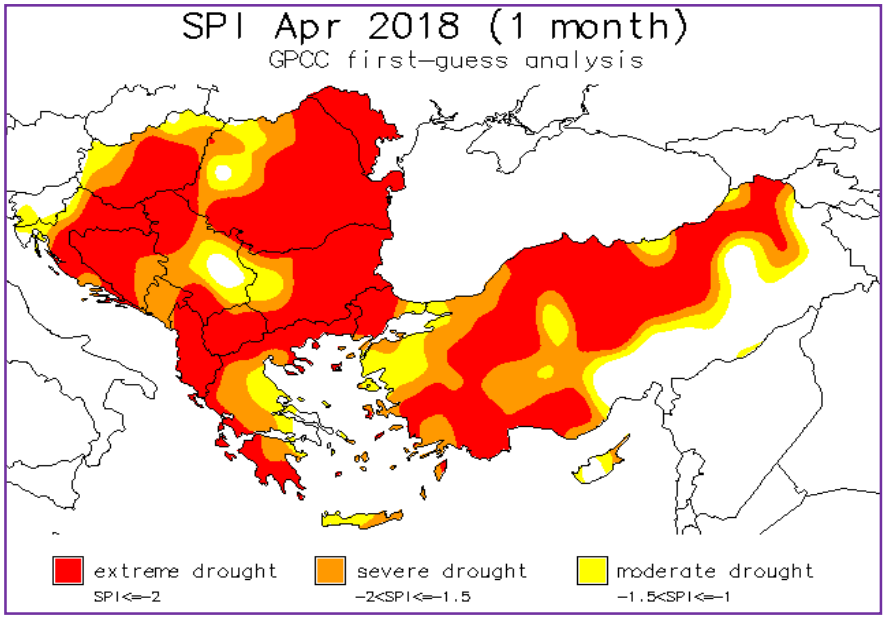

Fig.5. *The SPI values presented for the month of April 2018, as output of "Drought Management Centre for Southeastern Europe"*

CONCLUSION

Extreme events, are signing an increase on the area on NW of Albania. Snow events and their area of observation are less than norm values. SPI index shows an increase of extreme drought, in mean time flooding are more frequent.

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