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Evaluation of rainfall patterns in Lavras, Minas Gerais, before and after the formation of the Funil Lake

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ABSTRACT

Water has a wide range of uses in civilization. Water resources are closely linked to climate change, which has become the object of several studies in the recent decade. The goal of this study was to evaluate the tendencies of the rainfall patterns in the region of Lavras, Minas Gerais State, Brazil, after the formation of the Funil Lake. The study used daily rainfall data (1987 to 2017) from the BDMEP database, available on the Brazilian Meteorology Institute (INMET) website. Analysis of variation was conducted using the Mann-Kendall test for monthly mean rainfall, rainy and the dry season of the year, before and after the lake formation, LFB and LFA, respectively. It was verified, for the LFB period, that April and August had significant tendencies. For the LFA, the months February, June, July, and December reached significant tendencies. The LFA period in the rainy season had a significant negative tendency, and the LFB period in the dry season had a significant negative tendency, as well. These significant tendencies cases show that the formation of the Funil Lake did not trigger any relevant change in the rainfall regime in the region.

Introduction

It is estimated that only 2% of all the water on the Earth planet is fresh. Of this percentage, a portion is contained in glaciers, and therefore, it is unavailable for human consumption. Brazil is in a privileged position with regard to water resources, as it holds up to 12% of all fresh water worldwide (ANA, 2013).

Water resources are intrinsically related to human life. Water has a wide range of uses in civilization, such as domestic supply, irrigation, leisure, industry, energy generation, and so on. It is impossible to imagine human life without water (Marengo, 2008).

However, water resources are closely linked to climate change and have become an object of many studies over the last decades (Gocik & Trajkovic, 2013; Neves et al., 2018; Schmidt et al., 2018; Schuster, 2019). Ely et al. (2003) state that alterations in rainfall patterns lead to decreases in agricultural production in rural environments.

In the context of likely climate changes, the assessment of tendencies in climatologic data series is common. Where tendencies are defined as a systematic and continuous change in any parameter of a given sample, in case of climatic tendencies it aims to study the comportment of climatic parameters along with a temporal series (Yevjevich, 1972). These studies are essential for, besides, figuring out possible fluctuation that can occur over time.

Paulino et al. (2019) has shown, for the Brazilian State of Ceará, that there are significant positive tendencies in maximum temperature for five meteorological stations analyzed. Moreover, increasing tendencies are verified for evapotranspiration, which also increases the need for irrigation in the coming decades. Souza et al. (2018) demonstrated a reduction in the cumulative rainfall volume, for the region of Alfenas, a city in the state of Minas Gerais in Brazil, for the historical series from 1984 to 2016. Salviano et al. (2016) also observed significant tendencies for the rainfall regime in all the political regions of Brazil. Back (2001) verified growth tendencies for mean rainfall.

Minuzzi et al., (2010) using the Mann-Kendall test, found significant positive tendencies for maximum temperature in the state of Minas Gerais from 1961 to 2004. Recent studies carried out in the city of Goiania, GO, point to a tendency toward elevation of the mean maximum temperature in the region. It was also observed that there is a decline in the values for relative air humidity for the same region. The results presented a socio-environmental problem since they might result in health issues, like breathing problems and airborne diseases (Luiz et al., 2012). Those climate changes may result in impacts in the socioeconomic segments of agriculture and livestock in Brazil (Pinto et al., 2009).

In this sense, it is extremely important to study climatic variations since variability can cause severe changes in human behavior and in the environment.

In the context of changes in the pattern of precipitation, there are few studies on changes in the microclimate. Comparing monthly rainfall in Marcelino Ramos (RS, Brazil) before and after filling the hydroelectric plant lake at the Itá, Sanches et al. (2015) found that there were no significant changes in the region's rainfall pattern. Similar results were found by Sanches et al. (2017), who found that the formation of the Passo Fundo (RS) hydroelectric plant lake did not trigger changes in local monthly rainfall. Silva Filho & Rabelo (2012) found that there was an increase in precipitation in the region of Jaguarema (CE) due to the formation of the Castanhão lake.

In a more general context, artificial lakes can cause changes in other meteorological variables. Still on the Castanhão reservoir, Dantas & Sales (2015) found that the reservoir influenced the local air temperature and the relative humidity of the air. Souza (2010), in Presidente Epitácio (SP), found that the artificial lake of the Engenheiro Sérgio Motta hydroelectric plant did not cause changes in local temperature and relative air humidity, however, the lake contributed to a better thermal and hygrometric balance.

Thus, this work seeks to verify the possible influence on the rainfall regime due to the formation of the Funil Lake that power the hydroelectric power plant in the region of Lavras, state of Minas Gerais, Brazil.

Materials and Methods

Description of the data

Rainfall data was collected from the meteorological database for studies and research (BDMEP), available in the Brazilian Meteorology Institute (INMET) website (INMET, 2017). The BDMEP platform holds records of historical series from continuous observations of daily meteorological variables, obtained from climatological stations distributed throughout the Brazilian territory, as part of the national network of meteorology stations for surface observations. This study used a historical series of data from BDMEP for daily rainfall from the Main Weather Station in the region of Lavras, MG, obtained for the period from January 1st, 1987 to December 31st, 2017. The period comprehends 15 years before and 15 years after the formation of the Funil Lake in 2002. The lake was created by damming the water of the Rio Grande River for powering the Engenheiro José Mendes Júnior hydroelectric plant, also known as the Funil Power Plant.

The lake covers an area of 35 square kilometers with a maximum capacity of 258 million cubic meters of water. It is located in the region of the city of Lavras, nearby cities of Perdões, Ijaci, Bom Sucesso, Itumirim, and Ibituruna, in the south of the state of Minas Gerais, Brazil. The referred weather station is the only station used to infer the climate in the region. It is registry in the World Meteorological Organization (WMO) is 83687 with geographical coordinates latitude 21°14' S, longitude 45°00' W, and altitude 918.8 meters.

Historical series

Among the statistical methods applied for studying tendencies in time series, the Mann-Kendall test stands out. This method was proposed by Mann (1945) and Kendall (1975), it is a non-parametric statistical test used to detect significant tendencies in variations of certain data series (Salviano et al., 2016).

The test accepts or rejects a null hypothesis (Ho) that there is no significant tendency in the series of data analyzed considering a significance level (α), that indicates the percentage of error in the acceptance or rejection of the hypothesis Ho (Salviano et al., 2016).

In the Mann-Kendall test the statistical variable S is estimated from the sum of signals (s) of the difference in pairs of values taken for all the *n* values of the sample, which is obtained from the difference in each initial value, according to the equation below:

$$S = \sum_{i=1}^{n-1} \sum_{j=i+1}^{n} s(x_j - x_i) \quad (1)$$

The statistical variance Var (S) can be obtained using the equation (2), which is compared to the normal distribution for cases where $n > 10$.

$$Var(S) = \frac{(n*(n-1)*(n+5))}{18} \text{ R} \quad (2)$$

Following the normal distribution, the Z index, from equation (3), is calculated for verifying the hypothesis and comparing it to table value. The case of a positive Z index indicates that there are growth tendencies, and the case of a negative Z index shows decrease tendencies.

For $S > 0$,

$$Z = \frac{S-1}{\sqrt{Var(S)}} \quad (3)$$

For $S < 0$,

$$Z = \frac{S+1}{\sqrt{Var(S)}} \quad (4)$$

For $S = 0$, Z = 0.

To reject the null hypothesis, that affirms that there are no significant tendencies, the Z modal value must be greater than the Z table value for the significance level used in the test. Considering, for example, the significance level of 5% the Z table value is 1.96. So, the Z modal value calculated must be greater than 1.96.

While performing the Mann-Kendall test in the current study, to verify significant tendencies levels of significance of 1, 5, and 10% were used following the normal distribution for the Z table.

Calculation

With the daily data from the BDMEP platform it was possible to calculate the total rainfall and the standard deviation for every month from 1987 to 2017.

From the monthly rainfall amount, the mean value for each month was calculated in two distinct periods. The first period was from 1987 to 2002 (year of the lake formation in the region), and the second period corresponds to the years after the Funil Lake formation, from 2003 to 2017.

Using the monthly rainfall data, the Mann-Kendall test was applied to verify positive or negative tendencies. The test was performed using computational spreadsheets for rainfall data in three parts. The first was performed for each month of the year using the data of the months separately, for the period before and after the Funil lake formation. The second test was conducted using data for the rainy season of the year, considering the sum of the total volume of rainfall for months of October, November, December, January, February, and March. The rainy season of each year was compiled in two tables from 1987 to 2002, and from 2003 to 2017, applying the test in each table. The third test was conducted using the data from 1987 to 2017 for the dry season of each year, considering the total volume of rainfall for the months of April, May, June, July, August, and September, also separating the years prior to 2002, and from 2003 to 2017.

Results and discussion

As shown in Table 1, the values are shown in millimeters (mm) and are equivalent to values in liters (L) for every 1.0 square meter area.

Table 1. Mean rainfall (mm) for each month before and after the formation of the Funil Lake.

Month	Before 2002		From 2003 to 2017	
	Mean rainfall (mm)	Standard deviation (mm)	Mean rainfall (mm)	Standard deviation (mm)
January	284	174	308	156
February	222	94	141	85
March	168	57	159	71
April	52	33	61	39
May	53	50	36	25
June	16	19	26	28
July	9	10	13	14
August	16	20	10	11
September	64	44	50	42
October	103	55	95	38
November	180	65	187	75
December	249	84	245	107

The maximum value of rainfall monthly, on the period prior to the lake formation, was 284 mm for the month of January, while the minimum value was 9 mm for the month of July. For the period after the lake formation, the maximum rainfall was 308 mm for the month of January, while the minimum was 10 mm of rainfall for the month of August.

According to the normal distribution, the values of the Z index for significance levels of 1, 5, and 10% are 1.64, 1.96, and 2.57, respectively.

In the first part of the analysis, the Mann-Kendall test was applied separately for each month using the consecutive rainfall values year after year. This procedure was carried out for the period before and after 2002. The values of the Z index calculated by the Mann-Kendall test are shown in Table 2.

Table 2. Z value calculated for each month in the period before and after the Funil Lake formation. $Z_{(10\%)}$=2.57; $Z_{(5\%)}$=1.96; $Z_{(1\%)}$=1.64.

Months	Z_c	
	(from 1987 to 2002)	(from 2003 to 2017)
January	-0.42	-0.52
February	0.06	-2.22*
March	-0.18	0.13
April	-3.53*	0.39
May	-0.54	-1.05
June	-1.85	2.22*
July	-1.37	-1.70*
August	2.33*	0.26
September	-1.37	0.00
October	-1.02	0.00
November	1.61	-0.26
December	0.90	-2.22*

Analysis of indices before 2002 on Table 2 showed that only the months of April and August had shown significant tendencies, where April has shown negative tendency for significance levels of 1, 5, and 10%, and August has shown positive tendency for significance levels of 5 and 10%, and no tendency for 1% of significance level.

The period after the lake formation the months of February, June, July, and December showed significant tendencies. February showed negative tendency for significance levels of 5 and 10%, June showed positive tendency for significance levels of 5 and 10%, July showed negative tendency for significance level of 10%, and December showed negative tendency for significance levels of 5 and 10%.

According to the results obtained, there are significant trends for only a few months, which indicates that there were possibly no severe weather changes in the region due to the formation of the Funil lake. This fact is accentuated when analyzing that the months of April and August already presented trends before 2002. Similar results were found by some others authors (Gonçalves & Back, 2018; Mondal et al., 2012; Penereiro et al., 2018).

In turn, Sanches et al. (2017) verified that there was little statistical variability in monthly rainfall in the city of Passo Fundo (RS) and, therefore, there were no weather changes in the region due to the formation of the lake. Sanches et al. (2015), analyzing changes in the rainfall pattern of Marcelino Ramos (RS), also observed, statistically, that the monthly rainfall values had a very similar behavior before and after the filling of the Itá lake and, therefore, there were no rainfall pattern changes in the region due to the formation of the lake.

In the second part of the test applied, the Z values were calculated for the series of rainfall data of the rainy and the dry season of the year, considering before and after the Funil lake formation.

Table 3. Z Values calculated for the rainy and the dry season of the year, before and after the Funil Lake formation. $Z_{(10\%)}$=2.57; $Z_{(5\%)}$=1.96; $Z_{(1\%)}$=1.64.

Period	Z_c	
	Rainy season	Dry season
From 1987 to 2002	-0.18	-2.09*
From 2003 to 2017	-2.22*	0.92

As demonstrated in the results for the rainy season, the data after 2002 has shown a significant negative tendency for significance levels of 5 and 10%.

According to the results for the dry season, the period before 2002 showed a significant negative tendency for significance levels of 5 and 10%.

Through the results, it is possible to observe a possible tendency to reduce rainfall in the rainy season after the formation of the lake. These results concur with those of Almeida et al. (2019). They found negative tendencies for rainfall were found for the hydrographic basin in the city of Itajubá, in the southern region of Minas Gerais. Negative tendencies for rainfall were also demonstrated by Rodrigues et al. (2018) for the region of the city of Machado, state of Minas Gerais, for the month of October. Silva et al. (2015), also found negative tendencies for annual rainfall using the same Mann-Kendall statistical test.

However, it appears that the dry period showed significant trends in reducing the volume of rainfall for the period prior to the formation of the lake. Therefore, it can be that there is no very well defined trend pattern for the dry and rainy periods before and after the formation of the Funil lake. Melo et al. (2018), used the Mann-Kendall test, to assess the rainfall pattern in the Sobradinho region (BA) after the existence of the Sobradinho hydroelectric power plant lake. They found that it was not possible to state that there were changes in rainfall in the region because there were significant trends only in some cases of the tests performed. Sanches & Fisch (2005) also found few statistically significant results analyzing the distribution of rainfall and the formation of the artificial lake of the Tucuruí hydroelectric plant (PA).

According to the results obtained, in which few statistically significant results are observed, it is not possible to state that the Funil lake interfered with the rainfall pattern in the Lavras region. However, further studies of trends are necessary, using a longer period of time and involving other climatological variables in order to obtain a more expressive result.

Conclusion

As there are expressive results for some cases of the applied tests, it appears that there is no significant trend to change the rainfall pattern in the Lavras region due to the formation of the Funil lake.

References

ALMEIDA, L. T. de; SILVA, F. B.; CECÍLIO, R. A.; ABREU, M. C.; FRAGA, M. de S.; Análise do comportamento da vazão e precipitação na influência de enchentes na bacia hidrográfica a montante da cidade de Itajubá. **Revista Augustus**. Rio de Janeiro, v. 24, n. 49, p. 124-145, 2019.

ANA - Agência Nacional de Águas (Brasil). **Conjuntura dos recursos hídricos no Brasil**: 2013. Brasília: ANA, 432p., 2013.

BACK, A. J. Aplicação de análise estatística para identificação de tendências climáticas. **Pesquisa Agropecuária Brasileira**, Brasília, v. 36, n. 5, p. 717- 726, 2001.

DANTAS, S. P.; SALES, M. C. L. A influência do açude Castanhão no clima local de Jaguarema – Ceará – Brasil: Uma análise no campo térmico e higrométrico. **Revista Equador**, Teresina, v. 4, n. 2, p. 2-17, 2015.

ELY, D. F.; ALMEIDA, I. R.; SANT'ANNA NETO, J. L. Variabilidade climática e o rendimento da cultura do milho no estado do Paraná: algumas implicações políticas e econômicas. **Geografia**, Londrina, v. 12, n. 1, p. 495-508, 2003.

GOCIK, M.; TRAJKOVIC, S. Analysis of changes in meteorological variables using Mann-Kendall and Sen´s slope estimator statistical tests in Serbia. **Global and Planetary Change**, v. 100, p. 172-182, 2013.

GONÇALVES, F. N.; BACK, A. J. Análise da variação espacial e sazonal e de tendências na precipitação da região sul do Brasil. **Revista de Ciências Agrárias**, Lisboa, v. 41, n. 3, p. 592-602, 2018.

INMET - Instituto Nacional de Meteorologia. BDMEP – **BANCO DE DADOS METEOROLÓGICOS PARA ENSINO E PESQUISA**. Brasília, DF. Disponível em: <http://www.inmet.gov.br/portal/index.php?r=bdmep/bdmep>. Acesso em: 15 nov. 2017.

KENDALL, M. G. **Rank correlation methods**. London: Charles Griffin, 1975. 120p.

LUIZ, G. C.; CARDOSO, H. C.; RIBEIRO, L. L. Aplicação do teste sazonal de Mann-Kendall na análise de tendência da temperatura e umidade relativa do ar – Goiânia – GO: série histórica 1961 a 2008**. Revista Geonorte**, Manaus, Edição Especial 2, v. 3, n. 8, p. 414-427, 2012.

MANN, H. B. Nonparametric tests against trend. **Econometrica,** v. 13, n. 3, p. 245–259, 1945.

MARENGO, J. A. Água e mudanças climáticas. **Estudos Avançados**, v. 22, n. 63, 2008.

MELO, M. M. M. S.; SANTOS, C. A. C. dos; OLINDA, R. A. de; SILVA, M. T.; ABRAHÃO, R.; RUIZ-ALVAREZ, O. Trends in temperature and rainfall extremes near the artificial Sobradinho lake, Brazil. **Revista Brasileira de Meteorologia**, São José dos Campos, v. 33, n. 3, p. 426-440, 2018.

MINUZZI, R. B.; VIANELLO, R. L.; SEDIYAMA, G. C. Oscilações climáticas em Minas Gerais. **Revista Brasileira de Meteorologia**, São José dos Campos, v. 25, n. 2, p. 227–236, 2010.

MONDAL, A.; KUNDU, S.; MUKHOPADHYAY, A. Rainfall trend analysis by Mann-Kendall test: a case study of north-eastern part of Cuttack district, Orissa. **Internacional Journal of Geology, Earth and Environmental Sciences**, Jaipur, v. 2, n. 1, p.70-78, 2012.

NEVES, G. L.; VIRGENS FILHO, J. S. das; LEITE, M. de L.; MAUAD, F. F. Disponibilidade hídrica do solo, em Ponta Grossa – PR, sob diferentes cenários de mudanças climáticas globais. **Revista Brasileira de Climatologia**, Curitiba, v. 23, p. 116-133, 2018.

PAULINO, V. E. do N. P.; STUDART, T. M. de C.; CAMPOS, J. N. B.; PESTANA, C. J.; LUNA, R. M.; ALVES, J. M. B. Análise de tendências na evapotranspiração de referência e nas variáveis climatológicas do estado do Ceará-Brasil. **Revista Brasileira de Meteorologia**, São José dos Campos, v. 34, n. 1, p. 79-88, 2019.

PENEREIRO, J. C.; MESCHIATTI, M. C. Tendências em séries anuais de precipitação e temperaturas no Brasil**. Engenharia Sanitária e Ambiental**, Rio de Janeiro, v. 23, n. 2, p.3 19-331, 2018.

PINTO, H. S. Adaptação do Setor Agrícola Brasileiro. In: Fundação Brasileira para o Desenvolvimento Sustentável - FBDS. (Org.). **Mudanças Climáticas e Eventos Extremos no Brasil.** Rio de Janeiro: DaGema Comunicação, v. 1, p. 34-51. 2009.

RODRIGUES, G. S.; PUTTI, F. F.; SILVA, A. C. da; OLIVEIRA, A. S. de; FILHO, L. R. A. G. Climatological hydric balance and the trends analysis climatic in the region of Machado in Minas Gerais State, Brazil. **American Journal of Climate Change**, v. 7, n. 4, p.558-574, 2018.

SALVIANO, M. F.; GROPPO, J. D.; PELLEGRINO, G. Q. Análise de tendências em dados de precipitação e temperatura no Brasil. **Revista Brasileira de Meteorologia**, São José dos Campos, v. 31, n. 1, p. 64-73, 2016.

SANCHES, F.; FISCH, G. As possíveis alterações microclimáticas devido à formação do lago artificial da hidrelétrica de Tucuruí - PA. **Acta Amazonica**, Manaus, v. 35, n. 1, p. 41-50, 2005.

SANCHES, F. de O.; BIAVATTI, A.; SOUZA, D. de O. e; SILVA, R. V. da; FERREIRA, R. V. Chuvas em Marcelino Ramos (RS): influência do lago da UHE de Itá ou do ENOS? **Revista de Ciências Humanas**, Viçosa, v. 15, n. 2, p. 338-348, 2015.

SANCHES, F. de O.; FERRAZO, S. T.; SILVA, R. V.; CHECHI, L.; FERREIRA, R. V. Influence of the hydroelectric power plant of Passo Fundo lake (RS, Brazil) on local rainfall pattern. **Revista Brasileira de Climatologia**, Curitiba, v. 20, p. 299-312, 2017.

SCHMIDT, D. M.; LIMA, K. C.; JESUS, E. dos S. Variabilidade climática da disponibilidade hídrica na região semiárida do estado do Rio Grande do Norte. **Anuário do Instituto de Geociências – UFRJ**, Rio de janeiro, v. 41, n. 3, p. 483-491, 2018.

SCHUSTER, R. C. **Análise de cenários futuros de mudanças climáticas na disponibilidade hídrica na bacia hidrográfica da Laguna dos Patos**. 2019, 124p. Tese (Mestrado em Recursos Hídricos e Saneamento Ambiental) – Universidade Federal do Rio Grande do Sul, Porto Alegre.

SILVA, R. M. da; SANTOS, C. A. G.; MOREIRA, M.; CORTE-REAL, J.; SILVA, V. C. L.; MEDEIROS, I.C. Rainfall and river flow trends using Mann-Kendall and Sen's slope estimator statistical tests in the Cobres River basin. **Natural Hazards,** Springer, v. 77, p. 1205-1221, 2015.

SILVA FILHO, V. P.; RABELO, J. K. L. Detecção de possíveis diferenças ocorridas no comportamento da atmosfera local, como consequência da introdução do lago Castanhão no estado do Ceará. In: CONGRESSO BRASILEIRO DE METEOROLOGIA, 17., 2012, Gramado, RS. **Anais...** 2012. DVD

SOUZA, M. B. de. **Influência de lagos artificiais no clima local e no clima urbano: estudo de caso em Presidente Epitácio (SP)**. 2010, 204p. Tese (Doutorado em Geografia Física) – Universidade de São Paulo, São Paulo.

SOUZA, P. H. de; SANCHES, R. G.; SANTOS, B. C. dos. Índices climáticos e chuvas intensas no município de Alfenas/MG no período de 1984 a 2016. **Revista Brasileira de Climatologia**, Curitiba, DOSSIÊ CLIMATOLOGIA DE MINAS GERAIS, p. 320-341, 2018.

YEVJEVICH, V. **Probability and statistics in hydrology**. Fort Collins: Water Resources Publication, 1972. 276 p.

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Avaliação do padrão de chuvas na região de Lavras, Minas Gerais, antes e após a formação do Lago do Funil

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RESUMO

A água possui uma ampla utilização em diferentes setores da civilização. Os recursos hídricos estão intimamente ligados às mudanças climáticas, o que têm se tornado objeto de crescentes estudos nas últimas décadas. Com este trabalho objetivou-se avaliar as tendências no padrão de chuvas na região de Lavras, estado de Minas Gerais, após a formação do Lago do Funil. Os dados pluviométricos (1987 a 2017) foram extraídos no BDMEP disponível no site do Instituto Nacional de Meteorologia (INMET). A análise foi realizada pelo teste de Mann-Kendall com médias pluviométricas mensais, para o período chuvoso e para o período seco, anterior e posterior à formação do lago, AFL e PFL, respectivamente. Verificou-se que para o período AFL, os meses de abril e agosto tiveram tendências significativas. Por sua vez, para o período PFL, observou-se que os meses de fevereiro, junho, julho e dezembro atingiram tendências significativas. O período chuvoso PFL teve tendência significativa negativa assim como o período seco AFL. As tendências significativas em apenas alguns casos evidenciam que a formação do Lago do Funil não desencadeou mudanças relevantes no padrão de chuvas da região.

REFERENCIAÇÃO

JARDIM, G. F.; CARVALHO, L. G.; LIMA, J. E. D.; SANTOS, P. A. B.; SCHWERZ, F. Evaluation of rainfall patterns in Lavras, Minas Gerais, before and after the formation of the Funil Lake. **Agrometeoros**, Passo Fundo, v.28, e026697, 2020