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Komlan Koudahe

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# Trend of Thornthwaite's Aridity Index (AI) at Atakpame (Togo)



Komlan Koudahe

Contact: (+228) 93 63 90 48 Email: komlankoudahe@gmail.com



## Results and Discussions

### Abstract

Drought can severely affect agricultural production potential, destroying the local economy and creating famine. Data were collected (1990 to 2014) from the Meteorological Department of Togo. Reference evapotranspiration (ET<sub>o</sub>) varied with two peaks obtained on March 28 (5.84 mm) and on November 17 (4.87 mm). There was water deficit in all years except 2005 and 2007. Also, there was non-significant increasing trend of aridity index (AI). Specific actions should target efficient water management in Atakpame.

### Introduction

- Water is an important factor for crop production and a key element contributing to food security (World Bank, 2020).
- The objectives of this study are to: (i) assess the variation of evapotranspiration and, (ii) analyze the trend of annual aridity index (AI).



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### Data and methods

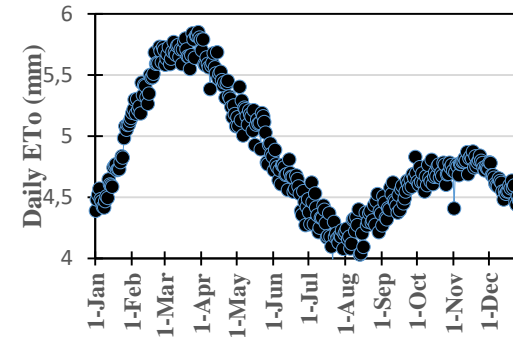
#### Study area and meteorological data used

- Atakpame is located in Togo (West Africa) with Latitude 7°31'37"N and Longitude 1°7'36"E.
- Reference evapotranspiration (ET<sub>o</sub>):** The Penman–Monteith (PM) equation (Allen et al. 1998).
- Alternative data estimation:** Hunt et al. (1998) solar radiation model, and Allen et al. (1998) model for relative humidity data were used.
- Thornthwaite's Aridity Index (AI):** Thornthwaite (1948) model  $AI = 100 \frac{P}{ET_o}$ .

### References

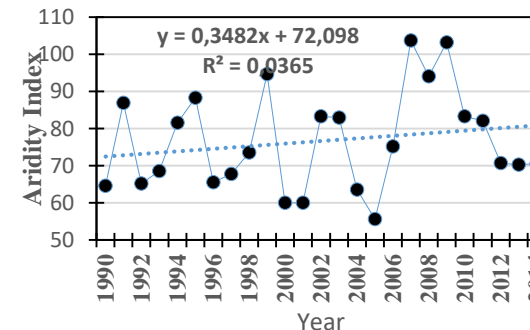
Allen, R.G., Pereira, L.S., Raes, D., Smith, M. (1998). Crop evapotranspiration: Guide-lines for computing crop water requirements. In FAO Irrigation and Drainage Paper No. 56; FAO: Rome, Italy, 300p.

### Distributions of the average daily reference evapotranspiration (ET<sub>o</sub>)



- Daily E<sub>to</sub> varied from 3.99 to 5.84 mm.
- It increases from January 1 (4.39 mm) to a maximum of 5.84 mm on March 28.
- It decreased thereafter to its lowest value of 3.99 mm on July 21 before rising again to another peak of 4.87 on November 17.

### Trend of annual Thornthwaite's Aridity Index (AI) in Atakpame



- Minimum AI (56%) in 2005 while the maximum AI (104%) in 2007.
- Precipitation meets the E<sub>to</sub> only in 2005 and 2007 with AI respectively 104% and 103%. Water deficit obtained in other years.
- Non-significant increasing trend confirming the results of Djaman et al. (2017) in Atakpamé.

### Conclusion

Results revealed temporal variation of E<sub>to</sub> with two peaks. Water deficit occurred in all years from 1990 to 2014 except 2005 and 2007. Important actions regarding water management should be taken to tackle the effect of water shortage.

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Hunt LA, Kuchar L, Swanton CJ (1998). Estimation of solar radiation for use in crop modelling. Agricultural and Forest Meteorology. 91(3):293–300.

Thornthwaite, CW (1948). An approach toward a rational classification of climate. Geographical Review, 38(1), 55-94. <http://dx.doi.org/10.2307/210739>.

World Bank (2020). Water in agriculture. <https://www.worldbank.org/en/topic/water-in-agriculture> (access on August 1, 2020).