Analyzing long term trend of potential evapotranspiration in the Southern parts of the Aras river basin

M. Esmaeilpour, Y. Dinapazhooh
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Extended Abstract
1- Introduction

Potential evapotranspiration ($ET_p$) is one of the most important component of hydrological cycle for irrigation systems scheduling, preparing input data for water balance hydrological models, and assessment of hydrological effect of climate change. One of the major issues of human societies in the present century is global warming due to green house gases increasing and water resources crisis. As a result, climate change may have significant effects on some of the hydrological parameters such as runoff, evapotranspiration, soil moisture and groundwater. Also, evapotranspiration is most important component of hydrological cycle after precipitation and usually crop water requirement determined using $ET_v$. Any change in climatological parameters due to global warming will affect evapotranspiration too. Eventual global warming may increase dry conditions in the world with increase of evapotranspiration and intensification of desertification. Therefore, Earth’s global warming may change the hydrological cycle components and global water resources will re-distribute in the time and place. This may intensify desertification in arid and semi arid countries such as Iran.

2- Methodology

In this study $ET_p$ values computed using the Blaney-Cridle method for the 6 synoptic stations located at southern part of Aras river basin in the period 1986-2008 (23 years). Furthermore, trend of $ET_p$ and some meteorological variables (precipitation, maximum temperature and minimum temperature) which affect it were analyzed in both annual and
seasonal time scales. Data used for computing involves: mean daily temperature, minimum relative humidity, wind speed (m/s) and sunshine hours. For trend computing, the effects of autocorrelation coefficients until 31 lags were included. Then trend analysis was performed with conventional MK method (for series with insignificant autocorrelation) and modified MK (for series with significant auto correlation). Mann – Kendall method is one of the most commonly used non parametric tests for considering trend in different hydrological and climatological variables. Test statistic \( Z \) was obtained from Mann-Kendall equations compared with normal \( Z \) in significance level \( \alpha \). If Mann-Kendall test statistic absolute value, \( Z \), was more than 1.645 then the trend (increasing or decreasing) considered being significant in 10% level. If it was more than 1.96, trend considered being significant in 5% level and if it was more than 2.33 then trend level will be 1%. In addition to trend test, slope of trend line also estimated using the Sen’s slope estimator.

3- Discussion

Results indicated that variation trend of \( ET_p \) as one of the main components of hydrological cycle at southern part of Aras river basin has spatial and temporal variations. Among all stations, Khoy experienced the most sever significant increasing \( ET_p \) trend \((P<0.05)\) at annual time scale. At this station strong decreasing trends detected for minimum relative humidity, which was stronger than other stations. At this station some parameters related to air temperature \( (T_{min}, T_{max}) \) and wind speed showed increasing trends. \( ET_p \) trend line slope estimated about 25 mm/year at the mentioned station. Increasing insignificant trends detected for \( ET_p \) at Makoo and Ahar stations at annual time scale. At this station decreasing trend for relative humidity experienced. Other station’s \( ET_p \) trend was detected to be decreasing (but insignificant). At seasonal time scale, combinations of both positive and negative trends observed for stations. Khoy station’s seasonal \( ET_p \) trend for all seasons was positive (autumn was significant at 5% level) and at Parsabad station was negative (but insignificant). Among considered parameters, trends of sunshine hours at all stations were significant at both seasonal and annual time scales. Minimum, maximum and mean air temperature in annual time scale at all stations had increasing trends. Trends of autumn precipitation at all stations were decreasing. Decreasing trends observed for wind speed at all stations (except Jolfa and Parsabad) at annual time scale.

4- Conclusion

Results showed that among all stations, Khoy had highest significant increasing \( ET_p \) trend which is due to significant increase in wind speed, sunshine and significant decrease in relative humidity values. Maximum value of \( ET_p \) trend line slope at this station observed at annual time scale which was estimated equal with 25 mm/year. Among
all stations the strongest decreasing trend slope belonged to Parsabad station (at annual time scale) equal with 8.4 mm/year. Among parameters which their effects considered on evapotranspiration more variation related to autumn sunshine hours in Ardebil station which is about 3.7 hours/year. The most decreasing precipitation trends observed at Ahar and Parsabad station which the slope of trend line was about 2.4 mm/year.

**Keywords:** Evapotranspiration, Blaney-Criddle, Trend, Mann-Kendall, Southern Basin of Aras River.

**References**


