# REVIEW REPORT 2

**Journal:** Hydrology and Earth System Sciences
**Paper:** hess-2018-291
**Title:** Multivariate hydrologic design methods under nonstationary conditions and application to engineering practice
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**GENERAL COMMENTS.**
It is rather difficult to evaluate this work. The Authors provided some answers to the issues raised by the Referees, but, in my opinion, these replies are also questionable. The Editor will take a decision. Some comments follow below.

**SPECIFIC COMMENTS.**

**Page(s) 9, Line(s) 215–216.**

**Author(s).** Given the limited length of the flood series used in this study, the higher-order distribution parameters such as scale and shape parameters were fixed to avoid possible large uncertainty.

**Referee.** However, such an assumption can make the work rather weak...

**Page(s) 10, Line(s) 219–220.**

**Author(s).** Since the domain of location parameter $\mu$ is generally $(0, +\infty)$, $\mu$ was expressed as an exponential function...

**Referee.** If this is the problem, any polynomial of the form $g(t) = t^{2k}$, with integer $k > 0$, would generally satisfy the non-negativity constraint...

**Page(s) 10, Eq(s) 3.**

In Eq. (3) the Authors are implicitly assuming a "multiplicative" model, being the exponential of a linear combination of the arguments: any reason for doing that?

**Page(s) 12, Line(s) 273.**

**Author(s).** Therefore the present study kept the copula parameters in T2 and T3 constant...

**Referee.** However, as above, such an assumption can make the work rather weak...

**Page(s) 13, Line(s) 284–285.**

**Author(s).** To satisfy the domain range of the copula parameter under any condition, the copula parameter $\theta_c$ was written as the sum of one and an exponential function of the covariates.

**Referee.** As above, if this is the problem, any polynomial of the form $g(t) = 1 + t^{2k}$, with integer $k > 0$, would generally satisfy the constraint...

**Page(s) 13, Line(s) 296–297.**

**Author(s).** The best nonstationary model for each pair copula in T1 was chosen from the nonstationary models generally expressed by Eq. (7) in terms of the AIC value (Akaike, 1974).

**Referee.** Maybe, it would be better to use a Corrected-AIC procedure: it should account for possible over-parametrization...

**Page(s) 14, Line(s) 317–318.**

**Author(s).** OR, AND and Kendall cases...

**Referee.** These were first introduced, and theoretically discussed, in Salvadori and De Michele (2004): please fix the references (always give proper credits to whom deserve credits).

**Page(s) 15, Eq(s) 10.**

The exceedance probability in Eq. (10) can be calculated directly via Eq. (1) in Salvadori et al. (2013), exploiting the inclusion-exclusion principle.

**Page(s) 20, Line(s) 448–450.**

**Author(s).** In addition, the change-point detection method based on the Cramer-von Mises statistic (Bucher et al., 2014) was employed to detect possible nonstationarities in both the marginal distributions and dependence of the multivariate flood series...

**Referee.** Please show the p-values of the tests.

# References

Salvadori, G., De Michele, C., 2004. Frequency analysis via copulas: theoretical aspects and applications to hydrological events. Water Resour. Res. 40, W12511, doi: 10.1029/2004WR003133.

Salvadori, G., Durante, F., De Michele, C., 2013. Multivariate return period calculation via survival functions. Water Resour. Res. 49, 2308–2311, doi: 10.1002/wrcr.20204.