

Interactive comment on “Multivariate statistical modelling of the drivers of compound flood events in South Florida” by Robert Jane et al.

Anonymous Referee #2

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The authors apply multivariate statistical analysis approaches to assess the correlation between flood drivers, particularly rainfall, ocean-side water levels, and groundwater levels, in South Florida. They then evaluate existing structural design approaches considering compound rainfall and surge and the effects of sea-level rise. Finally, they apply higher-dimensional copulas to generate estimates of joint probabilities between the three flood drivers. Overall, the paper is well-researched and written and applies a robust statistical analysis approach. It advances past assessments of compound flood drivers and is relevant to the scope of NHESS. Prior to acceptance, I recommend further assessing the groundwater contribution to compound events and strengthening the discussion of how the results of this analysis can inform planning/management.

Specific comments:

-When groundwater is incorporated, you find that “the annual exceedance event (i.e., trivariate event comprising the rainfall, Os-WL, and groundwater level with univariate return periods of 1 year) possesses return periods of 2000, 227, and 116 years” (L499). While it is important to note the likelihood of co-occurrence of these three exceedance events, co-occurrence of a high groundwater table and heavy rainfall OR extreme O-sWL is also a concern for flood management. The results of bivariate analysis of these interactions would provide further insight into the potential mechanisms of flooding in the region.

-You mention that rainfall cluster maxima “are paired with simultaneous O-sWL values and vice versa” (L185). Did you consider different time lags across the three sites?

-It would be helpful to have more information about SFWMD’s planning/design approach and how groundwater levels are considered. What types of structures are designed using the full-dependence approach? Does SFWMD have existing thresholds for groundwater levels that are used in the design or operation of their facilities? Are there seasonal differences in how the system is managed given rainfall patterns and the need to limit salt-water intrusion?

-You state in the abstract that this analysis “leads to recommendations for revised future design frameworks able to capture and represent dependencies between different flood drivers,” but you provide little discussion of how this information could be incorporated into SFWMD’s planning or what changes would be appropriate given the study results. How should the design guidelines be modified, if at all, especially considering future sea-level rise?

Technical corrections:

-The abstract should include more information about the results obtained.

-L26: No need to capitalize “state”.

-L35: Miami is spelled incorrectly.

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-L411: Rephrase “probability density is located along other parts of the line”. For example, you could say “probability density is non-zero [or above a certain threshold] along other parts of the line.”

-L421: This sentence is a bit confusing.

-L441: Looks closer to 30 years for the 100-year return period.

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