

## ***Interactive comment on “Spatial and temporal analysis of extreme sea level and skew surge events around the coastline of New Zealand” by Scott A. Stephens et al.***

### **Anonymous Referee #1**

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#### GENERAL COMMENTS

In this paper, the authors analyse sea level and skew surge extremes (values greater than the 5-yr return level are considered extremes) from 30 tide gauges around the coast of New Zealand.

The objective is to characterise the frequency and magnitude of these extreme events and also estimate the contribution of each sea level component (tide, surge and MSLA) to the sea level extremes. Sea level rise is not taken into account in this study.

In my opinion, the manuscript is very well written, well structured, clear and easy to understand. However, I have one main scientific concern and a few smaller issues that

C1

are explained below.

#### SPECIFIC COMMENTS

I have one main concern regarding the extremes' methodology: The authors say they use a GPD+POT model to obtain the return levels, but they define POT as the 5 largest events per year (line 99), which in my opinion is the r-largest method and not POT. The POT method should keep a constant threshold through time and in this case it varies each year. I think that extremes selected with the r-largest method should be fitted to a GEV instead to a GPD, so I am not sure if the return levels obtained here are correct.

lines 115-116: It is difficult to extract this information from table S7, maybe those TGs longer than 50 yr could be highlighted or the table could be order by the TGs length instead of the site number?

Table S7: It is not clear to me what the “model percentile” means in table S7. Are 2.5% and the 97.5% the confidence intervals? maybe the table could be simplified using the GPD or SSJPM values +- the confidence intervals?. Why is it that this information does not appear in table S8 for the skew surge?. Another main concern I have is that the return level estimations should not exceed 4 times the length of the observations (Pugh & Woodworth, 2014), since the longest TG is 120 yr, the 1000 return level is not reliable for any location. Maybe the reliable return levels, at each location, could be highlighted. Also, if sea level rise is not included, maybe there is no point in obtaining such large return periods.

lines 134-135: I am not sure if I understand: Some of the 155 SL extremes are not independent, so after keeping only those separated more than 3 days, it results in 85 independent events, is that right? (same for the Skew surges?). Also, which methodology (GPD or SSJM) is used for obtaining the return periods in table S2 and S3?.

line 163: from figure S2 I am not able to infer those values. For example, the ratio for station 18 should be aprox. 1.2m/2m, right?, but figure S2c reads ratio equal to 1.

C2

lines 169-170: Are those equations used somewhere else? what info can we infer?  
maybe they are not needed?

figures S3b and S4a shouldn't be identical?

figures 7a and S7a shouldn't be identical?

lines 252-254: I am not able to extract this information from figure 8a

line 269: maybe this event could be highlighted in figure 3a

#### TECHNICAL CORRECTIONS

Figure 4: x-axis is MHWS or MHWS-7?. y-axis is extreme sea level? I think storm-tide  
is not defined in the paper.

line 219-220: September-December?

line 221: April-July?

line 228: April-July?

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