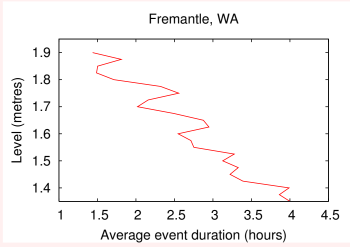
THE EFFECT OF CLIMATE CHANGE ON THE FREQUENCY OF EXTREME SEA–LEVEL EVENTS

John Hunter, Antarctic Climate & Ecosystems Cooperative Research Centre, Hobart, Australia

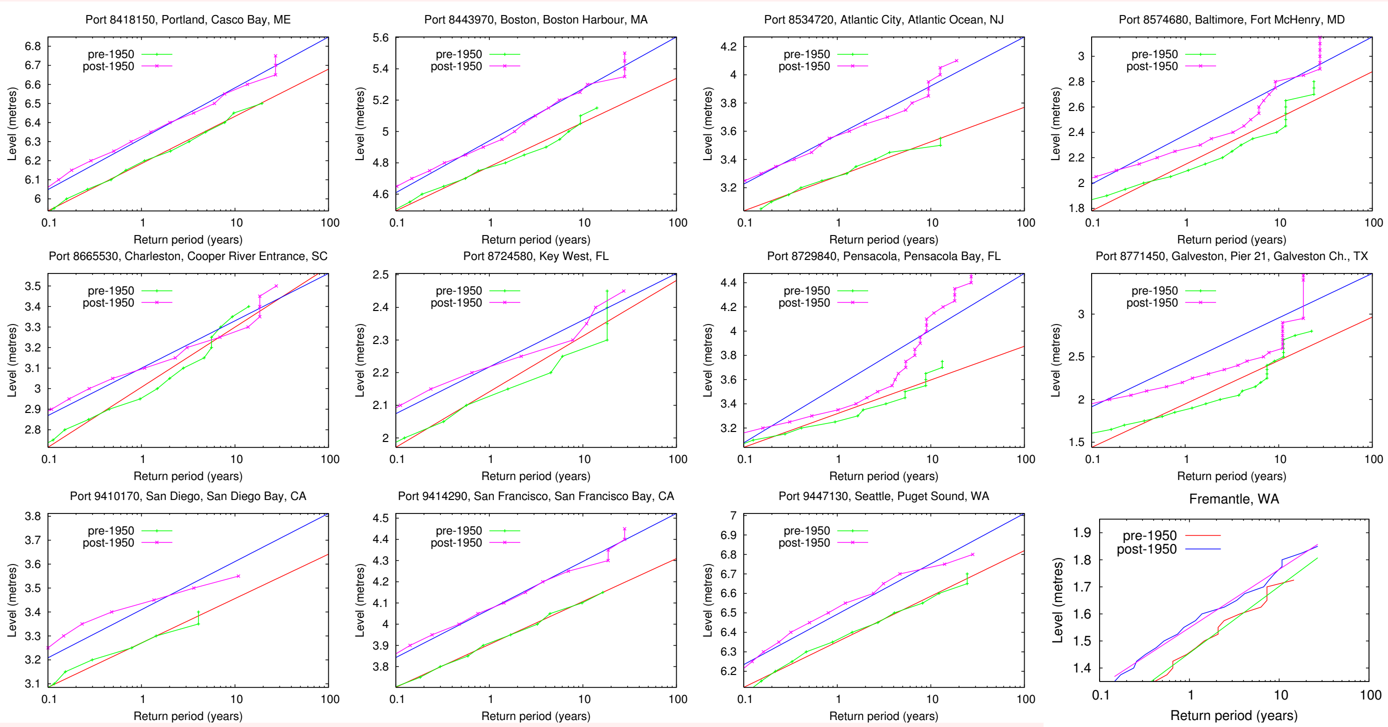
Sea-Level Extremes

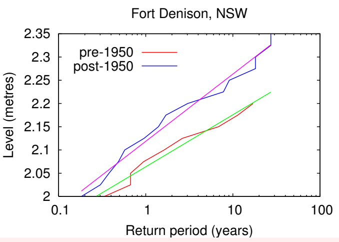
Effects of climate change will be felt most keenly through changes in extremes. For sea level, in cases where the infrastructure may be raised, the change of extreme levels for a given return period is of primary interest. However, where retreat is the only option, the change in return period for events of a given height is of prime importance; this is the subject of this poster.

How Long Does An Extreme Last?



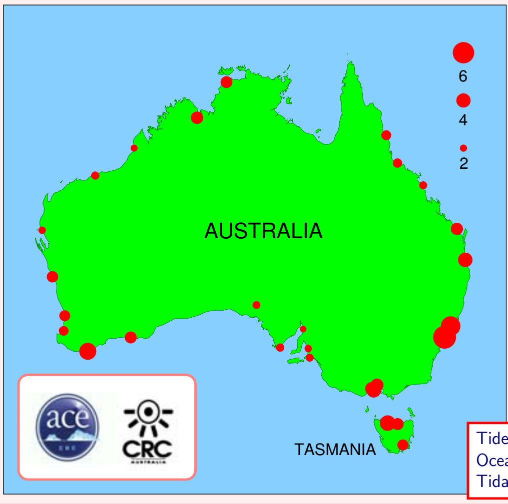
It is common to derive the return period of an extreme event from the proportion of time that the level is exceeded (i.e.the probability distribution) and an assumption about the average duration of an event (e.g. the data interval, if each data point is independent). However, the duration of exceedance events is often significantly longer than the data interval (which is generally 1 hour or shorter) as shown by the plot on the left for Fremantle, Western Australia. The return periods shown on this poster have therefore been derived directly in the time domain and not from the probability distribution.

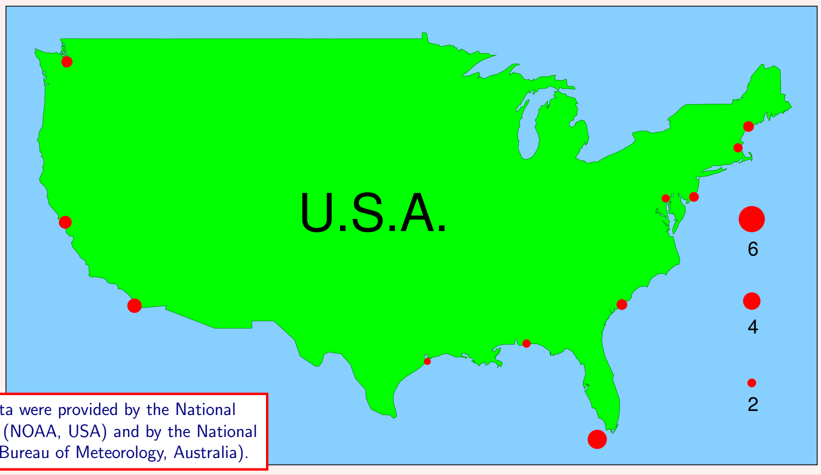




These plots show the return period (plotted logarithmically) as a function of sea level for 11 USA ports and 2 Australian ports, where the data has been split into "pre-1950" and "post-1950" segments. Also shown are the associated linear regression lines. The results show a typical sea level rise of 0.1 metres and corresponding increases in the frequency of extreme events by factors up to 15. Some stations (e.g. Fremantle) exhibit the property of a Gumbel distribution where the log of the return period varies linearly with the level. Others (e.g. Galveston) show a strong increase in level at long return periods due to the effect of hurricanes.

Using the slope of the present relationship between the log of the return period and the level, the increase in return period for a projected sea level rise may be derived. These plots show the factor by which the frequency of extreme events is expected to rise as a result of each 0.1 m of sea level rise (it should be noted that for a rise of 0.2 m, this factor is *squared*). These factors range from 2 to 6, *indicating a complete change in the regime of extremes if sea levels rises by as much as 0.5 m during this century.*





Tide gauge data were provided by the National Ocean Service (NOAA, USA) and by the National Tidal Centre (Bureau of Meteorology, Australia).