Exercise 1:
Scatter diagram representation of the wave climate

1. Compute the scatter table for the 10 years data provided corresponding to a location with water depth of 35 m. The dimensions of each bin in the scatter tables shall be no larger than 0.5 m and 1.0 s. The upper and lower bounds of the scatter tables should be selected such that a minimum of 99.9% of sea states are included.
2. Compute the wave energy contribution table.

$$Contrib_{bin} = \frac{(P_{wave})_{bin} \cdot Prob_{bin}}{\sum_{bin=1}^{n}((P_{wave})_{bin} \cdot Prob_{bin})}$$

3. Select and define the operational sea states for this specific location by following recommendations:
   - The amount of sea states should be limited (less than 10 preferably)
   - They should be selected in order to cover the wave energy contribution diagram as well as possible, rather than the scatter diagram.
   - The wave energy contribution of each sea state should be between 5 and 25 % of the total, while having a probability of occurrence of at least 0.5 % of the time, corresponding to 44 h annually.
   - The same size of zones (identical intervals of H_s and T_e) can be used for the different sea states, but they can be reduced for zones with higher contribution values in order to increase their accuracy.
   - As the optimal size of a WEC in terms of annual energy production (usually) increases proportionally with the wave power level of a site, it can be reasonable to have larger sizes (larger intervals of H_s and T_e) of sea states when describing more wave energetic locations.
   - For the estimation of the annual energy production, there is no need to include the very small or large wave conditions, as they will not contribute significantly to the annual energy production. This is due to their low wave energy contribution and a WEC has usually a bad performance in them, as their design is normally not optimized for them.
   - The corresponding equations to calculate the characterizing H_s and T_e for each sea state are:

$$H_{s\,SS} = \sqrt{\frac{\sum_{SS,\,bin=1}^{n} H_{s\,SS,\,bin}^{2} \cdot Prob_{SS,\,bin}}{\sum_{SS,\,bin=1}^{n} Prob_{SS,\,bin}}}$$

and

$$T_{e_{SS}} = \frac{\sum_{SS,\,bin=1}^{n} T_{e\,SS,\,bin} \cdot Prob_{SS,\,bin}}{\sum_{SS,\,bin=1}^{n} Prob_{SS,\,bin}}$$

where, the probability of occurrence ($Prob_{ss}$) and the wave energy contribution ($Contrib_{ss}$) of a sea state correspond to the sums of the respective values of the bins that each of them include.