The estimation of the probability of failure of the mooring of a marine structure needs two steps. First, a probabilistic step, which corresponds to the calculation of the distributions of the maximum forces applied to the mooring lines during a given sea-state (short-term). A second step, which uses the statistics of the sea-state conditions (climatology) to estimate the probability of failure of the line, considering all the situations that the structure will encountered during its service life (long-term). To be feasible, this statistical long-term step needs a probabilistic short term calculations, not too much costly in computing time, but of course with a sufficient accuracy in all the sea-state situations.

The modelling of behaviour of the marine structures is taken more and more complex (dynamic, nonlinear), and so the calculation of the distributions of the maxima during a given sea-state needs adapted methodologies. The roll motion and the low frequency movement of a floating marine structure will be given as examples. Comparisons between different methods and Gaussian hypotheses will be commented.