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Extreme Sea Conditions in Shallow Water: Estimation based on in-situ measurements

Izan Le Crom and Jean-Baptiste Saulnier
LHEEA, Ecole Centrale de Nantes, Nantes, FRANCE (jean-baptiste.saulnier@ec-nantes.fr)

The design of marine renewable energy devices and components is based, among others, on the assessment of the environmental extreme conditions (winds, currents, waves, and water level) that must be combined together in order to evaluate the maximal loads on a floating/fixed structure, and on the anchoring system over a determined return period.
Measuring devices are generally deployed at sea over relatively short durations (a few months to a few years), typically when describing water free surface elevation, and extrapolation methods based on hindcast data (and therefore on wave simulation models) have to be used.
How to combine, in a realistic way, the action of the different loads (winds and waves for instance) and which correlation of return periods should be used are highly topical issues. However, the assessment of the extreme condition itself remains a not-fully-solved, crucial, and sensitive task. Above all in shallow water, extreme wave height, Hmax, is the most significant contribution in the dimensioning process of EMR devices.
As a case study, existing methodologies for deep water have been applied to SEMREV, the French marine energy test site. The interest of this study, especially at this location, goes beyond the simple application to SEMREV's WEC and floating wind turbines deployment as it could also be extended to the Banc de Guérande offshore wind farm that are planned close by. More generally to pipes and communication cables as it is a redundant problematic.
The paper will first present the existing measurements (wave and wind on site), the prediction chain that has been developed via wave models, the extrapolation methods applied to hindcast data, and will try to formulate recommendations for improving this assessment in shallow water.