International Association of Oil & Gas Producers

JOINT INDUSTRY PROJECT
PROPOSAL

JULY 2019

Limits on Waves in Shallow Water (LoWiSH)

The JIP focuses on describing the height, crest and kinematics associated with waves in shallow and intermediate water depths. These are the three factors that allow the loading effect of waves on coastal structures to be determined and their design to be optimised.

Participants:

bp, ConocoPhillips, equinor, ExxonMobil, Shell, TOTAL, woodside

Principle service provider: Imperial College, London

What is the problem:

In recent years, there has been an increase in the number of structures being installed in coastal areas associated, in particular, with the growth of LNG production. These structures are necessarily in shallow water and the design of such structures is particularly dependent upon a sound understanding of the severity of the wave conditions impacting them. The severity is normally defined in terms of the loads produced by the waves and this in turn is dependent upon wave and crest heights of a specified return period (typically 100 years) and also their through-depth water velocity (kinematics). These wave characteristics have not been well described in the past and consequently there has been a larger uncertainty associated with the structural reliability of these coastal structures.

What is the solution:

Through the use of extensive field data, laboratory data and numerical modelling, to improve our understanding of wave and crest heights in shallow water and provide guidance on approaches to determining wave kinematics.

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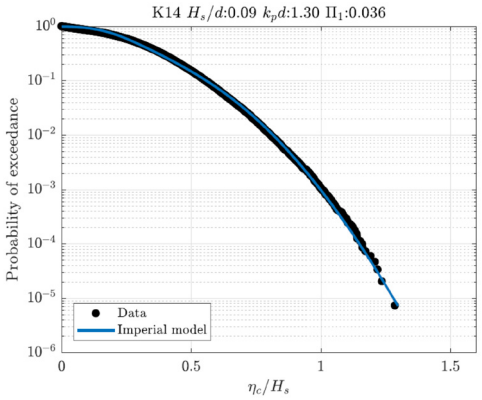
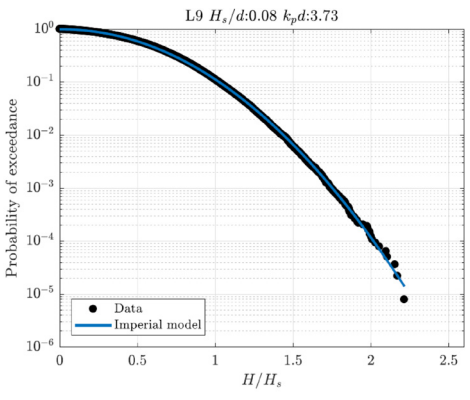
Progress to date:

The JIP has developed new wave and crest height probability distributions (which take into account wave non-linearities, wave spreading, spectral bandwidth and wave breaking), as well as defining upper limits on both sea states and individual wave and crest heights. In so doing, we have an improved physical insight into the progressive effects of the seabed on both sea states as a whole and on individual waves. In respect of wave kinematics, guidance has been produced on the best approaches to use for different types of wave regime and which methods should be avoided.



Normalised crest height distributions (η_c/H_s) comparing available field data and the Imperial model



Normalised wave height distributions (H/H_s) comparing available field data and the Imperial model

Next steps:

The JIP has now completed, and the findings of the study are ready to be utilised by the participants for design and analysis studies. These can now be incorporated directly into design methods in which extreme wave events play a critical role and into operability studies in which the distribution of wave and crest heights is a determining factor.

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