

**Spatial variability of wave fields over the scale of a wave energy test site**

Submitted by Ian Gerard Ashton to the University of Exeter  
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## Abstract

Accurate wave measurements are required for wave energy applications, including resource assessments and performance assessments. In response, wave data are measured from deployment sites, commonly using wave buoys or other point wave sensors. Spatial variability in the wave field will introduce inaccuracies to the analysis of data captured from a single point to represent a separate location or area. This thesis describes research undertaken to quantify the effect of spatial variability on the accuracy of direct wave measurements taken at a wave energy site. An array of four time-synchronised wave buoys were deployed, separated by 500m, in a location close to the Wave Hub wave energy test site in Cornwall, UK. These data were subject to close scrutiny in terms of data processing and quality control, which raised specific issues regarding data processing and the validation of wave data for a new measurement facility. Specific recommendations are made for data captured from this facility, and bespoke quality control routines were developed. This process minimises the possible contribution of errors to the processed data, which is observed to be of the highest importance when analysing simultaneous data sets, and provides a data set that is particularly suited to the examination of the spatial characteristics of ocean waves. The differences between simultaneous data demonstrated local physical processes to be causing a deterministic difference between the waves at the measurement sites, which contributed to a significant difference between the power statistics at different locations within the site. Instantaneous differences between measurements were observed to agree well with theoretical estimations of random error, based on sampling theory. The culmination of the research is a unique analysis of the spatial properties of ocean wave fields on the scale of a wave energy test site, of direct relevance to the development and monitoring of wave energy test sites.

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