3.4 Sea State

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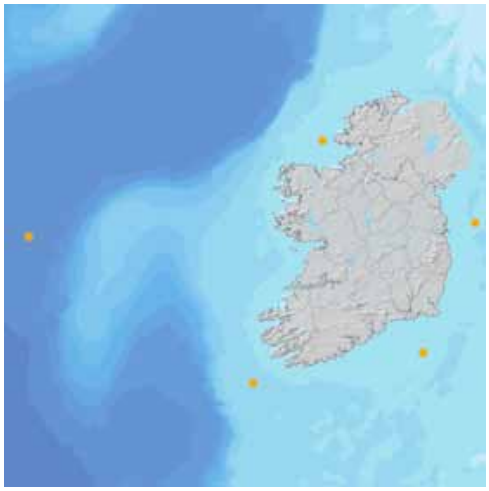
Observations of wave height, direction, length and frequency are relevant for monitoring changes in the marine environment, such as winds, storms and extreme events. Knowledge of sea state and how it is changing is also vital for the offshore oil industry, ocean energy development, shipping, coastal erosion and flooding among others. Increasing wave heights have been observed over the last 50 years in the northeast Atlantic, along with a northward displacement of storm tracks.

Photo: © Kathryn Smith



Map 3.4. Location of sea state observation stations.

Measurements

Non-directional measurements of waves have been made at the Marine Institute-operated offshore national weather buoys since 2002. Some of the buoys within the network now measure full-directional wave spectra, which provide complete information on wave frequencies and directions. By 2013 this enhanced information will become part of the standard suite of measurements on all buoys in the network.

Radar altimeters, on board a number of satellites including the *Jason* series, make measurements from which wave height and wave frequency can be inferred. *In situ* measurements are required to calibrate and validate such measurements.

'Analysis of data from satellite altimetry for the period 1988 to 2002 shows that there has been a general increase in wave height in the northeast Atlantic.'

Time-series and Trends

Analysis of data from satellite altimetry for the period 1988 to 2002 shows that there has been a general increase in wave height in the northeast Atlantic. Data from the Irish buoy network covers a relatively short

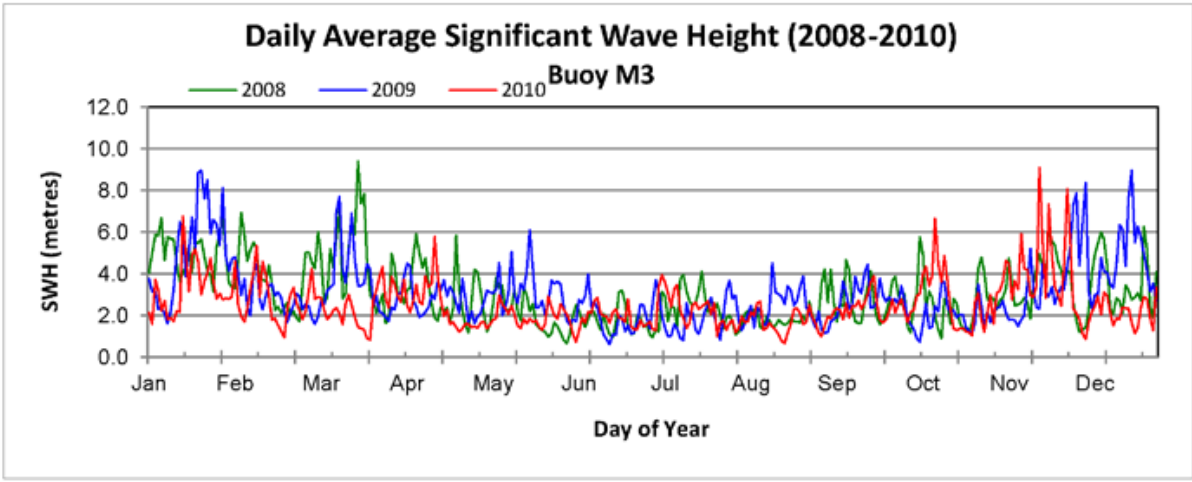


Figure 3.8. Daily averaged significant wave height at Buoy M3 (2008–2010).

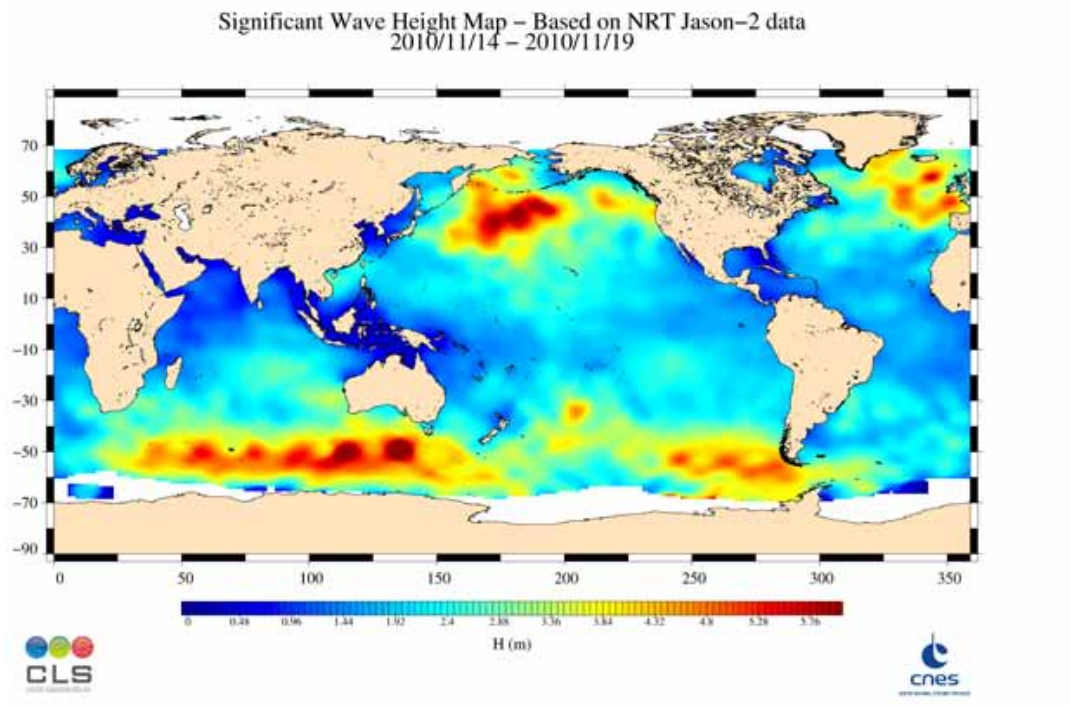


Figure 3.9. Significant wave heights as determined from measurements by the altimeter on board the *Jason-2* satellite for the period 14–19 November 2010.

period with the M3 buoy, located off the southwest coast, representing the longest available wave time-series (2002–2012) from the open ocean. Figure 3.8 shows averaged daily significant wave height (SWH)[15] for part of this time-series (2008–2010). Seasonal variations are evident: however, there is no obvious trend in the full-wave height dataset over the period 2002 to 2011.

Figure 3.9 shows the significant wave heights as determined from measurements by the altimeter on board the *Jason-2* satellite for the period 14–19 November 2010. Note the large waves observed in the northeast Atlantic, corresponding to a stormy period. These can also be seen in the M3 record above (red).

'The National Weather Buoy Network is a fundamental infrastructure for observing sea state and must be maintained.'

Maintaining Observations

The National Weather Buoy Network established in 2000 is a collaboration between the Marine Institute, Met Éireann, the UK Met Office and the Department of Transport. It is funded under a Memorandum of Understanding with the Department of Transport. Funding for this network is negotiated on an annual basis.

15 This is the average of the highest one-third of waves in a given period. Larger waves can cause the most storm damage or pose threats to navigation.

Further Information and Data Sources

Woolf, D.K., Challenor, P.G. and Corron, P.D. (2002) The variability and predictability of North Atlantic wave climate, *Journal of Geophysical Research,* Vol. 107, p. 3145, doi:10.029/2001JC001124.

Information and observations from the Irish Marine Weather Buoy Network : http://www.marine.ie/home/publicationsdata/data/buoys/

Information and data on a range of wave products derived from satellite, in-situ and model data: http://www.globwave.org/

Altimeter-derived oceanographic products including sea state: www.aviso.oceanobs.com/