A technique to predict the energy in future oceanic waves

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Marine energy has great future potential, according to the experts, but there is still a long way to go before it can be used on a large scale. Despite the problem of intermittency, wave energy has an advantage over wind energy. For example, it is easier to predict optimum swell than suitable gusts of wind. That is why knowing how much energy the waves will be bringing within a few hours is as important as having available efficient prototypes to make use of wave power. If predictions can be made, the energy produced by waves can be incorporated more easily into the mains, and renewable energy consumption can be increased at the same time.

The EOLO group (UPV/EHU) has developed various models for predicting the amount of wave energy for the Bay of Biscay by using a technique called "random forests." Gabriel Ibarra of the EOLO group explains: "Random forests (RF) is an algorithm developed in recent years in the field of machine learning. The basis of RFs are the so-called 'regression trees,' in which the input variables are regarded as roots and the output ones as the leaves—hence the name 'tree.' Random forest is a development of the regression trees that uses many trees—over a thousand, as a general rule—rather than just one, thus forming a forest."

According to the researcher, the models developed by his group are more reliable than existing techniques for predictions over the next three to sixteen hours. The EOLO models are based on a historical set of measurements that compare the energy levels of the waves at a given moment with each other and with those that are anticipated within a few

hours. The measurements are made by means of buoys, five of which are in place in the Bay of Biscay, three off the Galician coast and two out at sea. The Spanish Ports Authority maintains the buoys stationed in Galicia and the British meteorological service (MetOffice) the ones out at sea.

Climate change and swell

The EOLO group has two priorities with the future in mind: Firstly, to access the data of the WRF Weather Research and Forecasting meteorological model in real time, as this will enable it to improve the current results; secondly, to explore the climate scenarios that could emerge in the future. In fact, climate change is also affecting swell and the storms that routinely batter the Basque coast. In the view of the EOLO members, it is important to know how marine energy is expected to evolve over the coming decades. And this is, in fact, the focus of its research effort. In any case, the research into predicting wave energy has only just begun and they have yet to reach the operational stage, in other words, it has yet to be applied directly.

The first operational facilities to make use of marine energy were set up in Portugal in 2008. In the Basque Country, the small facility in Mutriku was officially opened in 2011. The Mutriku facility functions with OWC technology and sends the energy it produces to the mains. Then there is the BIMEP (Biscay Marine Energy Platform), which reports to the EVE, the Basque Autonomous Community's Energy Board; it will shortly be setting up a testing platform to try out prototypes using the activity of real waves.

More information: G. Ibarra-Berastegi, J. Saénz, G. Esnaola, A. Ezcurra, A. Ulazia (2015) "Short-term forecasting of the wave energy flux: Analogues, random forests, and physics-based models". *Ocean Engineering*, DOI: 10.1016/j.oceaneng.2015.05.038. 104. 530-539. 2015

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