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Prediction of seismic p-wave velocity using machine learning

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Knowledge of seismic velocities as a function of depth is generally restricted to borehole locations and is therefore sparse in the world's oceans. Consequently, studies requiring knowledge of seismic velocities often obtain these from simple empirical relationships. However, velocities obtained from empirical relationships may be inaccurate, as other parameters potentially influencing seismic velocities, such as porosity, depth to basement, crustal age, or water depth, are not taken into account. In this study, we present a machine learning approach to predict seismic p-wave velocities as a function of depth for any location in the Pacific Ocean. Based on a set of various geological and spatial parameters (features) obtained from borehole measurements and publicly available global datasets, a prediction model is created using the machine learning method Random Forests. The predicted seismic velocities are generally superior to those calculated empirically. We evaluate prediction accuracies and show which features are most important for predicting seismic p-wave velocities. With the extension of the model to a global approach, the predicted velocities will allow improving other global geological models, e.g. for gas hydrate prediction.