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Predicting sediment physical properties from seismic multi-attributes in the Kumano Forearc Basin, Nankai Trough

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We analyzed the borehole log data of the Nankai Trough IODP Expedition 314 at Site C0001D on the shallow part of the megasplay fault system, which appears to move coseismically during great earthquakes over the accretionary prism and at Site C0002A on the Kumano forearc basin, and IODP Expedition 319 at Site C0009A in the Kumano forearc basin and at Site C0010A on the megasplay fault, by integrating with a 2-D seismic reflection section that traverses those drilling sites. This study illustrates the use of seismic attribute studies for predicting the sediment physical properties in the subsurface. Using the dataset consisting of primarily of digital logs and seismic data, we show how correlations can be made between seismic attributes and physical properties (porosity, density, p- and s-wave and Vp/Vs), and how those relationships can be exploited to predict the distribution of the property of interest in two dimensions. The multi-attribute physical property prediction study can lead insights to the seismogenic behavior of the sediment properties and the evolution of the forearc basin and accretionary prism. The inversion result of p-impedance of the seismic section ranges from 1500 to 6000 m/s*gr/cc through the Kumano basin and accretionary prism. The prediction results of porosity, density, p-wave, s-wave and Vp/Vs of the seismic section through the Kumano basin and accretionary prism range from 30-60%, 1.8-2.1gr/cc, 1600-2600 m/s, 550-1050 m/s, and 2.9-2.5, respectively. We perform model–based inversion and employ three different prediction techniques, linear multi-attribute regression, probabilistic neural network (PNN), and multi-layer feed network (MLFN) to generate physical properties correlating well-logs and seismic attributes. We conclude that probabilistic neural network analysis gives the best results to predict sediment properties.