# Nankai Trough –An Introduction to 3D Geomechanical Modelling

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The Nankai Trough Subduction Zone offshore the Kii Peninsula, southern Honshu, Japan, is well known for the occurrence of great earthquakes (>8 magnitude). It has also been a subject to extensive scientific drilling and geophysical surveys, performed by the International Ocean Drilling Programme (IODP) and Japan Agency for Marine-Earth Science and Technology (JAMSTEC). Despite the intensive study, there is no consensus about the origin, evolution and development of Nankai Trough. JAMSTEC and the geomechanics team from Schlumberger created the Technology Adoption Programme (TAP) in order to develop a better understanding of the Nankai Trough Subduction Zone mechanics. The TAP’ s main objective was the knowledge transfer from Schlumberger team to JAMSTEC staff in particular with respect to the use of software platforms, such as, Techlog and Petrel for the development of 1 dimensional (1D), 3 dimensional (3D) geological and geomechanical models. Extensive borehole logging and drilling datasets, written reports, and 3D seismic cube data from various Nankai Trough expeditions were utilised for the construction of initial 1D well centric and 3D geological models covering in total an area of 50 km ×80 km. Subsequently, the calculated and analysed physical properties of the rock media were translated into the 4D geomechanical model. The geomechanical model consisted of approximately 3 million elements with a horizontal resolution of 150 ×150 m and varying vertical resolutions (60 - 150 m). Here we present the initial results from this collaboration. The constructed 1D wellbore stability models for wells C0001, C0002 and C0009 predicted pore pressure, stress profiles and breakouts orientation in the wells well. However, we were yet unable to model stress reorientation (breakout 90-degree shift) in well C0002. Our initial 3D geological results provided us with detailed delineation of sea bottom floor, megasplay, decollement and an extensive array of smaller faults located in the shallower part of the Kumano Basin. Initial 3D geomechanical model results show the spatial distribution of the pore pressure, mechanical and physical properties such as Youngs Modulus (static and dynamic), Poissons ratio, and the density calculated from 3D seismic cube. Additionally, the initial model shows that the stress magnitude orientation changes are driven by local fault structures. Our geomechanical models, once fully calibrated to depict real time scenarios, can be utilised to test current hypothesis regarding origin, evolution and development of the Nankai Trough. In the future, the models can also be run along the time axis enabling the prediction of stress magnitude and orientation, fault criticality and slip tolerance. Thus, the system is aimed to serve as an “early warning system” once finalised, in particular for the mega earthquake anticipated in the region in the near future.

Keywords: Nankai Trough, Geomechanical model, Stress Magnitude, Earthquake