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Thermal structure in the western Joetsu Basin, offshore Sado Island, Japan

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Stability of gas hydrate depends on pressure and temperature. Subsurface thermal structure thus provides key information to investigate formation of gas hydrate and distribution of gas hydrate stability zone. The western Joetsu Basin is one of areas where gas hydrate studies have been conducted intensively in the world (Matsumoto et al., 2009). In June 2010, MD 179/Japan Sea Gas Hydrates cruise using R/V Marion Dufresne was conducted in the western Joetsu Basin to investigate the mechanism of gas hydrate formation in the region. Measurements of heat flow were conducted during the cruise at seven sites along one of METI Sado-oki Nansei 2D seismic survey lines. The measured values of heat flow range from 84 to 90 mW/m^2, which is slightly lower than those measured around the Joetsu Knoll and Umitaka Spur by Machiyama et al. (2009). We inferred 2D thermal structure along the 2D seismic survey line to explain the heat flow values measured at the seafloor using the topography and geological structure interpreted from the seismic survey line and physical property data obtained during MD 179/Japan Sea Gas Hydrates cruise and from METI Sado Nansei Oki Well. In the calculation, we assumed that heat transport in the model is heat conduction only and that a constant basal heat flow is supplied at the base of the model. We sought the thermal structure model that best explains the measured heat flows, by giving various values of basal heat flow to the model. The best thermal structure model is of the basal heat flow of 88 mW/m^2. The calculation result suggests that in the modeled area, heat conduction dominates heat transport and that the basal heat flow in the area is about 88 mW/m^2.

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