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Methane concentration inside a submarine mud volcano examined through seismic velocity profiles

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Mud volcanoes are considered to be among largest geological sources releasing hydrocarbon gases into the atmosphere. Numerous studies have revealed their origins and compositions from submarine mud volcanoes. A recent long-term observation at a submarine mud volcano sheds light on that larger volume of methane gas than expected is escaped from deep-water mud volcanoes, suggesting that the global methane flux from the seafloor is likely underestimated. Yet, estimates of the gas amount inside mud volcanoes have been still challenging, because of the difficulty of in-situ measurements. This study provides a new model to bridge methane amounts and seismic velocities in fluidized mud conduits of submarine mud volcanoes. This model is universally applicable and enables estimates of methane concentration in the mud conduits, using the seismic velocity profile derived from reflection/refraction seismic and/or downhole logging data. In this study, (1) we examine our modeled results through deep-drilling data obtained at mud volcanoes in the Olimpi mud field of the central Mediterranean Ridge accretionary margin, to evaluate the difference between *in situ* methane amounts and those calculated from our model, and (2) apply our model to the seismic velocity profile derived from seicmic data to estimate the methane amount inside the submarine mud volcano in the Nankai accretionary margin. Our scheme may provide an opportunity to re-estimate the total methane flux from submarine mud volcanoes.