The effect of spatially varying permeability on

hydrate-production-induced instability of a submarine slope

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Abstract. Distribution of permeability in submarine sediments usually varies spatially in natural environment. The spatial variability of permeability contributes to the uncertainty of the stability of submarine slopes suffering from hydrate dissociation due to production. This paper presents a model for stability analysis of an idealized submarine slope with spatially varying permeability. A modified limit equilibrium model is proposed for the safety factor of the slope by considering the transient pore pressure buildup/dissipation and the decaying strength in the hydrate reservoir during production. The model is implemented by combining the limit analysis method with a thermo-hydro-chemical coupling numerical code for multi-component, multiphase fluid and heat flow associated with hydrate production. The spatial variability of permeability is then introduced into the model through a stochastic simulation to study the effect of dispersion of permeability on the instability of the submarine slope during hydrate production. The possible potential slip surfaces are searched with the general limit equilibrium formulation. This study is useful for developing a probabilistic approach of hazard assessment of submarine landslides associated with hydrate production.

Keywords: Submarine slope stability; Gas hydrate; Stochastic simulation; Limit equilibrium method