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Digital Rock Physics of hydrate-bearing sediments: Determination of effective elastic properties on the microscale

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To date, very little is known about the distribution of natural gas hydrates in sedimentary matrices and its influence on the seismic properties of the host rock, in particular at low hydrate concentration. Digital rock physics offers a unique approach to this issue yet requires good quality, high resolution 3D representations for the accurate modelling of petrophysical and transport properties. Although such models are readily available via in-situ synchrotron radiation X-ray tomography the analysis of such data asks for complex workflows and high computational power to maintain valuable results. More recently digital rock physics took also on data from a fairly new group of techniques focused on in-situ studies recreating complex settings that cannot be easily accessed by conventional means. Here, we present a best-practise procedure complementing high-resolution synchrotron-tomography data of hydrate-bearing sedimentary matrices from Chaouachi et al. (2015) with data post-processing, including image enhancement and segmentation as well as exemplary numerical simulations of acoustic wave propagation in 3D on realistic rock using the derived results. A combination of the tomography and 3D modelling opens a path to a more reliable deduction of properties of gas hydrate bearing sediments without a reliance on idealised and frequently imprecise models (Sell et al. 2016). The advantage of this method over traditional, often oversimplified models lays in a more faithful description of complex pore geometries and microstructures found in natural formations (Andrä et al., 2013b, a).

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