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The variation of fracture aperture and permeability during normal closure and shearing and with scale in large synthetic fractures

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Synthetic fractures of various different scales from 0.2 m to 12.8 m were created using the Glover *et al*. **[1]** spectral method. All the synthetic fractures were normalised such that the ratio of the power spectral density of the initial aperture (i.e., the aperture when the surfaces are in contact at a single point) to that of the surface height was the same as that determined for a tensile fracture of 1.0 m size. First, the size effect on the standard deviation of the initial aperture was analyzed for fractures with and without shearing. Next, by taking aperture data at constant intervals to establish a flow area, water flow was simulated for fractures during both normal closure and closure after shearing, by solving Reynolds equation to determine the hydraulic aperture. When the fracture is closed without shearing and has the same mean aperture, the effect of the fracture size on the hydraulic aperture disappears if the fracture is larger than about 0.2 m, since beyond this size the standard deviation of the initial aperture is almost independent of the fracture size. When the fracture is closed after shearing, the hydraulic conductivity shows remarkable anisotropy, which becomes more significant with both shear displacement and closure. However, the relation between the hydraulic aperture normalized by the mean aperture and the mean aperture normalized by the standard deviation of the initial aperture is almost independent of both the fracture size and shear displacement when the shear displacement is less than about 3.1% of the fracture size, at which point the standard deviation of the initial aperture of the sheared fracture is almost independent of the fracture size. **Reference.** [1] Glover PWJ, Mat-

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