The seismic response of single cracks and fractures is important in many geophysical investigations. This paper describes numerical modelling of seismic waves interacting with single fractures. Both synthetic and field data examples are given to demonstrate the effects of size of fractures. The method that we use is the Kirchhoff approximation, which gives more accurate solutions for the scattered wavefield than generalized ray theory, and requires substantially less computing time than finite difference or finite element methods. Analytical solutions for the far field can be obtained for simple crack geometry, such as circular or elliptical cracks. For general crack shapes in the near field, only numerical solutions can be obtained. Comparing crack radiation patterns and waveforms for circular cracks with the exact solution for 2D cracks, we find that the results are similar though differences can be clearly identified. We finally present some results of modelling a field dataset where scattered waves are observed during a hydraulic fracturing experiment. In contrast to the previous work, our modelling has resulted in a crack length of at least 1.5 times larger than previously predicted, whereas the height remains essentially the same as that using other techniques.