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Stress field around an asperity in a transform domain.

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We investigate the effects induced on stress and deformation fields by the presence of an asperity in an elastic homogeneous medium. The presence of an asperity in the hypocentral region of the $M = 6.5$ earthquake of June 17-th, 2000 in the South Iceland Seismic Zone was invoked to explain the change of seismicity pattern before and after the mainshock: in particular, the spatial distribution of foreshock epicenters trends NW while the strike of the mainfault is $N7^{\circ}E$ and aftershocks trend accordingly; the foreshock depths were typically deeper than average aftershock depths. A model is devised which simulates the presence of an asperity in terms of a high rigidity inclusion with circular cross-section, within a softer elastic medium in a transform domain with a deviatoric stress field imposed at remote distances (compressive $NE - SW$, tensile $NW - SE$). An isotropic compressive stress component is induced outside the asperity, in the direction of the compressive stress axis, and a tensile component in the direction of the tensile axis; as a consequence, fluid flow is inhibited in the compressive quadrants while it is favoured in tensile quadrants. Within the asperity the isotropic stress vanishes but the deviatoric stress increases substantially, without any significant change in the principal stress directions. Hydrofracture processes in the tensile quadrants and viscoelastic relaxation at depth may contribute to lower the effective rigidity of the medium surrounding the asperity. According to the present model, foreshocks may be interpreted as induced, close to the brittle ductile transition, by high pressure fluids migrating upwards within the tensile quadrants; this process increases the deviatoric stress within the asperity which eventually fails, becoming the hypocenter of the mainshock, on the optimally oriented fault plane.