Implications of ground-deformation measurements across earth fissures in subsidence areas in the southwestern USA

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Abstract Ground deformation was monitored at earth fissures in areas of land subsidence induced by groundwater extraction in the southwestern United States. The ground deformation is consistent with the mechanism that fissures are caused by horizontal strains generated by bending of overburden in response to localized differential compaction. Subsidence profiles indicated that localized differential subsidence occurred across the fissures and that maximum convex-upward curvature was at the fissure. The overall shape of the profile stayed similar with time, and maximum curvature remained stationary at the fissure. Horizontal displacements were largest near the fissure, and generally were small to negligible away from the fissure. Maximum tensile horizontal strains were at the fissure and coincided with maximum curvature in the subsidence profiles. Horizontal tensile strain continued to accumulate at fissures after they formed, with rates of opening ranging from 30 to 120 microstrain/year at fissures in Arizona.

Key words subsidence; earth fissure; ground deformation; geodesy; monitoring; creep; groundwater; USA