

## Gravity Monitoring of Ground-Water Storage Change in the Tucson Active Management Area

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Repeat observations of the absolute acceleration of gravity have been made routinely at 6 gravity monitoring stations in the Tucson Active Management Area since 1998. The observations are gravity control for repeat relative-gravity surveys of networks of stations that monitor aquifer-storage change. The absolute acceleration of gravity is measured twice each year at the stations to an accuracy of about plus or minus 2 microGal, or about a 5 cm thickness of water. Gravity variations during the period of record at the stations have ranged from 4 to 21 microGal. The greatest variations occur at stations where nearby water-level variations document correlative trends in aquifer storage. Gravity variations in the Tucson Active Management Area also can result from non-aquifer sources, such as vertical displacement of the stations due to land-surface elevation change, as well as fluctuations in near-surface soil moisture. The vertical position of the stations is monitored by using the Global Positioning System, and any land-surface elevation change due to land subsidence or other factors is accounted for in the ground-water storage change calculation. Gravity variations at stations on crystalline rocks show poor correlation with soil moisture, however, gravity variations at stations on alluvial soils generally correlate with near-surface variations in soil moisture. Accounting for the affects of soil-moisture fluctuations on the gravity measurements at these alluvial stations decreased the variation in gravity measurements among the stations to 14 microGal and improved the correlation of the residual-gravity variations with water levels and hence aquifer storage. Gravity data collected between the spring of 2005 and summer of 2006 in the central and northern portion of Tucson Basin were used to calculate a ground-water

storage reduction of 60,000 acre-feet. The calculated storage change correlates to an annual water-level decline of about 0.4 feet per year.