

SIGNALS OF FOCUSED RECHARGE ALONG AN EPHEMERAL WASH BY REPEAT MICROGRAVITY SURVEYS, ARROYO DE LOS PINOS, NM

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We present preliminary results showing small (10-50- μ Gal) changes in gravitational acceleration along Arroyo de los Pinos, NM east of Socorro following two flow events. These changes in gravity caused by subsurface mass change indicate that repeat microgravity is a viable technique to understand focused recharge along ephemeral streams. In semi-arid regions, ephemeral streams are common and form a significant source of both flow and recharge. However, floods in these streams are commonly violent and sediment-rich, making gaging and recharge estimates difficult. Repeat microgravity measurements do not require boreholes or access to the subsurface, so they are a good candidate for estimating recharge. In Summer 2016, we installed sixteen 0.6 m length Feno survey spike monuments along a 5-km reach of Arroyo de los Pinos. Stations were located within a meter of the stream or as near as appeared stable. Stations were located along straight, relatively narrow reaches of the stream to avoid bank cutting and erosion/sedimentation in the stream bed below the station. A reference station, where gravity was assumed to be stable, was installed on a bedrock ridge outside of the catchment. In Summer 2018, we conducted three surveys on June 25-26, July 19-20, and July 28-29. Surveys had multiple occupations of each station with repeat measurements once an hour to correct for drift, and ties of at least three survey stations to the reference station. The June 25-26 survey was after several months of no rain or streamflow. The July 19-20 survey was after a 0.5 m maximum-stage flow on July 16; observations showed that it was bank-full but did not overtop the banks. The July 28-29 survey followed a 1.5-m depth flow on July 26; this flow did overtop the banks and removed two stations. Several other stations were buried by 2 cm to 5 cm of sediment, which was cleared away to a distance 3 m from each monument prior to the gravity survey. Changes in gravity were found relative to the base station and between occupations. For both flow events, there was a positive change in gravity indicating an increase in mass in the subsurface from recharged water. The gravity changes were larger for the narrower, single-trace, sinuous portions of the stream. Downstream, the channel transitions into a braided, multiple-thalweg channel, though constrained within a single low channel. Overall, there was a lower gravity change in this portion of the system. These observations argue that the conceptual model of using stream morphology with greater recharge occurring in braided systems than for sinuous systems may not be appropriate in streams like Arroyo de los Pinos.

Keywords:

gravity, recharge, Arroyo de los Pinos, ephemeral stream

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