**Geoelectric Monitoring of the Electric-potential Field of the Lower Rio Grande Before, During, and After Intermittent Streamflow, May–October, 2022**

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**1. Abstract**

Understanding the intermittent hydraulic connectivity between ephemeral rivers and alluvial aquifers is a key challenge for managing water resources in arid environments. In the Mesilla Basin of southeastern New Mexico, the lower Rio Grande flows for short discontinuous periods during the irrigation season, and the hydraulic connections between the river and the Rio Grande alluvial aquifer vary spatially and temporally and are not well understood. Self-potential (SP) monitoring and time-lapse electric resistivity tomography (ERT) were therefore performed along linear cross-sections spanning the riverbed and flood plain for 5 months to monitor the transient hydraulic connection between the river and the alluvial aquifer by measuring time-lapse changes in the electric potential field in the riverbed and flood plain. The monitoring period began on May 21, 2022, when the riverbed was completely dry, continued through the irrigation season while streamflow was provided by reservoir releases from upstream dams, and ended on October 4, 2022,when the riverbed was again dry. SP monitoring data show: (1) a background condition in the dry riverbed comprised of (a) a positive electric-potential anomaly of about +100 mV attributed predominantly to a subsurface vertical salt concentration gradient and (b) diurnal electric-potential fluctuations with amplitudes of 40–90 V attributed to near-surface heat conduction driven by climate variability, in addition to (2) a streaming-potential anomaly during the irrigation season with maximum amplitude of about -3,500 mV whose transient behavior shows clearly a change from the background anomaly to exclusively losing streamflow conditions that persist through the irrigation season. Time-lapse ERT monitoring results depict rapid infiltration of streamflow into the subsurface and imply the river and Rio Grande alluvial aquifer establish a full hydraulic connection within a few hours after streamflow arrival at the monitoring site. The combination of SP and ERT monitoring demonstrated herein shows the potential for broader applications of time-lapse monitoring of hydraulic intermittency and near-surface heat fluxes in different rivers and biomes.