A Review of Shallow Temperature Surveys for Geothermal Exploration in the Great Basin and their Contributions to Resource Conceptual Models

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Abstract: Over the past 40+ years, shallow (2-meter) temperature surveys have been employed in the Great Basin region of the western United States for the exploration of geothermal energy resources. This technique has proven to be effective for mapping the extent of shallow thermal anomalies due to geothermal upwelling and outflow in arid environments, particularly where shallow, cold groundwater does not mask the thermal signatures. Several approaches have been developed to increase the effectiveness of these surveys, related to survey equipment design, survey grid geometry, and advanced processing techniques, such as correcting for the effects of seasonal temperature cycles, variations in albedo, thermal conductivity, and elevation. In this poster, we present a compilation of regional 2-meter temperature data assembled for the INGENIOUS project funded by the U.S. DOE. We review several examples of shallow temperature surveys and discuss their contribution to geothermal conceptual models at those locations. We also present the results of a new 2-meter temperature survey from 2021 collected for the INGENIOUS project at a “blind” geothermal prospect: Granite Springs Valley, NV. At Granite Springs Valley (GSV), we collected 85 shallow temperature measurements between June and July 2021. At this location we observed a subtle thermal anomaly with temperatures about 2.5-3 °C above background. Along with supplemental data from shallow temperature gradient wells, geologic mapping, and geophysics, we provide a case study demonstrating how to incorporate these data into the geothermal conceptual model for GSV. In addition to the new case study, we also reviewed the past uses of the technique, and how the method is incorporated into conceptual models, by providing information about the possible upflow and outflow locations of geothermal fluids. Lastly, we reviewed the compiled data at a regional scale to investigate the magnitude of atypical geothermal anomaly at sites with confirmed geothermal activity, and the typical dimensions of a shallow thermal anomaly in map view.