

Potential of Airborne Remote Sensing for Geothermal Resource Exploration: A Case Study of Pilgrim Hot Springs, Alaska

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In 1983, the Alaska Division of Geological and Geophysical Surveys published the first comprehensive map of the geothermal resources of Alaska. Pilgrim Springs in western Alaska were identified as a one of the promising geothermal resource. As a first phase of a project jointly funded by the Department of Energy (DOE) and the Alaska Energy Authority, in September 2010 we collected high resolution thermal infrared images (1.3m spatial resolution) and very high resolution optical images (< 20 cm spatial resolution) over the Pilgrim Hot Springs. The hot springs and pools showed up clearly on the thermal infrared images due to the high thermal contrast, which in some places was about 40 degrees Celsius for the pixel average temperature. Further analysis of the thermal infrared images revealed more subtle features such as upwelling hot waters within and areas of thermally anomalous ground. We used an adapted version of the Stefan-Boltzmann equation to calculate the thermal flux for the hot spots, that according to published literature can give a first order estimate of the production capacity of a geothermal system. Our remote sensing data and field investigations indicated that these estimated fluxes can vary seasonally. To better constrain these flux estimates, we plan to acquire additional airborne thermal images during winter, spring and summer as well. Additionally, to better understand the heat source of the geothermal system, the thermal infrared image analysis needs to be integrated with lithological and structural data for the area. We also plan to acquire high-resolution airborne geophysics data to composition of the basin and map the key structures controlling hydrothermal fluid flow in the regions. Our preliminary analysis indicates that multisensor remote sensing data can provide a rapid and relatively low cost method for exploration and investigation of undeveloped geothermal systems in Alaska.