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Combining ASTER Thermal Data and Spatial-Based Insolation Model for Identification of Geothermal Active Areas

Authors : Khalid Hussein, Waleed Abdalati, Pakorn Petchprayoon, Khaula Alkaabi

Abstract : In this study, we integrated ASTER thermal data with an area-based spatial insolation model to identify and delineate geothermally active areas in Yellowstone National Park (YNP). Two pairs of L1B ASTER day- and nighttime scenes were used to calculate land surface temperature. We employed the Emissivity Normalization Algorithm which separates temperature from emissivity to calculate surface temperature. We calculated the incoming solar radiation for the area covered by each of the four ASTER scenes using an insolation model and used this information to compute temperature due to solar radiation. We then identified the statistical thermal anomalies using land surface temperature and the residuals calculated from modeled temperatures and ASTER-derived surface temperatures. Areas that had temperatures or temperature residuals greater than 2σ and between 1σ and 2σ were considered ASTER-modeled thermal anomalies. The areas identified as thermal anomalies were in strong agreement with the thermal areas obtained from the YNP GIS database. Also the YNP hot springs and geysers were located within areas identified as anomalous thermal areas. The consistency between our results and known geothermally active areas indicate that thermal remote sensing data, integrated with a spatial-based insolation model, provides an effective means for identifying and locating areas of geothermal activities over large areas and rough terrain.

Keywords : thermal remote sensing, insolation model, land surface temperature, geothermal anomalies
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