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# Surface temperature monitoring in geothermal districts from space and drones: Parco delle Biancane and Sasso Pisano(Italy) test sites

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The Italian Tyrrhenian margin is characterized by several high and medium enthalpy geothermal systems and in Tuscany several geothermal systems with a large-scale steam-dominated geothermal anomaly are presents. Surface thermal signatures may be used to define the evolution of development of shallow structures present on both volcanic districts and geothermal areas and possibly related to tectonic activity along active faults. Remote sensing represents an effective and expedite tool to acquire infrared images when there are large extents of areas affected by thermal anomalies. However medium range (drone) to long range (satellite) thermal images are affected by errors and underestimates due both to the distance and to atmospheric absorption so they require to be calibrated with short range field measurements in order to accurately correct for these effects. In this context, systematic global cataloging of thermal anomalies as measured from high spatial resolution spaceborne sensors and acquired with thermal camera installed on drones are still in their infancy.
Our goal is to create and analyze a catalog of data by examining the magnitude, frequency and distribution of Tuscany geothermal districts thermal signatures at the highest available spatial resolution ranging from the hundreds of meters per pixel of satellite thermal images to the tenths/hundreds of centimeters per pixel of the thermal images acquired by drones. The surface temperature maps obtained by satellite data acquired at suitable spatial resolution and temperature measured by thermal camera installed on drones have been orthorectified and geocoded in order to be overlapped on digital terrain models or on the orthophotogrammetric mosaic obtained after processing photos acquired by drone. This allows, for example, to follow the evolution of thermal anomalies, that may represent a modification of the current state of the geothermal field and a possible hazard for both the population and for industrial assets.
Here we show the results obtained during two field campaigns and in particular the one held at the end of September 2018 during which the simultaneously acquisition by Landsat8 satellite and thermal data of FlyBit have been analysed. By removing the atmosphere contribute, from Landsat8 data we have produced a surface temperature map that will be compared with the ground field measurements and surface temperature map measured by VUE PRO-R on FlyBit.