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Analysis of the Thermal Behavior of Landslides Using Remote Sensing Data

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Landslides are widespread geomorphological phenomena that play an important role in the evolution of landscapes and represent a severe hazard in many regions worldwide. Identifying and mapping landslides is a problem of scientific and societal interest that has drawn the attention of researchers and landslide risk managements for many years. In the recent years, investigators have attempted to exploit multiple remote sensing technologies to identify, map and characterize landslides.

In this research we have investigated the possibility of using Land Surface Temperature (LST) and Normalized Difference Vegetation Index (NDVI) maps to characterize slope failures and to prepare landslide susceptibility zonation. The aim is to validate the hypothesis that unstable areas are more humid than stable ones, since they act as “sponges” and during the day, they show a surface temperature (LST) lower than the stable areas. For the purpose, we have prepared for the Collazzone area, in central Italy, maps of NDVI obtained by processing raw NIR and RED channels at 15 m x 15 m resolution of an image acquired by the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER), on board the TERRA satellite, and maps of LST obtained by processing raw TIR channels at 90 m × 90 m resolution from the same image. We have exploited analyzed and combined the NDVI and the LST maps prepared from images acquired in different season and in different years. The LST maps have been compared with a detailed landslide inventory map available for the study area to determine if stable and landslide areas exhibit a different thermal behavior.

The NDVI and LST maps have been also used to prepare susceptibility models in order to understand the possibility of exploiting information obtained from processing satellite data for susceptibility and hazard zonation.