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Inter-calibration of Landsat-TM/ETM scenes in heterogeneous areas

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Detecting temporal land cover variation by using remotely sensed imagery is a precious support for researchers and land managers interested in the effects of natural impacts and management practices on the environment. An important step in developing multitemporal analyses techniques is the assumption that digital values of the satellite time series are radiometrically consistent for all scenes.

Numerous radiometric normalization approaches specific to Landsat data are available in literature. Since many of the proposed methods were devised for homogeneous territory, in this work we tested on a region of southern Italy with very complex landscape patterns the effectiveness of different relative inter-calibration algorithms: No-change regression normalization (NC), Minimum-maximum normalization (MM), Mean-standard deviation normalization (MS), and Pseudo-invariant normalization (PI).

The selected normalization techniques were evaluated on a time series of Landsat-TM/ETM summer scenes acquired in 1987, 1998, 2002, and 2004. The master image for applying the correction algorithms was selected by using the DDV (Dense Dark Vegetation) approach: the image identified as the most stable was the scene of 2004. The goodness of the performed corrections was evaluated from scatterplots between

the bands of each date and those of the master image. By analyzing the regression values the best results were obtained for PI and NC (R= 0.70, S=0.74-1.06). In order to select the best algorithm between these two, a further analysis was conducted on the respective pixel sets. NC showed a correlation coefficient ranging from 0.96 to 0.99 and slope values from 0.91 to 0.98 with an exception for 1987, which exhibits values lower than the other dates, but higher than those obtained for the bands corrected with PI.

The performed analyses showed that algorithms based on statistics from the entire image, or from a large part of it, works worse; a possible explanation is the high probability of outliers. For the correction techniques based on statistics from a selected set of pixels, on the analyzed heterogeneous landscape the NC performs a better normalization than the PI algorithm. The reason can be linked to the type of selection of invariant features, since the NC-set is evaluated on the basis of more restrictive thresholds for the identification of unchanged features.