ANALYSIS OF THE SATELLITE IMAGES MISREGISTRATION ERRORS. A CASE STUDY FOR ROMANIA

Corina Alecu[1], Simona Oancea[1], Nektarios Chrysoulakis[2], Gheorghe Stancalie[1]

[1]National Meteorological Administration
97, Sos. Bucuresti-Ploiesti, sector 1, 013686, Bucharest, Romania
e-mail: corina.alecu@meteo.inmh.ro
[2]Foundation for Research and Technology - Hellas
Institute of Applied and Computational Mathematics
Regional Analysis Division
Vassilika Vouton, P.O. Box 1358,
GR-71110, Heraklion, Crete, Greece

Many of the remote sensing applications are based on the multi-temporal and/or multi-sensors approaches. The procedures of geometric correction and georeferencing of satellite data are extremely important in order to obtain reliable information. It is a known fact that georeferencing and geometric correction could lead to errors in the results of satellite image processing and the multi-temporal and multi-sources applications are the most affected by these procedures.
Multi-source data integration for applications in geomatics requires geometric processing adapted to the nature and characteristics of the data in order to keep the best information from each image in the composite mapping products. To integrate different data in a Geographic Information System (GIS), each image must be separately geometrically corrected so that it can be registered, compared, combined, pixel by pixel, but also with cartographic vector data.
Errors due to misregistration of the satellite images are reflected on the correlation factor for the images analyzed.
The data used in this study are ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer) image acquired over Romania. Test areas representing different land use/land cover were chosen and the three VNIR bands, the first three SWIR bands and three TIR bands were used.
In this study, the effect of misregistration on land cover types estimation was examined by means of statistical analysis that was based on a comparison between original and simulated ASTER datasets (pairs of images) of known land cover types. Misregistration effect was simulated by performing affine transformations to the original ASTER datasets. These simulated datasets were compared against one another and also compared to the original datasets for eight test areas.
The methodology to estimate these errors is to compare the regression factor between two images derived either from one single band or from two bands. To check this correlation, a procedure of degrading the geometric position of one single band or of two different bands, using the same resolution or different resolutions are applied. In order to obtain this artificial degradation, a transformation on three directions: on x axis, on y axis and on both x and y axis of one image comparing with itself or with another was applied. Another comparison was performed based on simulated bands having coarser spatial resolution. These spectral bands were produced by appropriately downscaling the original data to 30 and 90 m.
Statistical analysis was employed to compare the correlation between the original and the simulated dataset. Starting with pairs of the same dataset, for which the Root Mean Square Error (RMSE) was 1, the next pairs which was compared had been transformed by shifting one and two pixels on x direction, y direction and both x and y, respectively, resulted in 6 simulated datasets. As the correlation between ASTER bands in the same spectral area was relatively high, the above mentioned operations were applied to the other bands in order to estimate the behavior of their correlation coefficient during these transformations.
The study was performed for different scales, different land cover types and different complexity to evaluate the most influencing factors. This approach allowed quantification of the inappropriate image georeferencing, as well as the quantitative estimation of the size of distortion of the final results, in case of comparison of images from different dates and different sensors.