Geophysical Research Abstracts
Vol. 14, EGU2012-14342, 2012
EGU General Assembly 2012

Comparison of fractal dimensions based on segmented NDVI fields obtained from different remote sensors.

C. Alonso (1), R.M. Benito (2), A.M. Tarquis (3,4)

(1) Remote Sensing Department, Indra Espacio S.A., Madrid, Spain. (calonso@indra.es), (2) Grupo de Sistemas Complejos, Departamento de Física, UPM, 28040 Madrid, Spain, (3) CEIGRAM - ETSI Agónomos, Universidad Politecnica de Madrid, Madrid, Spain (anamaria.tarquis@upm.es), (4) Dpto. Matematica Aplicada, ETSI Agónomos, UPM, Madrid, Spain

Satellite image data have become an important source of information for monitoring vegetation and mapping land cover at several scales. Beside this, the distribution and phenology of vegetation is largely associated with climate, terrain characteristics and human activity. Various vegetation indices have been developed for qualitative and quantitative assessment of vegetation using remote spectral measurements. In particular, sensors with spectral bands in the red (RED) and near-infrared (NIR) lend themselves well to vegetation monitoring and based on them [(NIR - RED) / (NIR + RED)] Normalized Difference Vegetation Index (NDVI) has been widespread used.

Given that the characteristics of spectral bands in RED and NIR vary distinctly from sensor to sensor, NDVI values based on data from different instruments will not be directly comparable. The spatial resolution also varies significantly between sensors, as well as within a given scene in the case of wide-angle and oblique sensors. As a result, NDVI values will vary according to combinations of the heterogeneity and scale of terrestrial surfaces and pixel footprint sizes. Therefore, the question arises as to the impact of differences in spectral and spatial resolutions on vegetation indices like the NDVI. The aim of this study is to establish a comparison between two different sensors in their NDVI values at different spatial resolutions.

Scaling analysis and modeling techniques are increasingly understood to be the result of nonlinear dynamic mechanisms repeating scale after scale from large to small scales leading to non-classical resolution dependencies. In the remote sensing framework the main characteristic of sensors images is the high local variability in their values. This variability is a consequence of the increase in spatial and radiometric resolution that implies an increase in complexity that it is necessary to characterize. Fractal and multifractal techniques has been proven to be useful to extract such complexities from remote sensing images and will applied in this study to see the scaling behavior for each sensor in generalized fractal dimensions.

The studied area is located in the provinces of Caceres and Salamanca (east of Iberia Peninsula) with an extension of 32 x 32 km2. The altitude in the area varies from 1,560 to 320 m, comprising natural vegetation in the mountain area (forest and bushes) and agricultural crops in the valleys. Scaling analysis were applied to Landsat-5 and MODIS TERRA to the normalized derived vegetation index (NDVI) on the same region with one day of difference, 13 and 12 of July 2003 respectively. From these images the area of interest was selected obtaining 1024 x 1024 pixels for Landsat image and 128 x 128 pixels for MODIS image. This implies that the resolution for MODIS is 250x250 m. and for Landsat is 30x30 m.

From the reflectance data obtained from NIR and RED bands, NDVI was calculated for each image focusing this study on 0.2 to 0.5 ranges of values. Once that both NDVI fields were obtained several fractal dimensions were estimated in each one segmenting the values in 0.20-0.25, 0.25-0.30 and so on to rich 0.45-0.50. In all the scaling analysis the scale size length was expressed in meters, and not in pixels, to make the comparison between both sensors possible. Results are discussed.

Acknowledgements

This work has been supported by the Spanish MEC under Projects No. AGL2010-21501/AGR, MTM2009-14621 and i-MATH No. CSD2006-00032

References

C. Alonso, A.M. Tarquis and R.M. Benito. Multifractal Characterization of Multispectrum Satellite Images.Geophysical Research Abstracts, Vol. 7, 05413, 2005

C. Alonso, A.M. Tarquis, R.M. Benito, I. Zúñiga. Scaling properties of vegetation and soil moisture indices: multifractal and joint multifractal analysis. Geophysical Research Abstracts, Vol. 9, 11643, 2007.

C. Alonso, A.M. Tarquis, R.M. Benito and I. Zúñiga. Influence of spatial and radiometric resolution of satellite images in scaling/multiscaling behavior. Geophysical Research Abstracts, Vol. 10, EGU2008-A-06184, 2008.

S. Lovejoy, A.M. Tarquis Alfonso, H. Gaonac'h and D. Schertzer. Single and multiscale remote sensing techniques, multifractals and MODIS derived vegetation and soil moisture. Vadose Zone Journal, 7 (2). 533 – 546, 2008.