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Nonlinear Processes in Geophysics
Discussions

Interactive comment on "Spatial and radiometric characterization of multi-spectrum satellite images through multifractal analysis" *by* Carmelo Alonso et al.

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This manuscript characterizes several bands of multi-spectral images obtained with different radiometric and spatial resolution by IKONOS-2 and LANDSAT-7 satellites by multifractal analysis. Three of the studied bands were in the visible wavelength spectrum (red, green and blue), while the fourth one was in the near-infrared region. IKONOS-2 images were taken with a radiometric resolution of 11 bits/pixel and the pixel size was 4m x 4m pixel size. LANDSAT-7 images were taken with a radiometric resolution of 8 bits/pixel and the pixel size was 30m x 30m. For IKONOS-2 images both, the original pixel code (11 bits) and a transformed pixel code (8 bits) have been considered. Then, the effects of spatial and radiometric resolution on several multifractal parameters were investigated. The rationale and the objectives exposed in the

Introduction section are worthwhile and in general the work appears well justified. The main findings are the usefulness of multifractal parameters to: 1) assess different patterns of scaling heterogeneity and evenness of the studied bands, and 2) discriminate between bands with different spatial and radiometric resolution. In general, the paper is well written and organized, and represents an original contribution. The results are based in robust data analysis. This study also is compatible with the aims of Nonlinear Processes in Geophysics (NPG) and may fit well into the scope of the current special issue titled "Multifractal Analysis in Soil Systems". In my opinion, it should be acceptable for publication following minor revisions. Some specific comments are next provided. - The IKONOS-2 image presented and analyzed for multifractality is square and consists of 2048 x 2048 pixels of 4 x 4 m. The original LANDSAT-7 image is rectangular and consists of 772 x 828 pixels of 30 x 30 m; however multifractal analysis was not performed on the rectangular image, but on a square of 512 x 512 pixels. In my opinion this should be considered. To be consistent, I suggest modifying Figure 5 for including only the portion that has been used for multifractal analysis. - In general the discussion section should be tightened up. The authors should put an emphasis on what are the novel results and the novel things they have learned using multifractal analysis. - Specifically, I wonder if the authors could include data about the effect of spatial and radiometric resolution on the vegetation indices mentioned in the Introduction, i.e. NDVI (normalized difference vegetative index) and EVI (enhanced vegetation index). Are changes in multifractal parameters related changes in NDVI, EVI or to other physical properties measured or derived from multispectral images? - Tables 1, 2 and 3 list Hölder exponent parameters obtained from singularity spectra for q=1, q=2 and q=3. Please provide also the respective errors of these values. - I disagree with the statement in Page 8, Lines 13 and 14: "In order to avoid any other effect beside the spatial resolution a comparison between Landsat (with an original pixel code of 8 bits) and the rescaled histograms from Ikonos is made". This is because there are other factors of variation including 1) the total size of the image analyzed and 2) difference in the wavelength of a given spectral band between satellite images. Regarding my first

remark, please note that if you change the size of the image, proportions of different vegetation and soil types are also changing and this has effects in the multispectral results. Regarding to the second remark, please note for example that wavelength for ETM#3 of Landsat was from 0.53 to 0.61 micrometers, while those for the same band of Ikonos was from 0.506 to 0.595. - Even if the paper is reasonably well written, as before stated, the English language should be improved before acceptation.

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