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Use of Scaling Models in Remote Sensing Image Fusion and Image Filtering

Q. Cheng (1,2), L. Jing (2)

(1) State Key Lab of Geological Processes and Mineral Resources, China University of Geosciences, Wuhan, Beijing, China (Qiuming@cug.edu.cn), (2) Department of Earth and Space Science and Engineering, York University, Toronto, Canada (qiuming@yorku.ca) , (jlh@yorku.ca)

The scale effect in map processing such as remote sensing image processing has been a critical issue which has been increasingly attracting interests in the fields of geographic information system (GIS) and remote sensing (RS) due to several science and technology advancements: new advanced sensors can capture spatial data in variable resolutions which has provided rich and diverse datasets covering the same area for application, the advancement of information technologies of GIS and RS has made it possible for processing spatial data in multiple scales, and non-linear theories and models including scaling analysis have provided effective methods and tools for handling these types of spatial data. This paper introduces some novel ideas of utilization of scaling models in remote sensing image fusion and filtering. Due to the multifraclities of the reflectance patterns on remote sensing images, the changing rate of pixel values at a fixed location but captured at different scales or resolutions might be different depending on the property of pixel values reflecting the real objects or mixing objects on the earth surface. The influence of objects with lower fractal dimension on the pixel values decays quicker than those with higher fractal dimensions as decreasing the image resolution. The changing regularities can be quantified using power-law functions or in terms of self-similarity. Distinctive self-similarities can be based for upscale processing (for example filtering) and downscale processing (for example image fusion). Landsat ETM images from an urban area of the Greater Toronto Area, Canada, were applied for methodology demonstration.