Scripts by Jack™

Calibrating Multispectral Satellite Images

The cornerstone script in the geospatial analysis series of *Scripts by Jack™* calibrates each spectral band of a multispectral satellite image into a surface reflectance raster object. This SRFI script (see the color plate entitled *Scripts by Jack: Calibrate Satellite Images to Surface Reflectance*) adjusts the cell values of each image band to a consistent, calibrated reflectance scale that represents a consistent biophysical property of the surface. These adjustments can remove wavelength-variable atmospheric effects (haze and attenuation) that have variable but predictable impacts on each band in an individual multispectral image. The adjustments also compensate for date/time/scene-dependent effects such as sensor gain differences and varying solar illumination geometry that become important factors when you are working with multiple scenes. An accompanying TERCOR script (see the color plate entitled *Scripts by Jack: Correct for Terrain Induced Radiance Effects*) performs local adjustments to the reflectance values to account for the effects of slope and aspect of terrain relative to the geometry of its solar illumination.

ASTER, 9 May 2001

ASTER, 5 May 2002

Color-infrared combination of ASTER image bands (Red = near-infrared band, Green = red band, Blue = green band) that have been calibrated to scaled reflectance using the SRFI and TERCOR geospatial scripts. Band combinations from the two dates are displayed with the same contrast enhancements, so similar colors in the two displays indicate the same scaled reflectance values. In computing scaled reflectance, these scripts have adjusted for band-dependent effects (atmospheric scattering), between-scene effects (differences in the solar illumination direction and changes in sensor gain in the green and red bands), and for the variable effects of slope and aspect on reflectance, among others. These calibrated images provide an improved basis for analyzing the distribution and condition of crops, natural vegetation, soil, mineral assemblages of rocks, and other features on each date and for comparing these features between scenes. For example, the illustrations below show optimized vegetation index images on the two dates for the area indicated by the box (upper left). These index images were computed using the GRand Unified Vegetation Index (GRUVI) geospatial script.

Once these scripts have converted the "as collected" image values (scaled radiance) to surface reflectance (a biophysical property of the surface), the image bands can be be further processed and analyzed as desired in any appropriate TNT process or script. For example, they can be used to compute band ratio indices of properties within a single scene, such as a map of green vegetation biomass (a biological property) or a map of soil brightness (a physical property). Other scripts in this series (see the *Scripts by Jack* color plates entitled *Mapping Vegetation/Soil Biophysical Properties* and *Generalized Mapping of Biophysical Properties*) provide flexible approaches to computing these and other maps of biophysical surface properties.

The calibrated image bands also provide the basis for analyzing multiple images that may have been acquired by different sensors, at different locations, and/or on different dates. The use of scaled reflectance values enables more accurate comparison of conditions in different areas or of changes in conditions in a single area through time.

Dr. Jack F. Paris, a private remote-sensing and geospatial consultant/coach, has developed a collection of advanced, model, geospatial ***Scripts by Jack™*** and associated documentation called ***FAQs by Jack™***. These scripts are in the public domain and can be used and modified as desired. For access to the scripts and FAQs, more information, and contact with Jack, go to: **www.microimages.com/freestuf/ScriptsByJack.htm**

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