

Decorrelation Stretch

Product ID: AST06

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Product Level: 2

Production Mode: routine

Absolute Accuracy: N/A

Relative Accuracy: N/A

Horizontal Resolution: 15, 30, and 90 m

Units: none

Product Size (MB): 84, 21, 3 for VNIR, SWIR, and TIR, respectively

Product Description

This product, which is available for each of ASTER's three telescopes, is a decorrelation stretched image of ASTER radiance data. The decorrelation stretch is a process to enhance (in image processing parlance, "stretch") the color differences found in a color image by a method that includes the removal of the inter-channel correlation found in the input pixels; hence, the term "decorrelation stretch". The image is produced at pixel resolutions of 15 m for VNIR, 30 m for SWIR, and 90 m for TIR. Decorrelation-stretched images provide an overview that enhances spectral reflectance variations.

Algorithm Description

If one views the pixels in an ASTER scene as a set of 3-vectors, a linear transformation can be found which results in removing the correlation among the vectors in the transformed space. This is an eigenvector problem, and can be thought of as a rotation of the coordinate system of the original vector space. Within this rotated space, each component is rescaled (contrast stretched) by normalizing the variances of the eigenvectors. If processing were to stop here, the result would be a principal component image. To produce the decorrelation stretched image, the principal component image is modified by the linear transformation that rotates the vectors back into the original coordinate system.

In practice, the original transformation, the variance normalization step, and the reverse transformation are combined into a single algebraic step.

Applications

These images are used as a visual aid in reviewing the ASTER scene data and making the selection of suitable scenes for further analysis and research. In particular, a decorrelation-stretched image would show the potential user which scenes have spectral variations large enough to be useful for subsequent spectral analysis

Constraints

The decorrelation stretch algorithm is best suited to the case where the input data of all three channels have a joint distribution that is Gaussian (or near Gaussian) in form. Fortunately the

algorithm is fairly insensitive to substantial deviations from the ideal. One should be aware, though, that if the distribution of the input pixels is strongly bimodal (or multimodal), the effectiveness of the decorrelation stretch is weakened, and there will be less diversity of color in this image than in other images.

Additionally, the decorrelation stretch algorithm is a method of color enhancement that exploits whatever interchannel differences that may exist. Implicit in this technique is the assumption that the differences are real, and not noise or processing artifacts. The algorithm single-mindedly produces a color enhanced output; if noise is a major component of the scene variation, the algorithm will enhance those noise differences to produce an output that, while colorful, will be painfully noisy.