Product Brochure

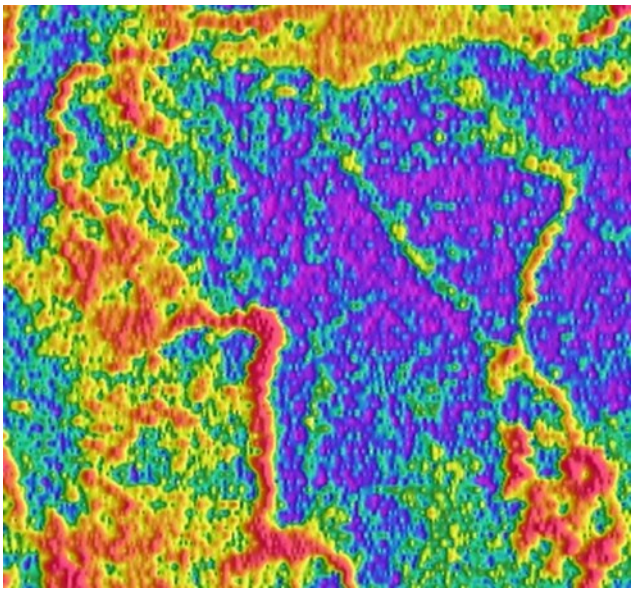
GAMMA_Plus

Minty Geophysics

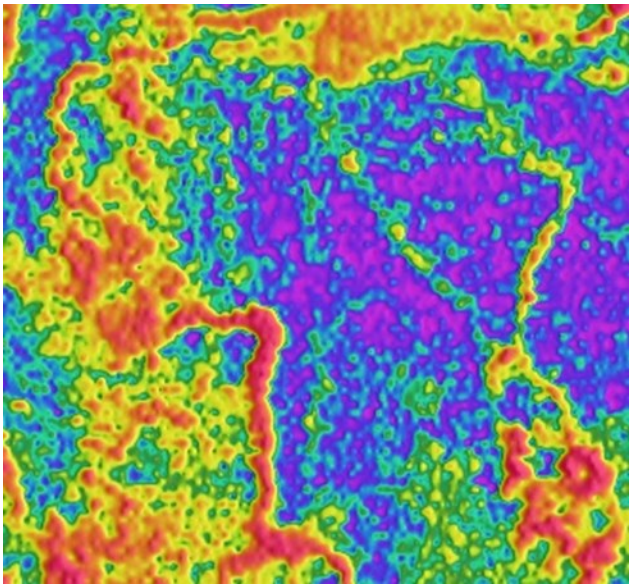
Enhanced noise-reduction for gamma-ray data

GAMMA_Plus is a multichannel method for reducing noise in gamma-ray spectra while preserving the gamma-ray signal.

Conventional processing



GAMMA_Plus noise reduction



(Data courtesy Mineral Resources Tasmania)

Features

- New method for the optimum sorting of spectra based on spectral shape
- NASVD by cluster for maximum noise reduction
- Tracing of errors through the entire processing chain

Benefits

- Reduced noise in final estimates of radioelement concentrations
- Improved anomaly definition
- Errors are available for every radioelement estimate — can be used to guide interpretation

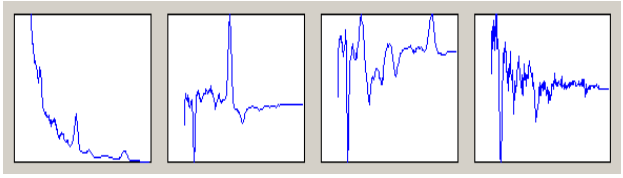
Motivation

The random nature of radioactive decay ensures that noise levels are a significant limitation of the gamma -ray spectrometric method. Fortunately, much of this noise can be removed using either the NASVD or MNF methods (Hovgaard and Grasty, 1997; Green et al., 1988; Dickson and Taylor, 1998). For large surveys, the implementation of either of these methods can be improved by first sorting the raw spectra into clusters on the basis of similarity in spectral shape (Minty and McFadden, 1998). The NASVD or MNF method is then applied to each cluster of spectra in turn.

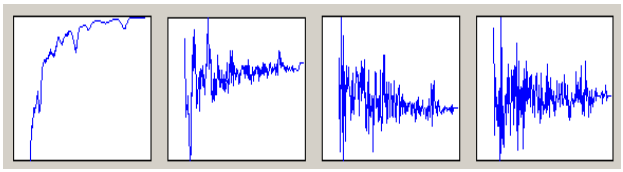
GAMMA_Plus

Background

In the absence of the application of any noise reduction techniques, the noise (fractional standard deviations) on processed airborne gamma-ray spectrometric data can be as high as 10%, 15% and 58% for the estimation of K, eTh and eU concentrations respectively (Minty, 1997). Fortunately, much of this noise can be removed using either the NASVD or MNF methods.



Eigenvectors from NASVD by flight, showing significant signal in the four lower-order components

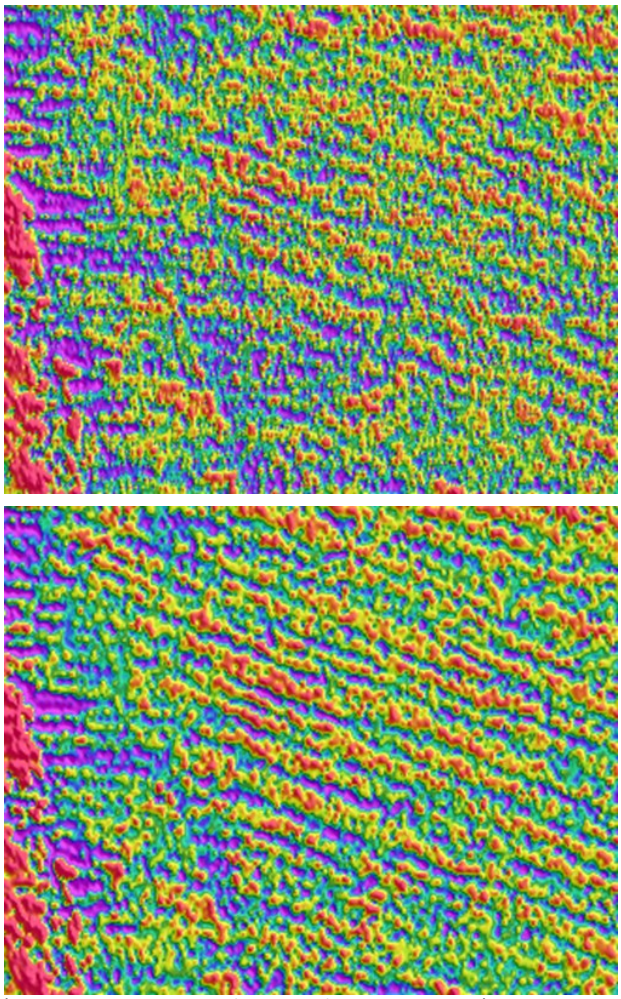


Eigenvectors from GAMMA_Plus for a single cluster. Most of the signal is now in the lowest-order spectral component

GAMMA_Plus

GAMMA_Plus delivers improved noise reduction while maintaining the accuracy of the gamma-ray signal as follows:

- a new clustering method is used to sort gamma-ray spectra into clusters based on their spectral shapes. The new method incorporates spatial information and is optimised for the sorting of gamma-ray spectra;
- the NASVD method is applied to clusters, but also uses spatial information in the spectral analysis;
- non-linear filtering is incorporated into the data reduction procedure at more than one point in the processing chain.



(Data courtesy Dept Industry and Resources, WA)

Equivalent uranium images processed by NASVD followed by minimum curvature (top); and GAMMA_Plus followed by GAMMA_Grid (bottom)

Incorporating the Errors

We use knowledge of the errors in the raw data (variance = mean count rate for Poisson-distributed counts), and trace the propagation of these errors through the conventional data processing procedures to estimate the errors in the final count rates. These are used for subsequent inversion by GAMMA_Grid.

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