Apart from noise introduced by the atmosphere, the instrumentation, and from quantization and sampling, the GERIS data are corrupted by a heavy two line and four line banding. This is due to slight differences of the surfaces of the rotating mirrors in the scanning device. These differences in the optical properties probably stem from dirt and oil on the surfaces.

PC versus MAF

In Figures 2.1 and 2.2 the 62 principal components and the 62 minimum/maximum autocorrelation factors are shown. The images are ordered row wise with component/factor 1 in the top-left corner (paper in landscape mode). Each subimage consists of 340×500 7.5×7.5 m^2 pixels. Because of the extreme noise content channel 28 is omitted from the analyses. It is evident that the principal components transformation is not capable of producing a natural ordering of image quality. The minimum/maximum autocorrelation factors do a much better job in terms of ordering as well as separating signal from noise. One might describe the MAF transformation as a decomposition of spatial frequency.

MNF/Fourier Noise Filtering

In Figure 2.3 we see the effect of filtering out the peaks in the MNF Fourier domain that result from the striping. The effect is dramatic in terms of improved image quality. The line banding causes very distinct peaks in the Fourier domain as seen in Figure 2.4. Three peaks in each half plane are easily detected. These peaks are replaced with an iterated local mean.

After filtering of the twenty first maximum noise fraction components (signal) and replacing the remaining MNFs with their mean value, we transform them back to the original space. In this fashion we remove all types of noise isolated in MNF21 through MNF62 including salt-and-pepper noise and a herringbone-like noise isolated in MNF21. The effect of this on the original channel number 1 can be seen in Figure 2.5. It is evident that a considerable improvement is obtained.

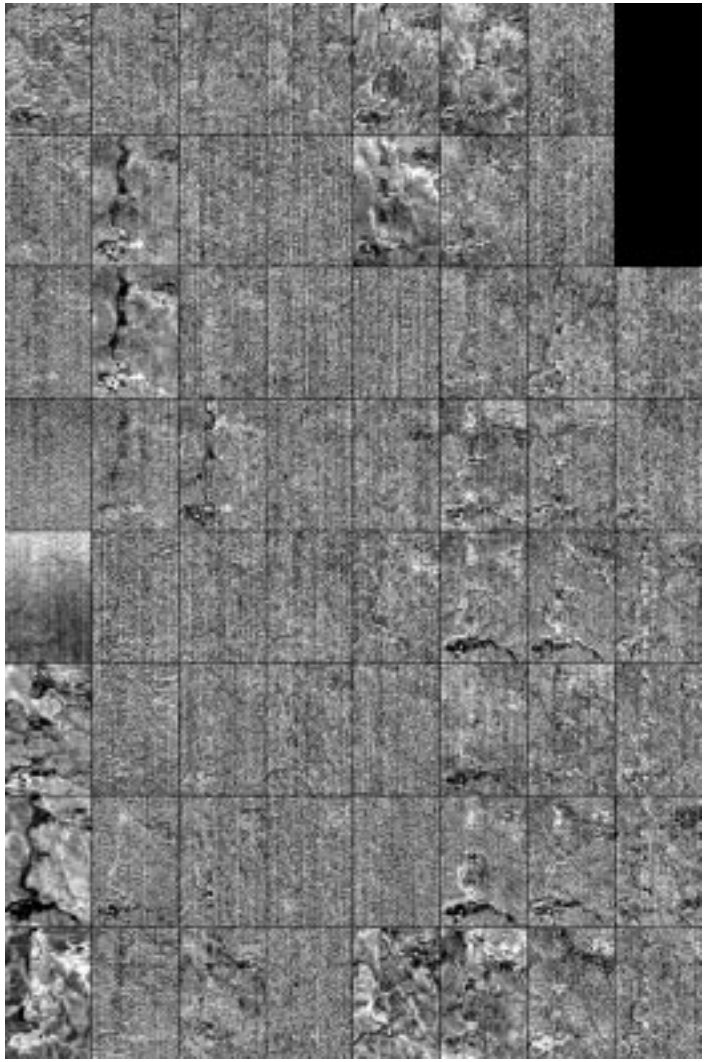

Figure 2.1: Principal components of 62 GERIS bands