MATH-578: PCA Assignment

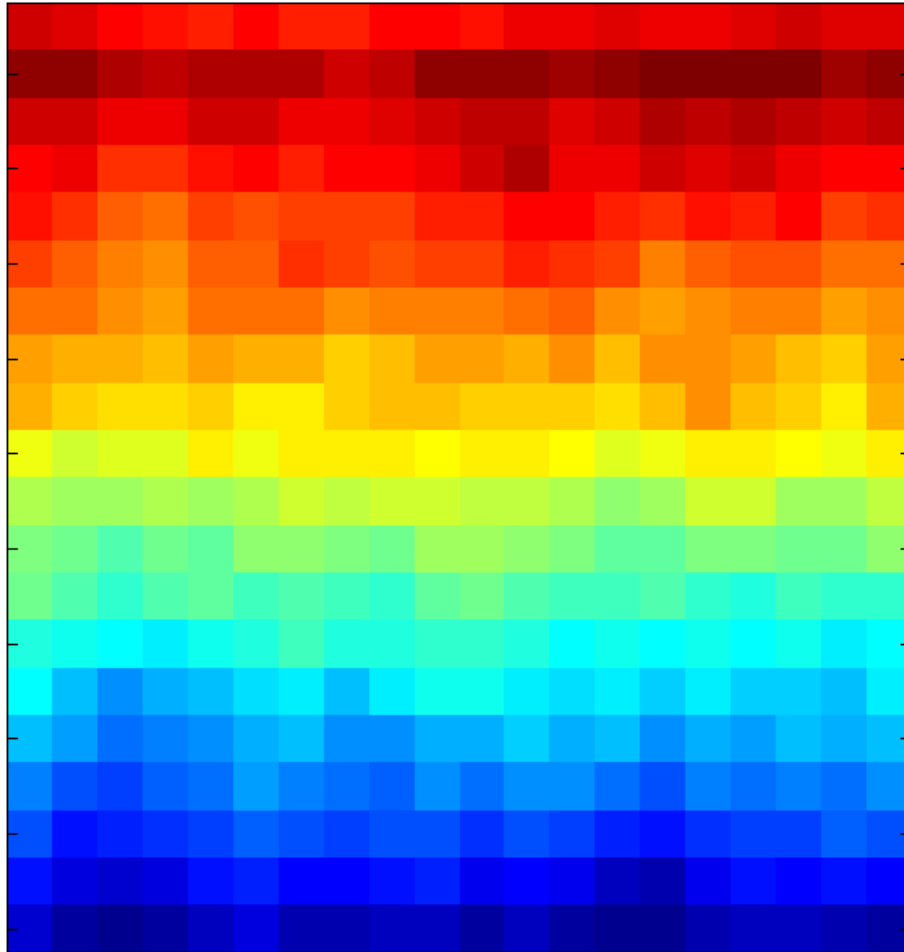Saket Choudhary
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Figure 1: Mean Patch for Photo Images

1 Part a

1.1 Photo Image

General feature of Photo Image: Band of colors with gradual descent(colors merge into one another), indicating image has less features(less variance) overall.

1.2 VTEC Image

General features of VTEC Image: Band of colors which form a steep gradient(different colors do not merge into one another), indicating that the image has more features (the total variance is high)
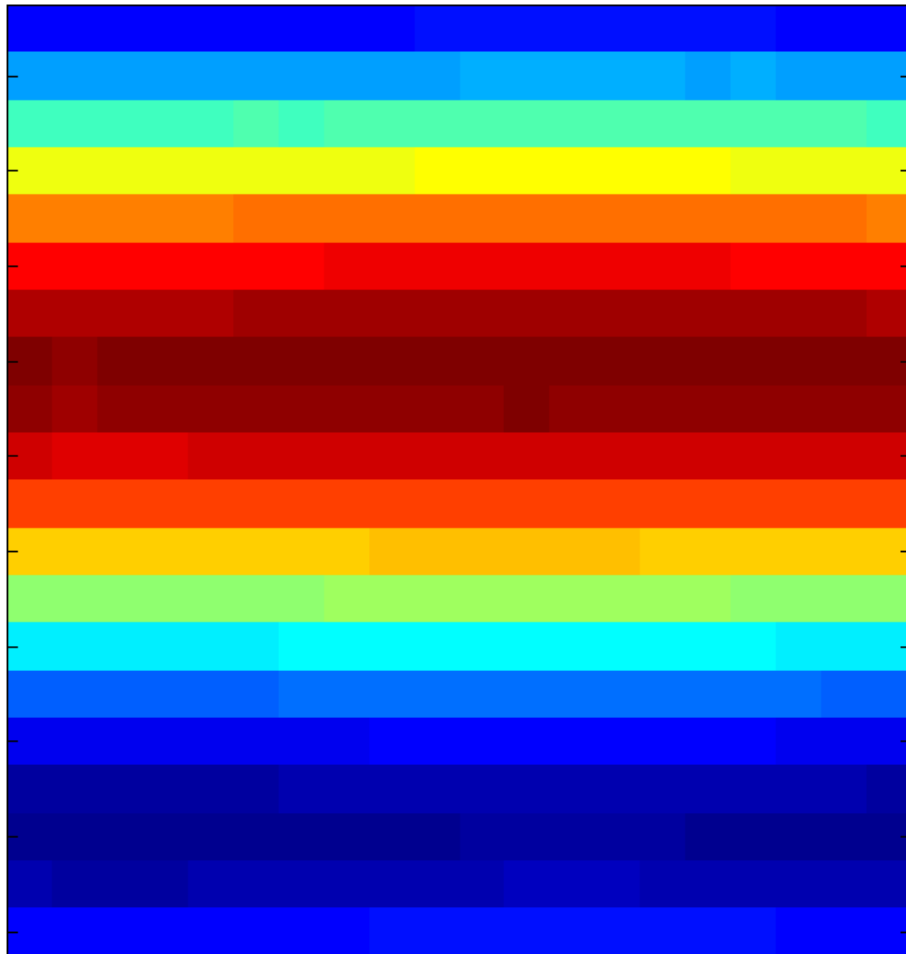
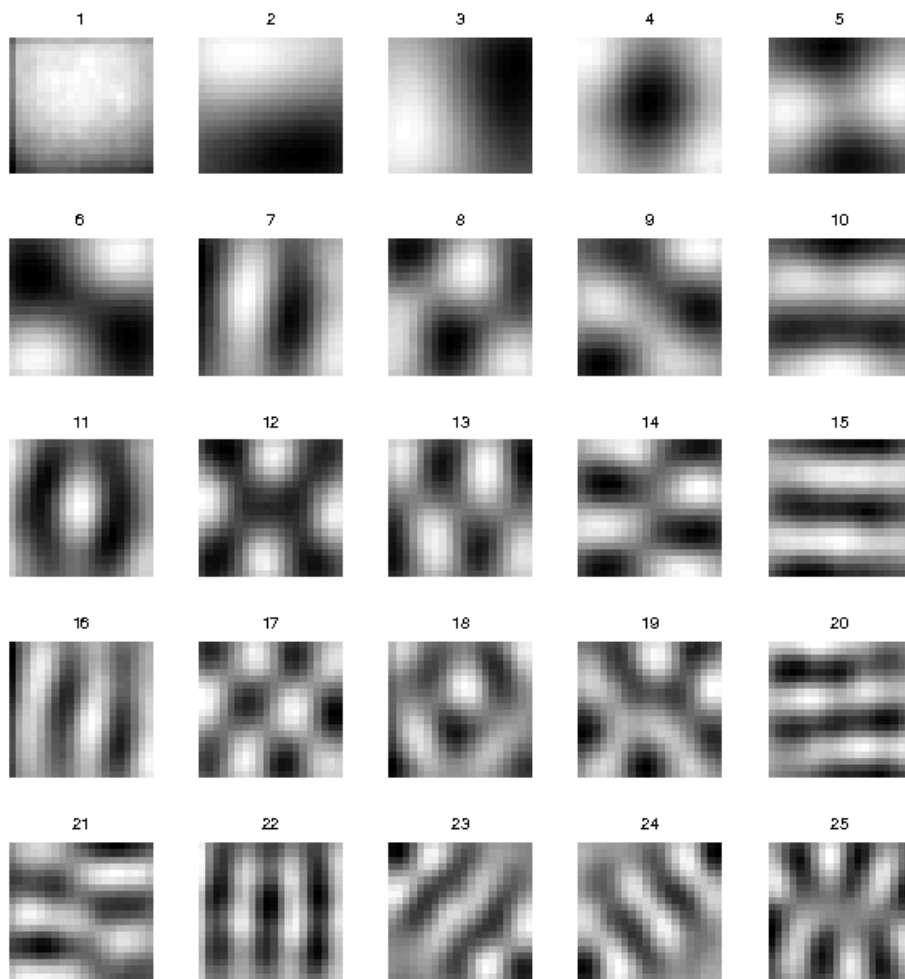Figure 2: Mean Patch for VTEC Images

Figure 3: First 25 eigen vectors of Photo Image. The images exhibit high variance

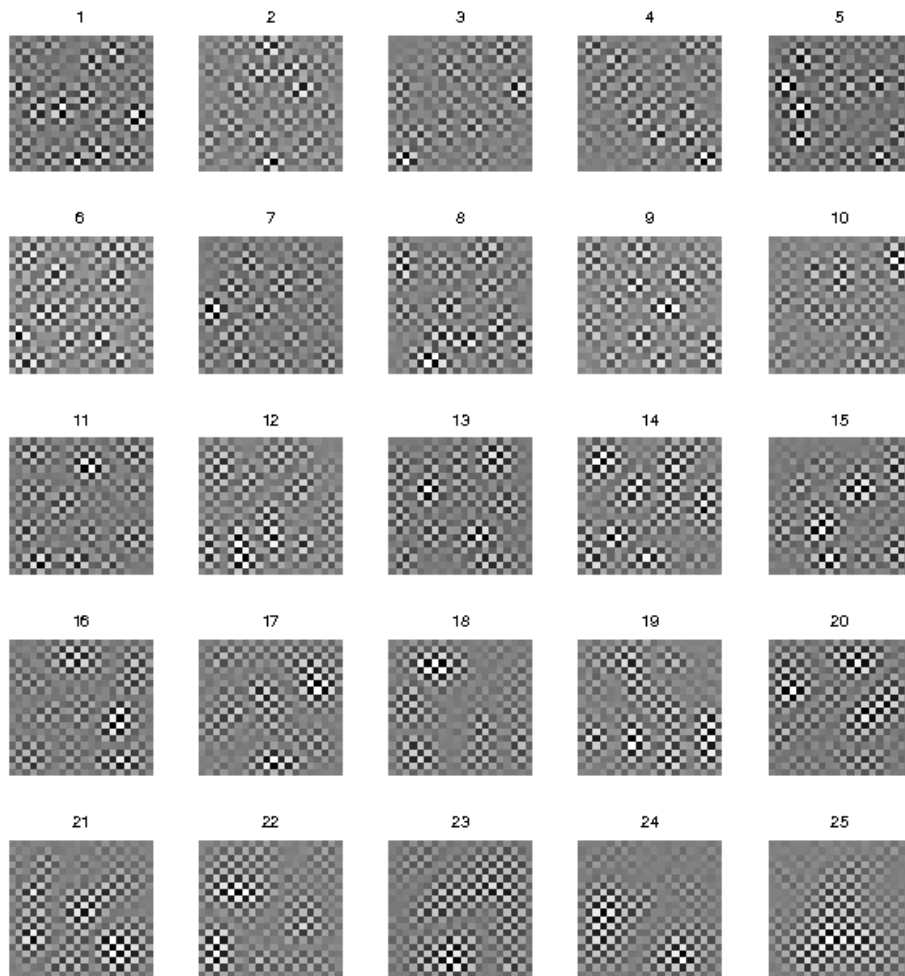# 2 Part b

2.1 Photo Image

2.2 VTEC Image

Figure 4: Last 25 eigen vectors of Photo Image. Images exhibit low variance and hence are indistinguishable
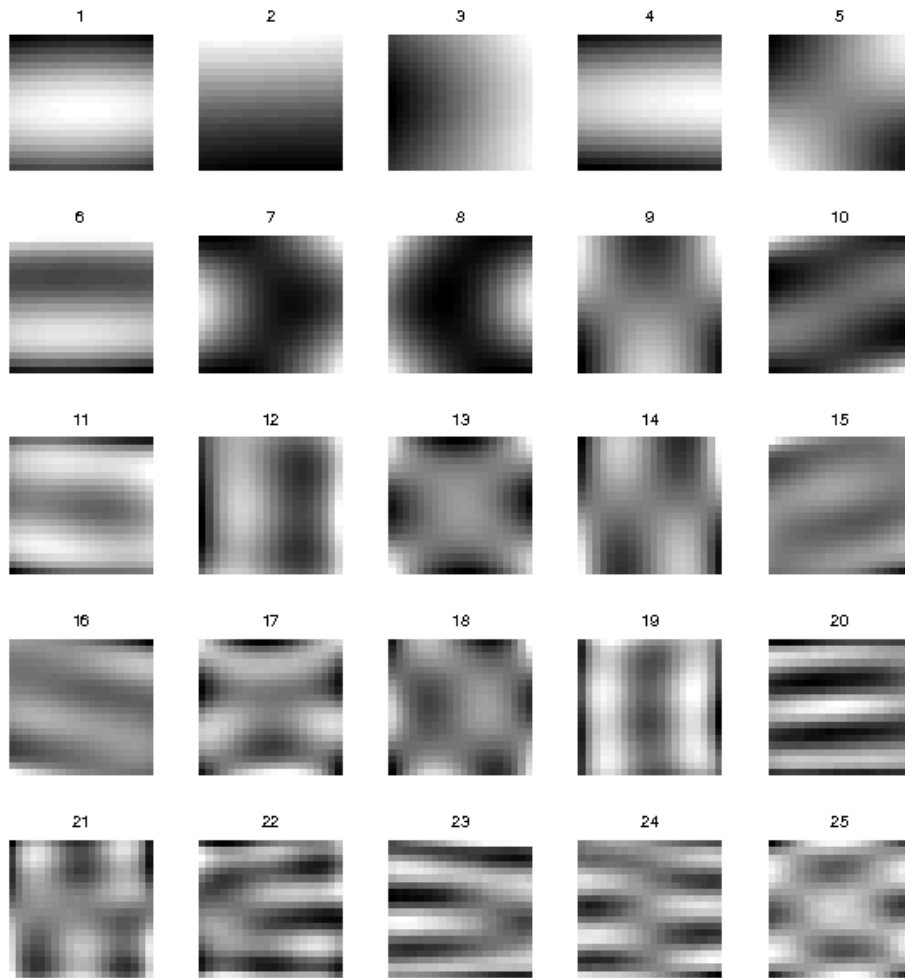
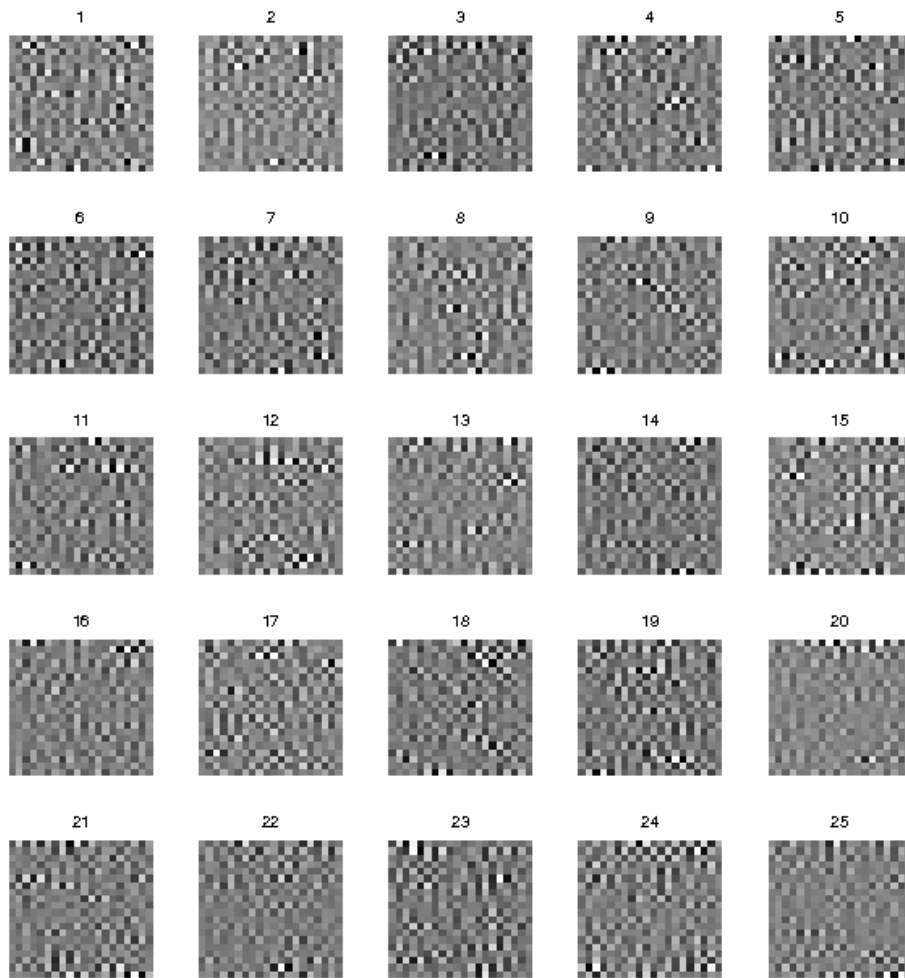Figure 5: First 25 eigen vectors of VTEC Image. Images exhibit high variance.

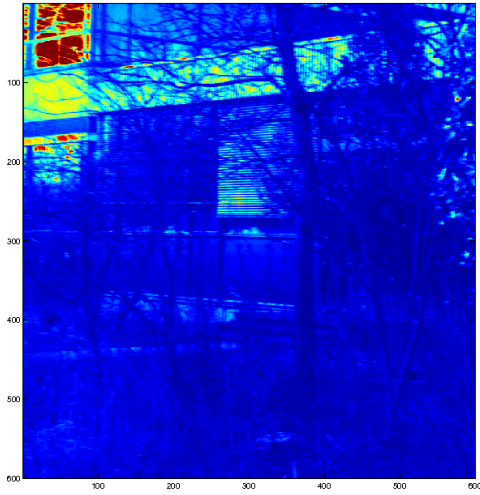Figure 6: Last 25 eigen vectors of VTEC Image. Images exhibit low variance and are indisinguishable
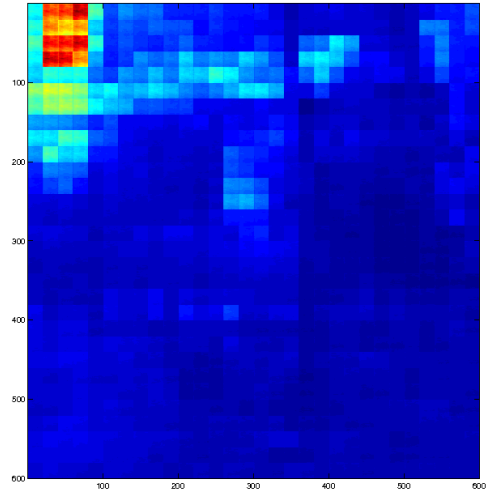
Figure 7: Original 170th Photo Image

Figure 8: r=1. % variance = 78.7749

3 Part c,d,e

Given that we are compressing a 600×600 to a $400 \times r$ matrix of eigen vectors(assume the eigen values vetor of length r occupies egligible space), we can simply store this eigen vector matrix, we attain a $\frac{400}{r}\%$ reduction. For example with $r = 1$ we are attaining a 400% reduction, with $r = 80$ it is 5%. With $r = 10$, it is 40%.
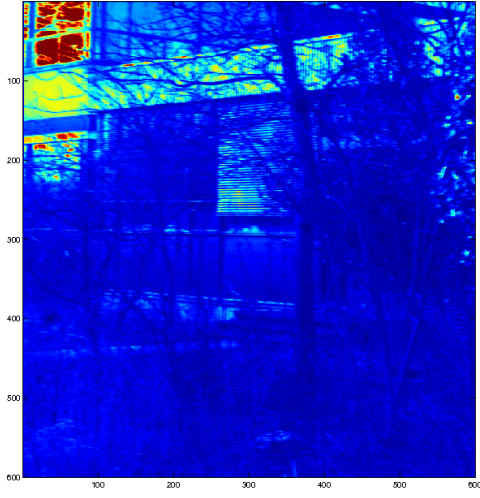
3.1 Photo Images

3.2 VTEC Images

Figure 9: Original 170th Photo Image
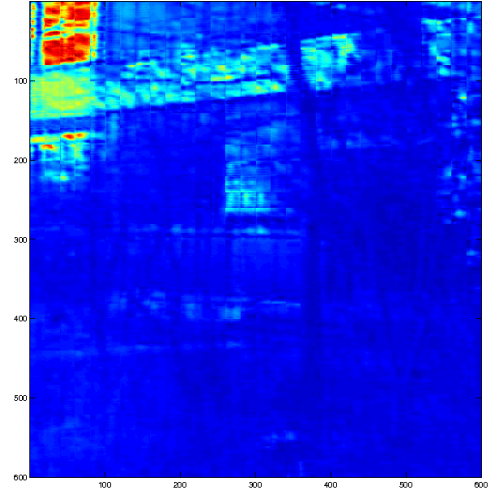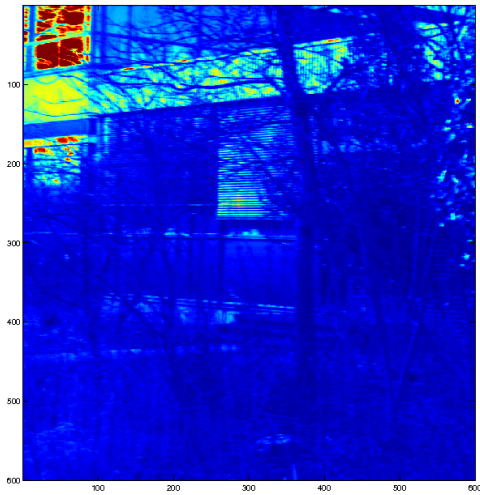

Figure 10: r=10. % variance = 92.1408
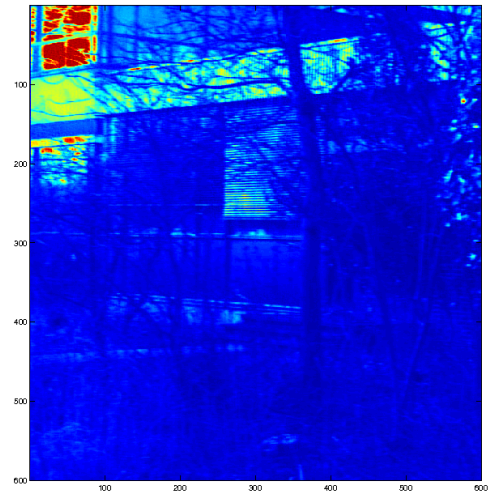

Figure 11: Original 170th Photo Image
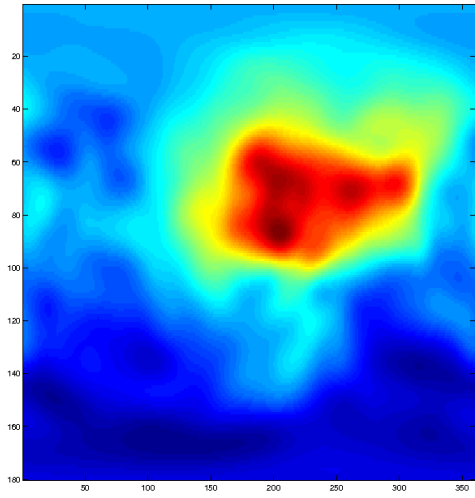

Figure 12: r=80. % variance = 99.3984
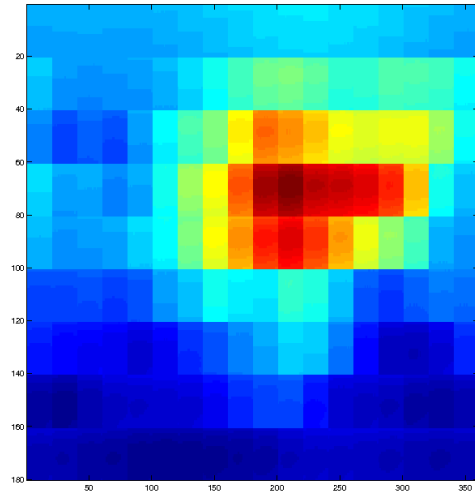
Figure 13: Original 170th VTEC Image
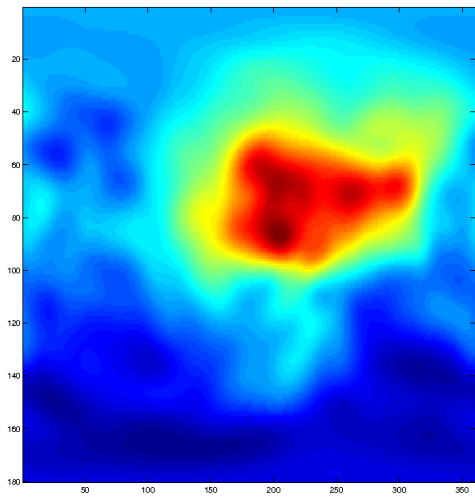

Figure 14: r=1. % variance = 95.3856
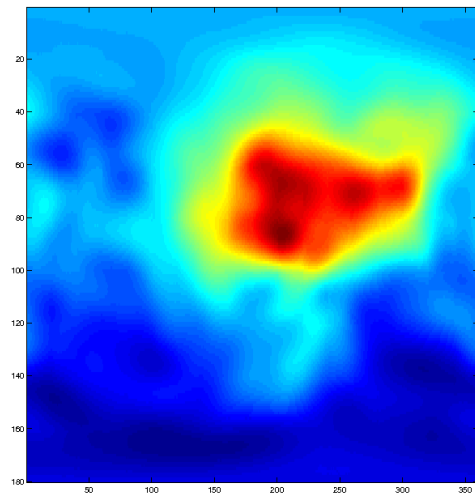

Figure 15: Original 170th VTEC Image
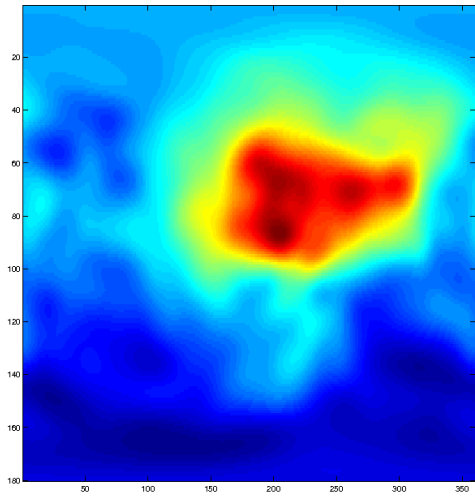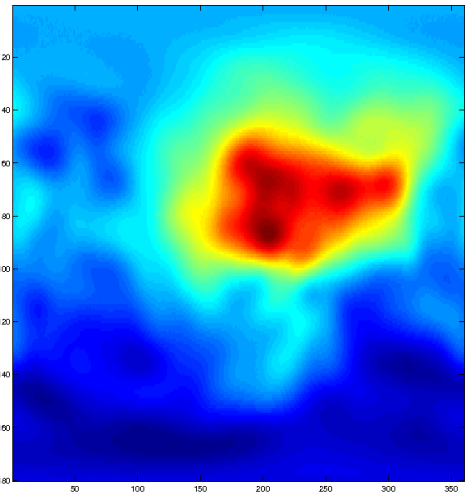

Figure 16: r=10. % variance = 99.9930

Figure 17: Original 170th VTEC Image

Figure 18: r=80. % variance = 99.9991