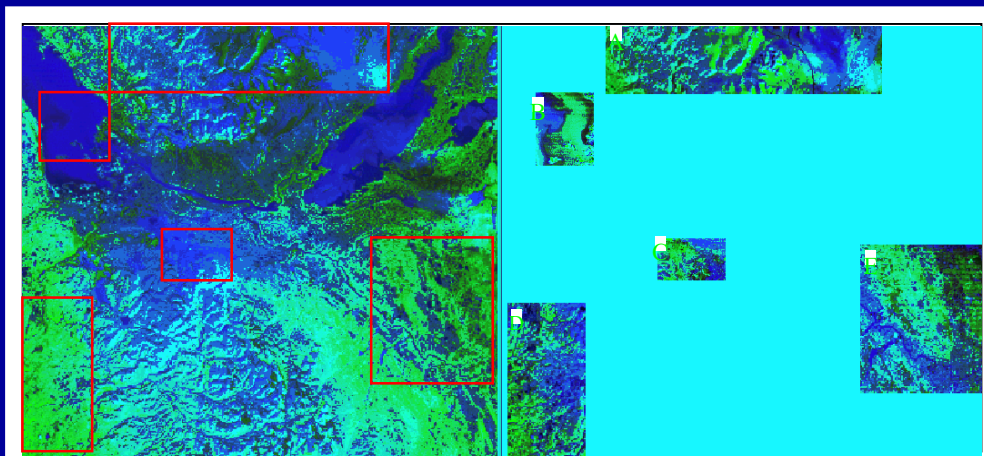


Principal Component Analysis of Subset Images: *an Evaluation Using a Landsat TM Image*



Arjun Aryal

EAS

Acknowledgement

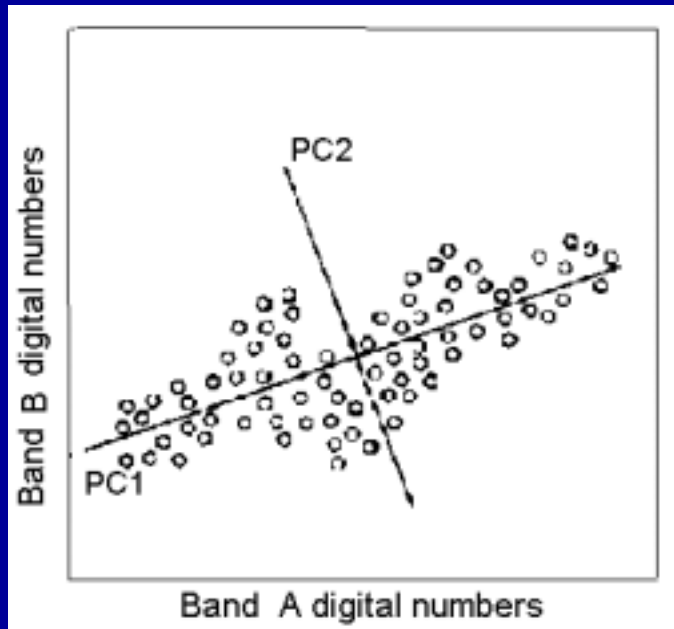
Dr C. Oppenheimer and Dr O. Tutubalina and Dr G. Rees

Cambridge University

Outline

- Introduction of the topic and objectives
- Data sets and subsets
- Discussion of the results
- Conclusion

Introduction of the topic and objectives



What is PCA?

PCA is a transformation which decorrelates data

Applications

- Data compression
- Image enhancement

$$\%_p = \frac{\text{eigenvalue} \lambda_p \times 100}{\sum_{p=1}^7 \text{eigenvalue} \lambda_p}$$

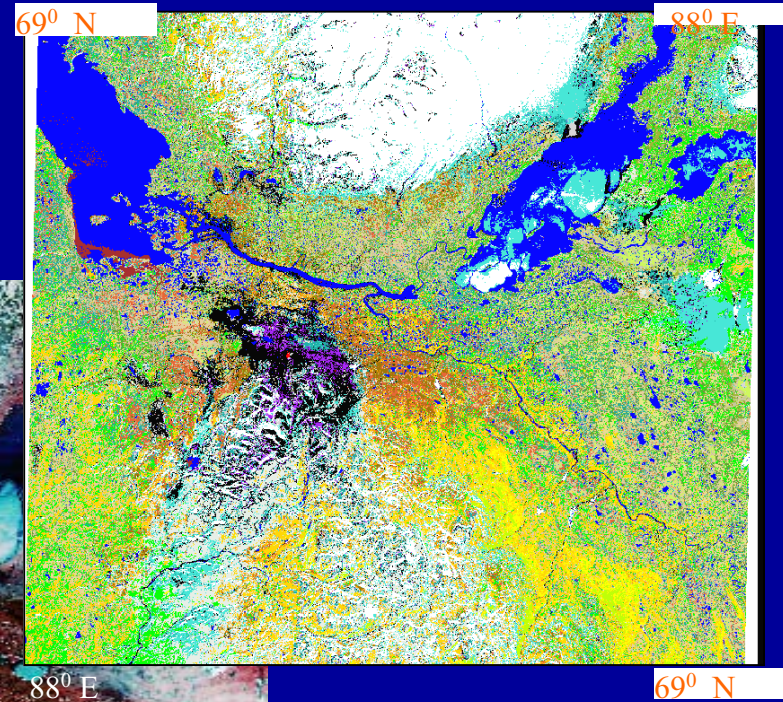
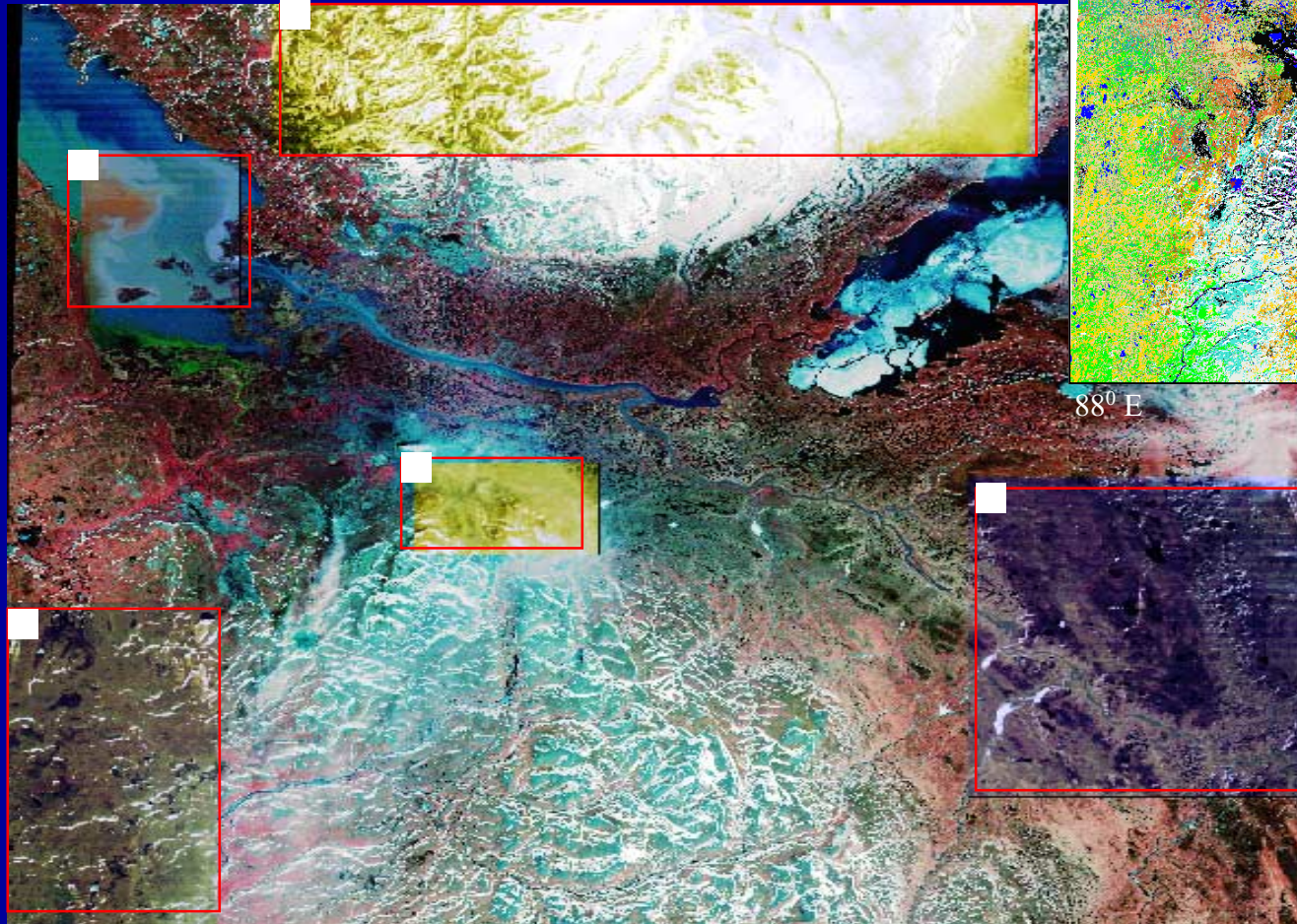
$$R_{kp} = \frac{a_{kp} \times \sqrt{\lambda_p}}{\sqrt{\text{Var}_k}}$$

Objective of the work

Evaluation of PCA of subset images and its applicability

Data sets and subsets

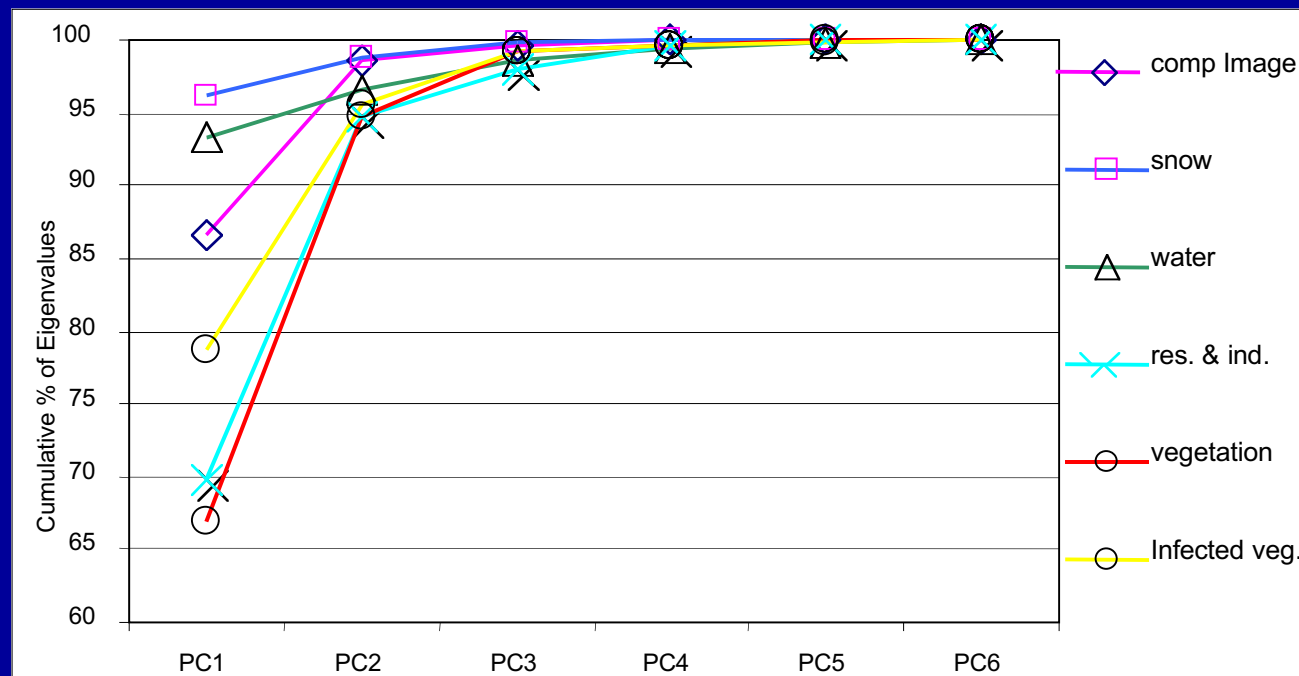
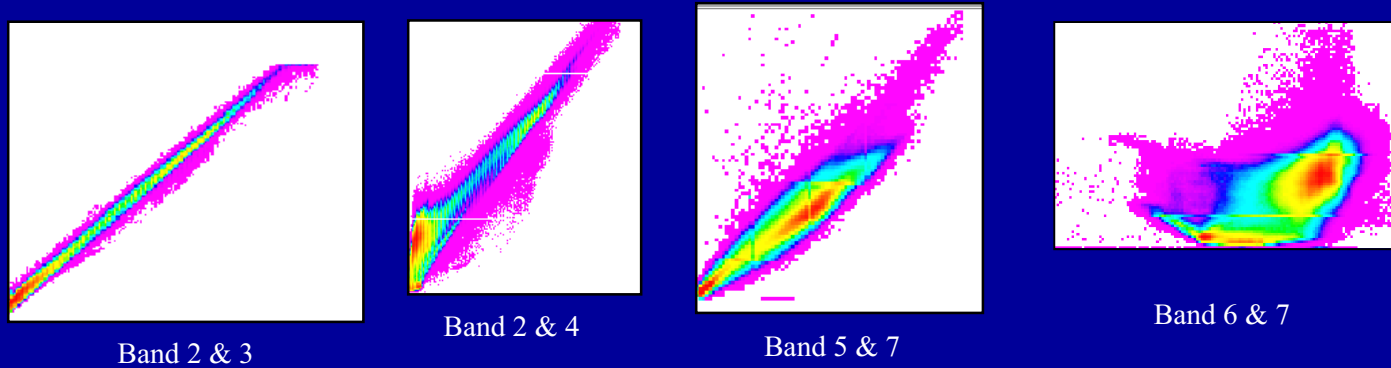
RGB colour composite (432). Subsets are in 321 RGB



Subsets

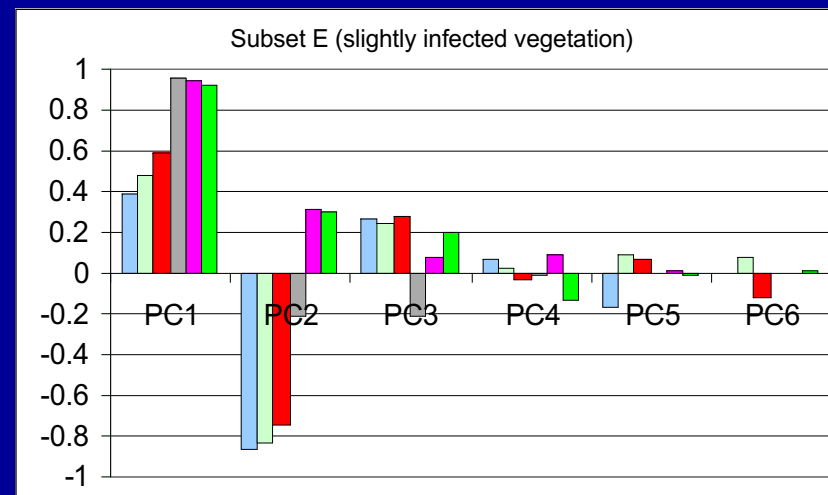
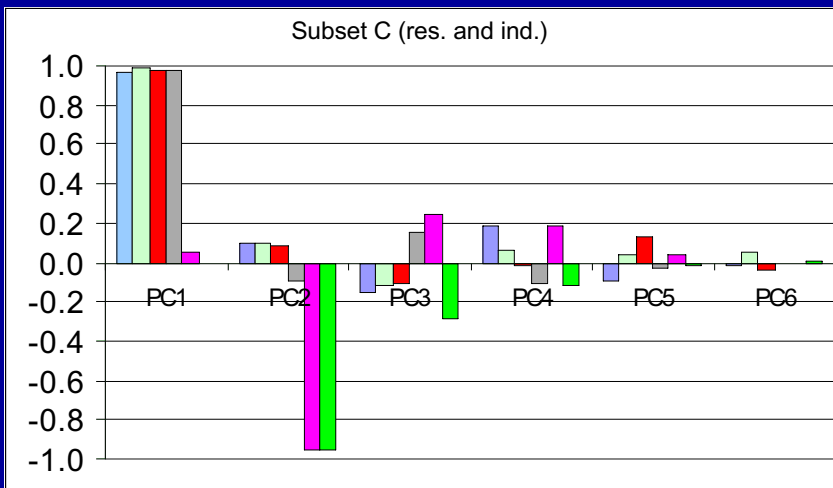
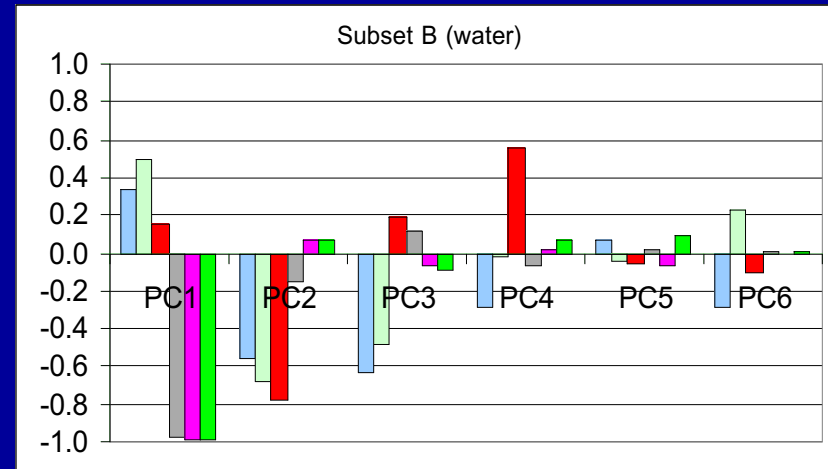
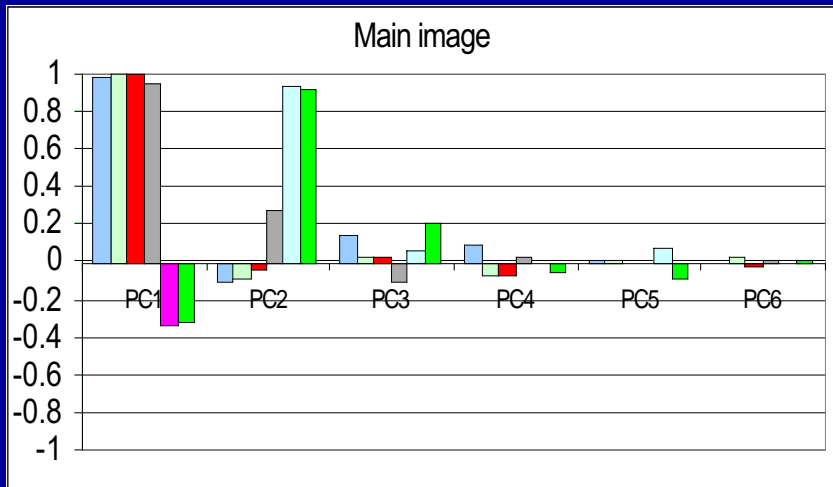
- A - snow area
- B - surface water area
- C - residential and industrial
- D - fresh vegetation
- E - moderately infected vegetation

Feature plots and eigenvalues of PCs



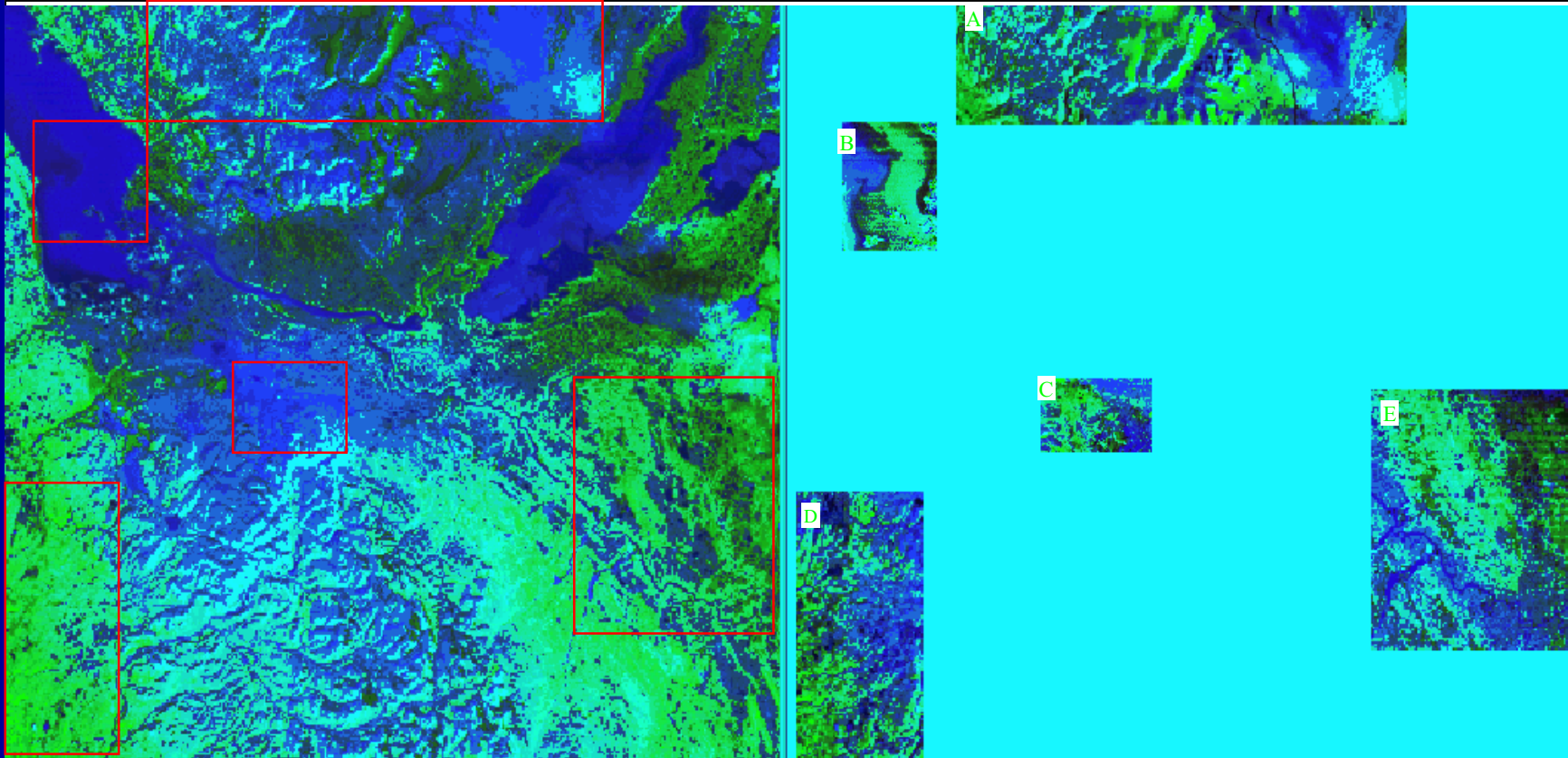
Plot of cum. % of eigenvalues

Loading factors (contribution of each bands to PCs)



■ Band 1
 ■ Band 2
 ■ Band 3
 ■ Band 4
 ■ Band 5
 ■ Band 6

Comparison of PC images



Principal component colour composite; PC1-red, PC2-green and PC3-blue

Conclusion

PCA as a data compression (dimensionality reduction)

data capture by PCs is irrespective of size of image (as each subsets are of different size), but is respective to the uniformity of land cover. The cumulative percentage of variances of the first three PCc, however, was not found to be significantly different.

PCA as an image enhancement

The PCA of subset images allows a more enhanced and interpretable images than the PCA output of the whole image of the area.

In practice, it could be beneficial to carry out PCAs of subset images if the work is focused on regional scale work and deals with local details of the selected areas.