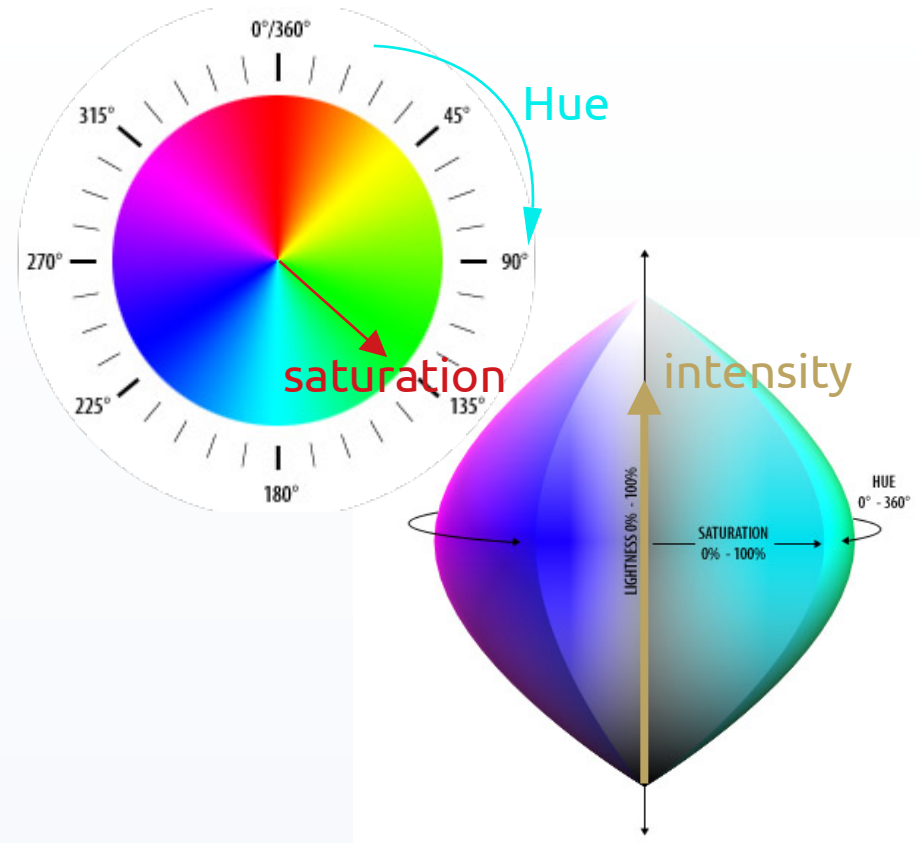


EGM702 – Photogrammetry and Advanced Image Analysis

Week 3, Part 5: Image Transformation

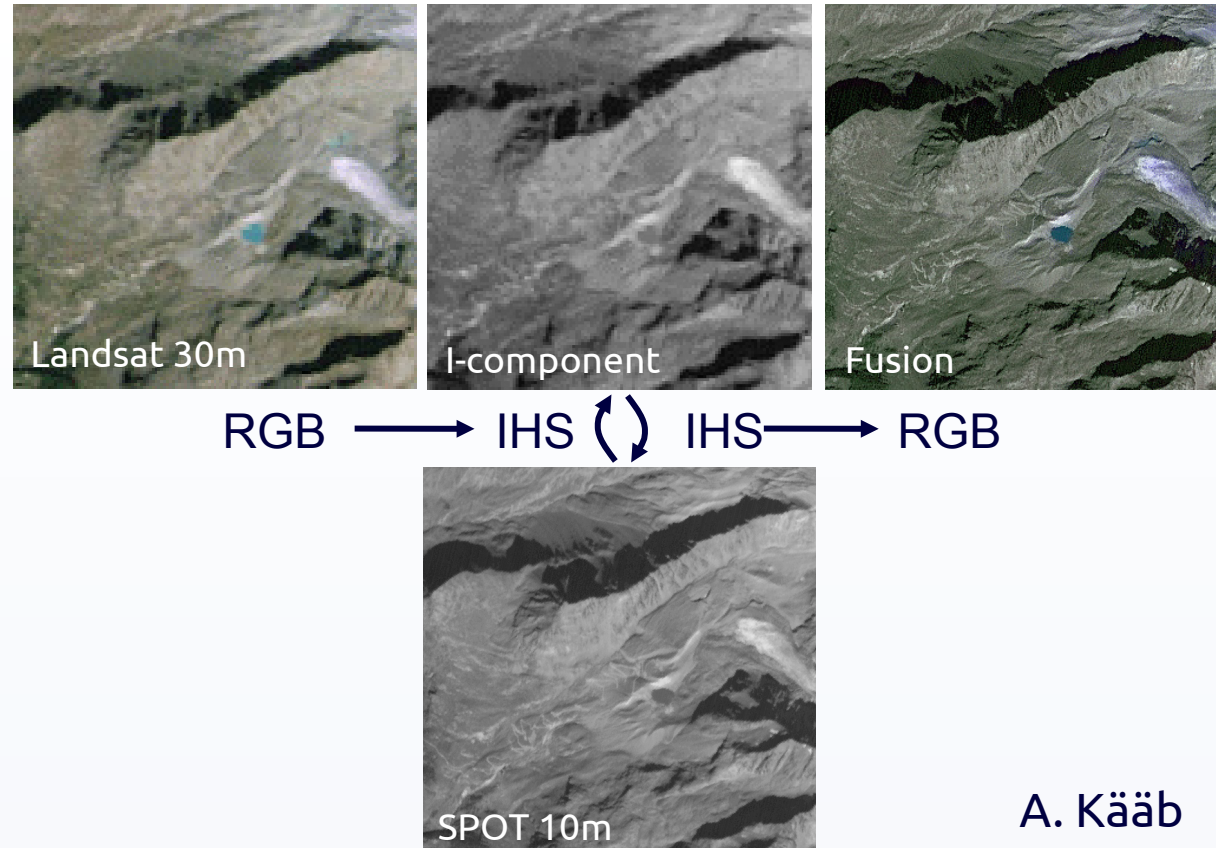
Intensity, Hue, Saturation (IHS)

- Sometimes also called Hue, Saturation, Lightness (HSL)
- Components:
 - **Hue**: the colour of the pixel
 - **Saturation**: how much white is mixed with colour
 - **Intensity/Lightness**: how bright the pixel is



Example: IHS Fusion

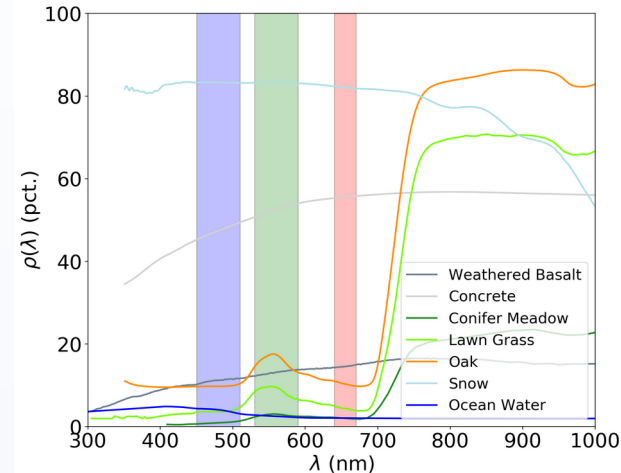
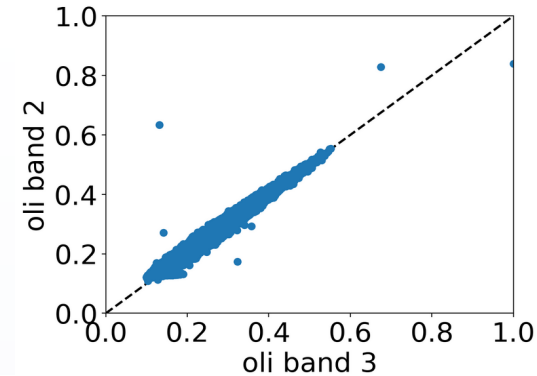
- Use high-resolution pan-chromatic data to 'sharpen' multispectral data
- Steps:
 1. Re-sample MS data to same resolution as Pan
 2. Transform MS to IHS
 3. Swap intensity for high-resolution pan
 4. Transform IHS to high-resolution RGB



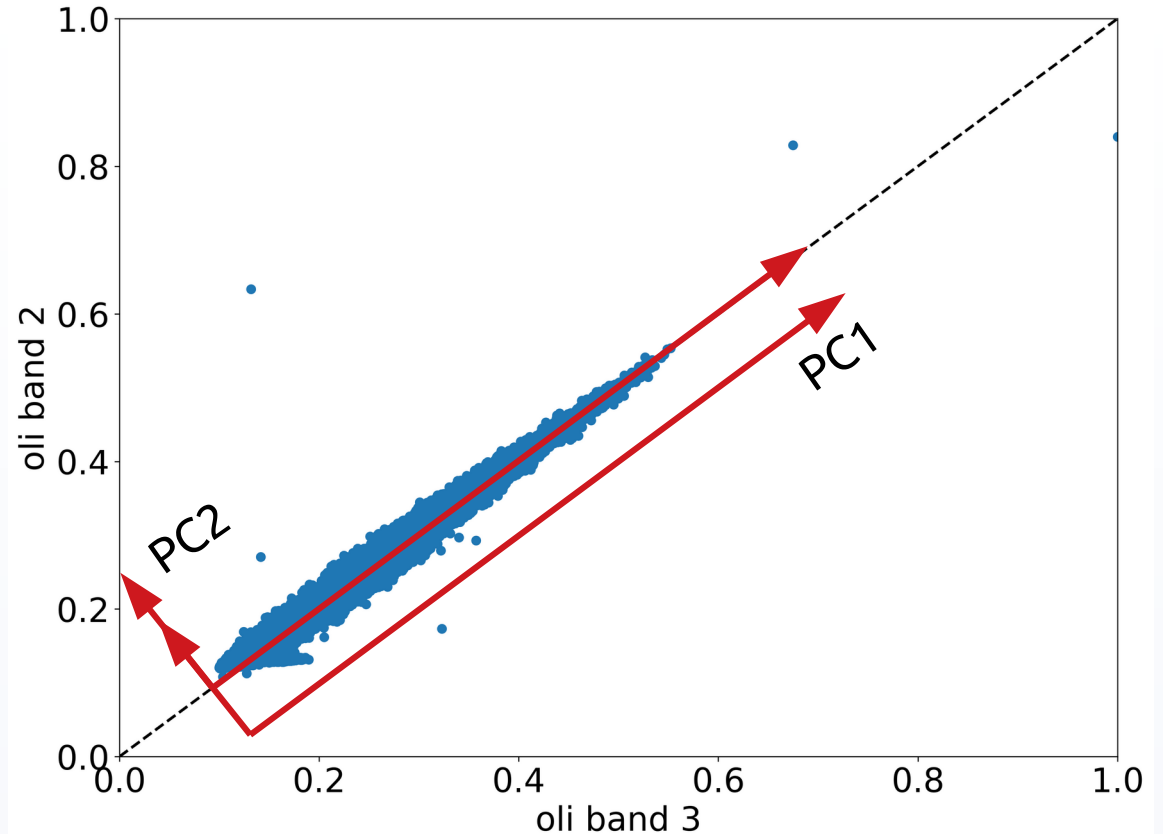
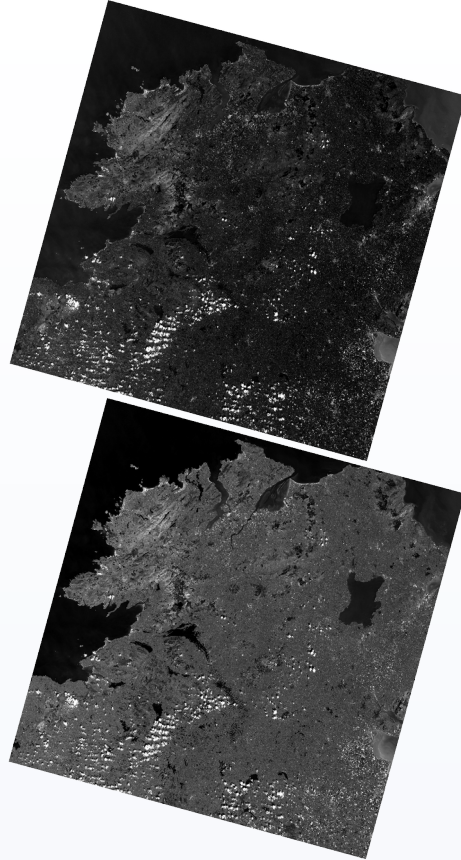
A. Kääb

Band correlation

- Many surfaces have similar reflectances in nearby wavelengths
- Results in **redundant** information being stored
- Can also make distinguishing different surfaces difficult
 - e.g., snow vs cloud, different kinds of vegetation
- Often, we want to maximise the differences between bands

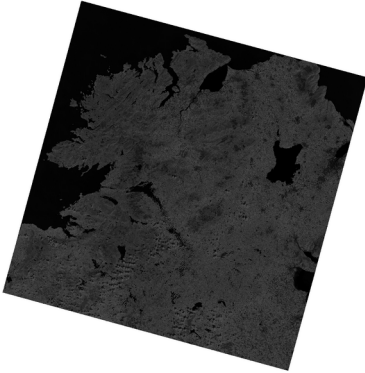


Principal Component Transformation

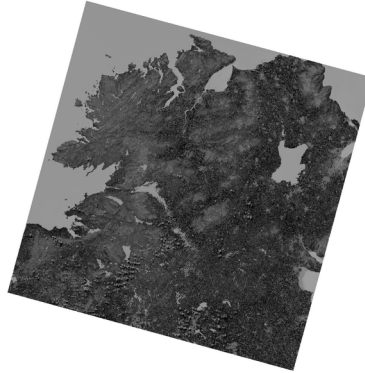


Principal components

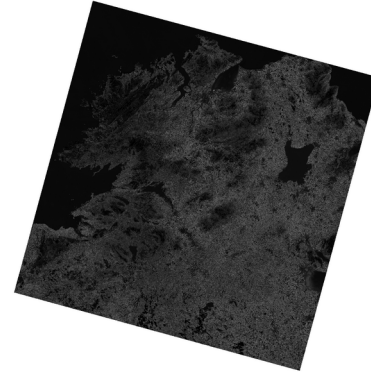
PC1



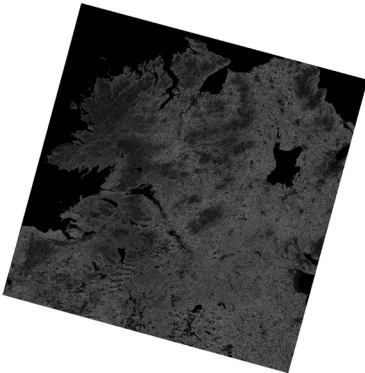
PC2



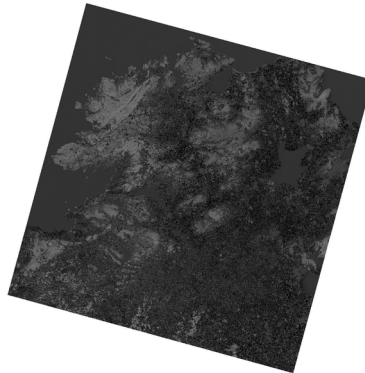
PC3



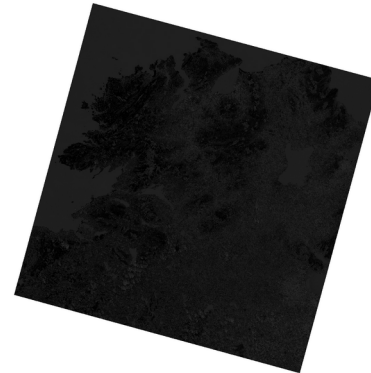
PC4



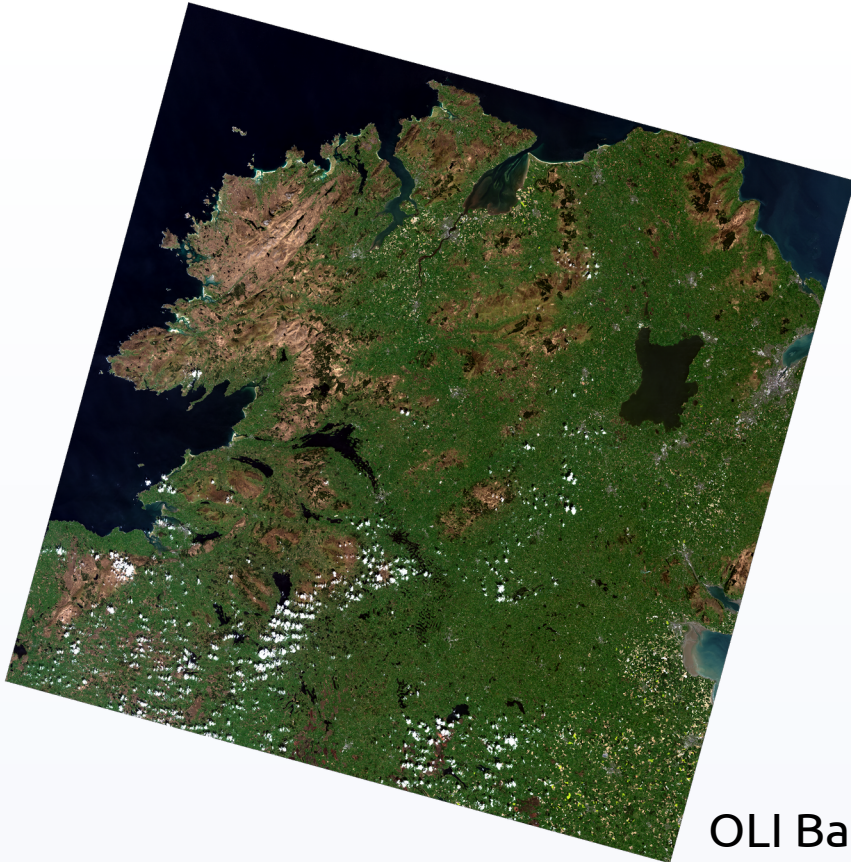
PC5



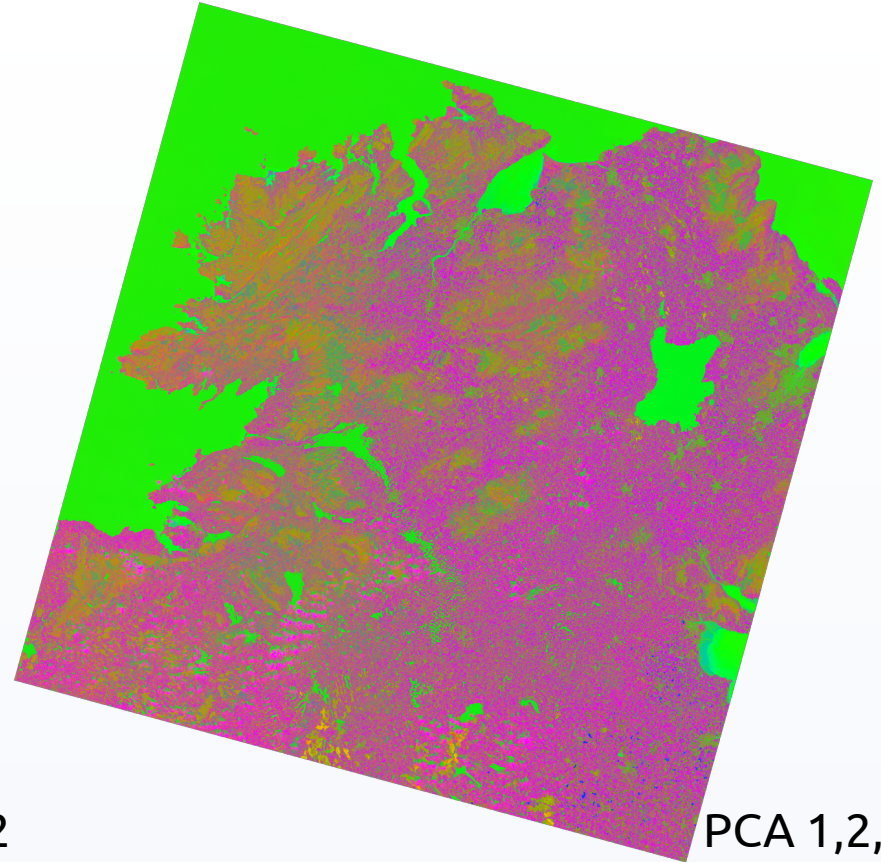
PC6



Decorrelation stretch

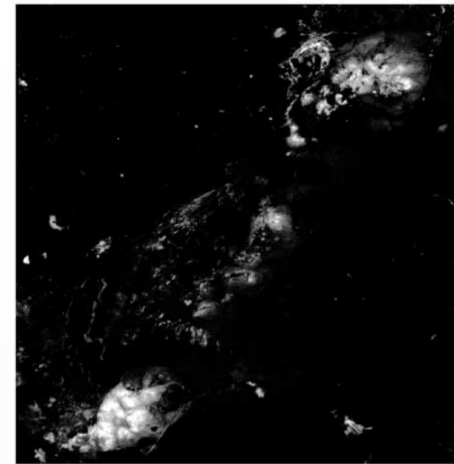


OLI Bands 4,3,2



PCA 1,2,3

- Feature Oriented Principal Component Selection (FPCS):
 - Start with known target signatures (1)
 - Examine PC to determine relative contribution from each band (2)
 - Select/Interpret PC using (1) + (2)
- Example (Crósta et al., 2003):
 - PC4: pos. B6, B7, neg. B1, B4
 - Kaolinite: $\uparrow B4, \uparrow B7, \downarrow B1, \downarrow B6 \Rightarrow \downarrow PC4$
- Useful for, e.g., geologic mapping



Kaolinite abundance

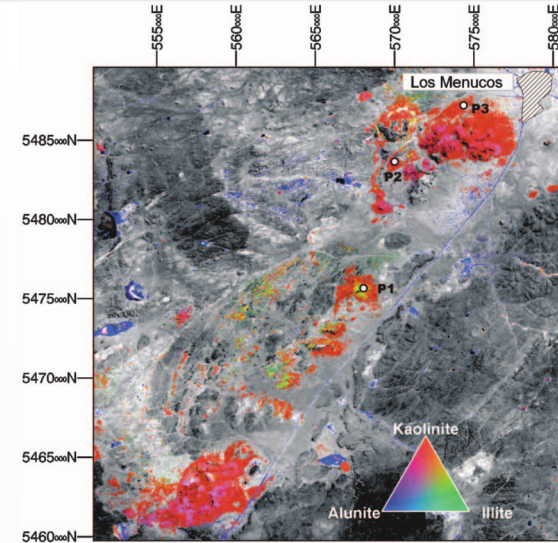


Table 2. Eigenvector statistics for ASTER bands 1, 4, 6 and 7. This band set was selected for identifying spectral response from kaolinite. PC4 will depict the pixels likely to contain kaolinite due largely to the spectral contrast between bands 4 and 6, minimizing spectral response from other surface materials.

	PC1	PC2	PC3	PC4
Band 1	0.667	-0.722	0.179	-0.039
Band 4	0.441	0.384	-0.258	-0.769
Band 6	0.443	0.217	-0.648	0.580
Band 7	0.406	0.532	0.694	0.266

- Transforming image data helps us make more use of the information
- Can be used to sharpen multispectral images
- Can be used to improve spectral differences between surface types
- By examining relative contributions of bands, can interpret PCs for different applications

- Lillesand, Kiefer & Chipman – Chapter 7
- Tempfli et al – Chapter 5.4
- Jensen – Chapter 8
- Crósta et al., 2003 [[Int. J. Remote Sens.](#)]
- HSL Color Space [[Khan Academy](#)]