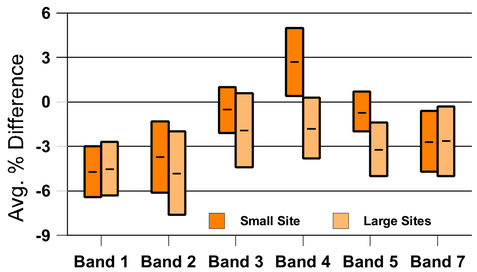
Adjacency Effects in High Resolution Imagery

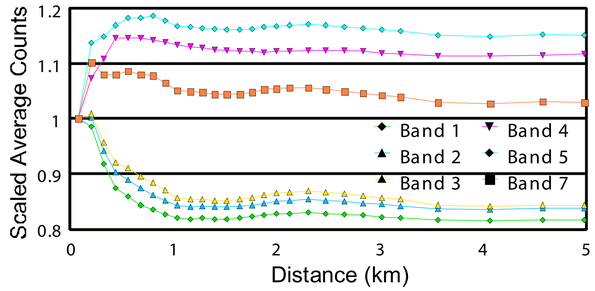
C. Cattrall* and K.J. Thome
Remote Sensing Group, Optical Sciences, University of Arizona
*Chris.Cattrall@opt-sci.arizona.edu (520) 621-4242

Landsat ETM+ example

Landsat 7 has been radiometrically stable since launch from multiple onboad approaches. With a large set of surface measurements to work with, it is an ideal test bed for observing the adjacency effect over small test sites.



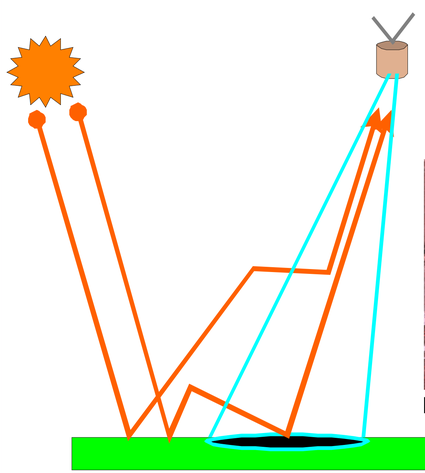
Average percent difference between preflight and reflectance-based calibrations for largeand small test sites (44 and 7 datasets, respectively). We suspect offset in Bands 4 and 5 are partly caused by adjacency effects from surrounding vegetation (see right).



Reflectance of surrounding area as a function of distance from the image pixel, normalized to site counts (3x3) average.

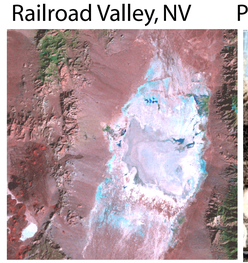
PREMISE: We believe we can see an adjacency effect in Landsat images of small, dark test sites with relatively bright surroundings. In this poster, we explore the possible adjacency effects which may be observed in Quickbird image of Pima County Fairgrounds near Tucson, where surroundings have higher reflectance than the dark target.

Definition: Radiance from surrounding pixels contribute towards the at-sensor radiance over a target pixel (below).



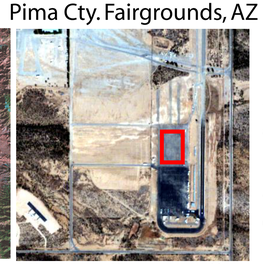
This adjacency effect is low when the surface reflectance of the target pixel is at least as great as the surrounding pixels (e.g., Railroad Valley), but greater when the target pixel reflectance is lower than that of the surroundings (e.g., PCFG).

Railroad Valley, NV

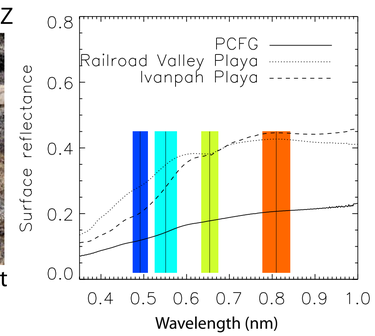


Low adjacency effect

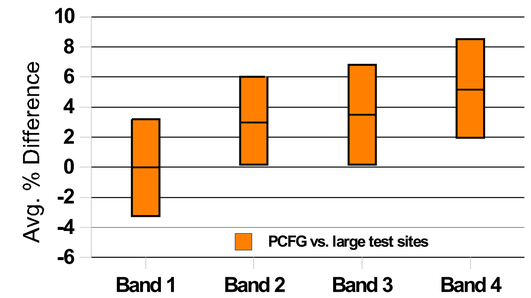
Pima Cty. Fairgrounds, AZ



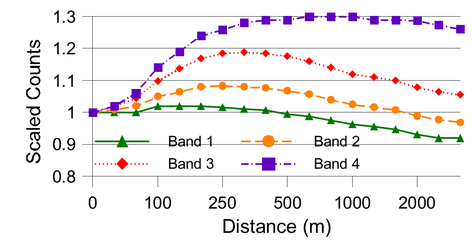
Higher adjacency effect (site outlined in red)



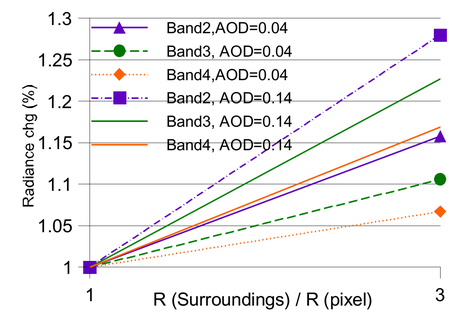
Quickbird test case - November 11, 2002 (Pima County Fairgrounds, Tucson, Arizona)



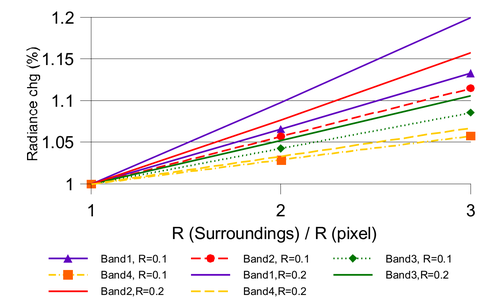
Percent difference between vicarious calibrations using large test sites and November 11, 2002 calibration at PCFG.



Reflectance of surroundings relative to test site, as a function of distance. Note increasing contribution of vegetation in red and NIR.



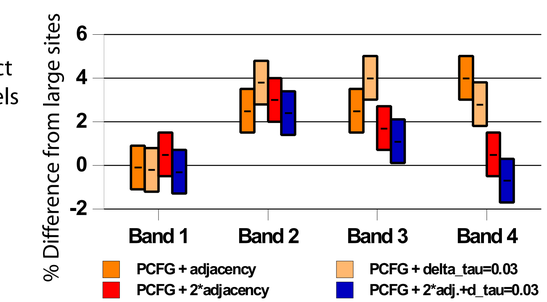
Change in observed radiance, correcting for adjacency effect at increased aerosol optical depth.



Change in observed radiance, correcting for adjacency effect, as a function of scaled surrounding reflectance, for R=0.1 and R=0.2.

RESULTS

Correction for the adjacency effect improves agreement with vicarious calibration coefficients from large test sites (right). Errors in aerosol optical depth have little effect upon the results. Increased reflectance from surrounding pixels (i.e., specific surroundings areas such as bright sand to NW of test site) increases the adjacency effect.



Percent difference between vicarious calibrations using large test sites and November 11, 2002 calibration at PCFG, correcting for adjacency effects and possible error in measured aerosol optical depth.

CONCLUSIONS

- Adjacency effects may explain discrepancies in vicarious calibration results from small test sites.
- This effect strongly depends on wavelength.
- Knowledge of appropriate reflectance of surroundings is crucial.