Earth Sciences Sector

Reducing Canada's vulnerability to climate change

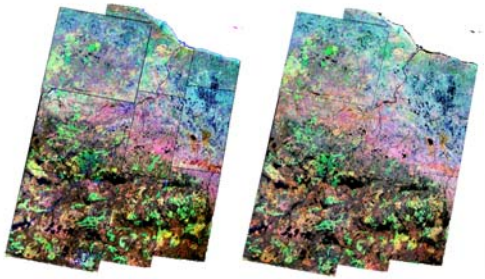
Methodological Development for Northern Land Cover Mapping and Carbon Accounting

[1]Olthof, I., [2]Fraser, R. and [2]Chen, W.

1 Noetix Research Inc.
2 Canada Centre for Remote Sensing

Abstract

Canada's northern environments are expected to undergo unprecedented change in the coming century due to climate change and northern development. Monitoring these changes has become a priority of the Canadian government to support climate change studies and carbon modeling, and to provide baseline information for national parks and resource management. Medium resolution (~30m) satellite data is required for northern mapping and monitoring because it provides the detail necessary to capture significant features such as lakes and wetlands (Stow et al., 2004). Change indicators may also be too variable or subtle at the permanent plot level, thereby requiring remote sensing to detect changes at the regional level, for example, in the forest-tundra boundary. This poster describes Landsat image normalization for northern mapping, and a field campaign that will be conducted along the Dempster highway in the summer of 2004.



Radiometeric normalization (Olthof et al., in prep.)

Problem: Shortcomings associated with traditional overlap and invariant target Landsat normalization methods over northern regions have motivated the development of a new approach

Solution: Use coarse (1km) resolution SPOT VGT composite data as a reference for normalization

1. Landsat is resampled to 1km resolution

2. A random sample of spatially coincident Landsat, SPOT pixels is generated for each Landsat scene

3. Robust regression that is sensitive to ~29% outliers, called Thiel-Sen is used to produce normalization function

4. Scene wise normalization functions are applied prior to mosaicing

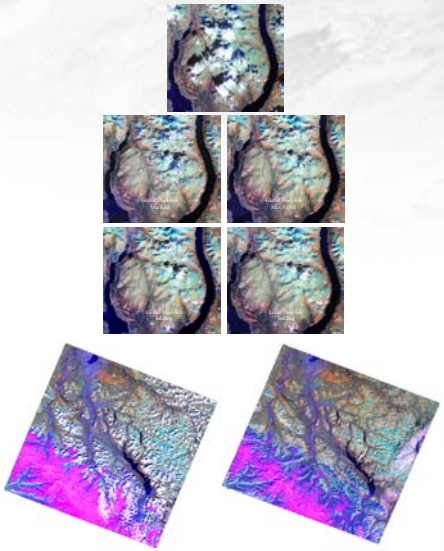


Image compositing

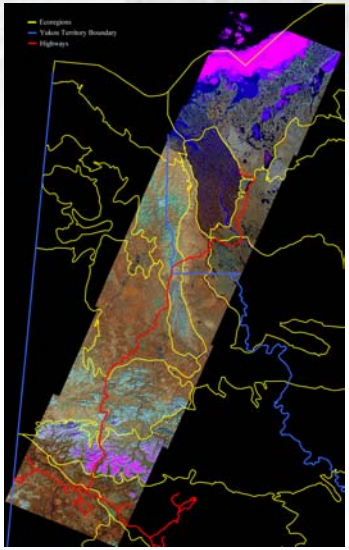
Problem: Cloud cover is frequent in the far north (Hope et al., 1999)

Solution: Multi-temporal Landsat compositing is being evaluated to produce cloud-free data

1. Multi-temporal set is normalized using Thiel-Sen applied to clear sky data

2. Standard Maximum Value Compositing (MVC) is being evaluated and compared to a) cloud infilling after scene-wise nomalization and b) infilling each cloud separately after local normalization using Thiel-Sen and pixels surrounding each cloud

3. Radiometric consistency and land cover classification accuracy will be evaluation criteria



Dempster Highway transect field campaign

736km long highway that runs north from Dawson, Yukon to Inuvik, NWT, traversing 10 northern ecoregions

Transect will be stratified using Landsat data, and within each stratum, airphotos and high-resolution imagery will be acquired to cover landcover types it contains.

Field plots will be visited and imaged on the ground and vegetation will be described.

Direct and indirect biophysical measurements will be made to quantify components of the carbon cycle.

References

Hope, A., Coulter, L. and Stow, D. (1999). Estimating lake area in an arctic landscape using linear mixture modelling with AVHRR data. *International Journal of Remote Sensing, 20*: 829-835.

Olthof, I., Pouliot, D., Fernandes, R.A. and Latifovic, R. ETM+ radiometric normalization comparison for mapping remote areas. *Remote Sensing of Environment.* In preparation.

Stow, D.A., Hope, A., McGuire, D., Verbyla, D., Gamon, J., Huemmrich, F., Houston, S., Racine, C., Strum, M., Tape, K., Hinzman, L., Yoshikawa, K., Tweedie, C., Noyle, B., Silapswan, C., Douglas, D., Griffith, B., Jia, G., Epstein, H., Walker, D., Daeschner, S., Petersen, A., Zhou, L. and Myneni, R. (2004). Remote sensing of vegetation and land-cover change in Arctic Tundra Ecosystems. *Remote Sensing of Environment, 89*: 281-308.