

Earth Sciences Sector



Groundwater Earth Observation and Thematic Research project

Groundwater Mapping Program



GEOBIA, 2008
Pixels, Objects, Intelligence: Geographic Object Based Image Analysis for the 21st Century


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With the collaboration of the Canadian Space Agency



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Program Description

Brief description of the context and objectives



Groundwater Mapping Program:

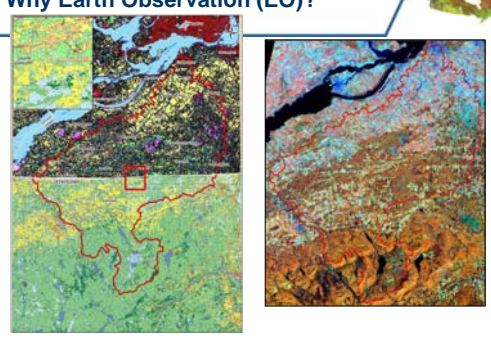
- ESS Program as part of the Earth Sciences for a Clean Environment Priority
- This is the **second phase** of a continuing program
- The "Groundwater Program" first phase, ran from 2003-2006
- A 2nd Phase ("Mapping") was approved for 2006 to 2009

• Purpose
Identify, map and assess prioritized **regional-scale aquifers of Canada** to estimate groundwater availability, vulnerability and sustainability

• Objective
Advance the National Groundwater Inventory, to the point where decision-makers will have access to sound science advice in the form of a **robust information base**


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Why Earth Observation (EO)?



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
EO Objectives & Approach



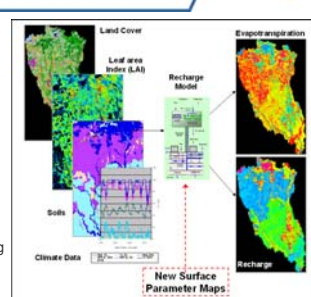
- The goal is toward the development of Earth Observation (EO) **applications** and **products**; actually used in groundwater modeling activity or help fill gaps in current groundwater mapping efforts.
- The purpose is to **optimize/sustain actual operational products** and to develop **new hydrogeological prototype products** in order to improve and/or support the study of groundwater.
- To **develop** methods, tools and best practice guidelines to enable Private and Public Sectors to map aquifers.

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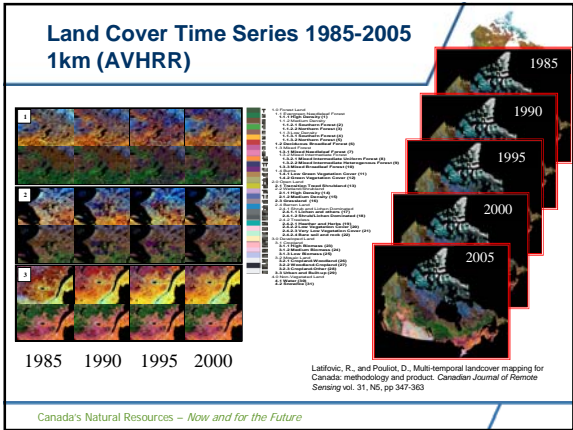
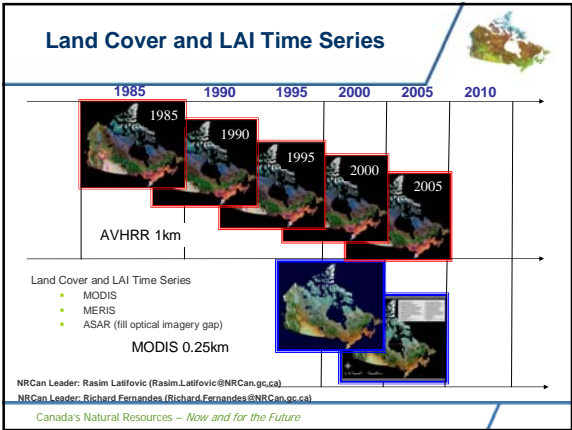
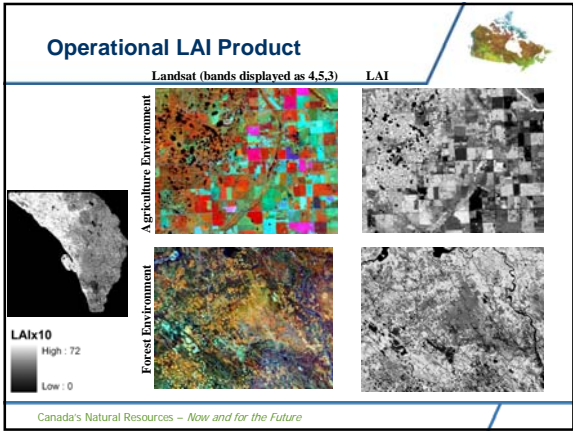
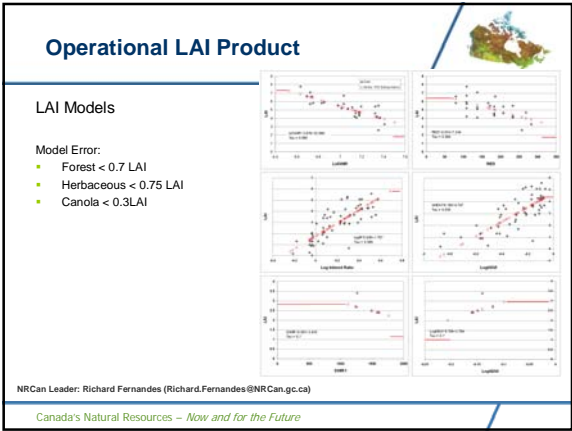
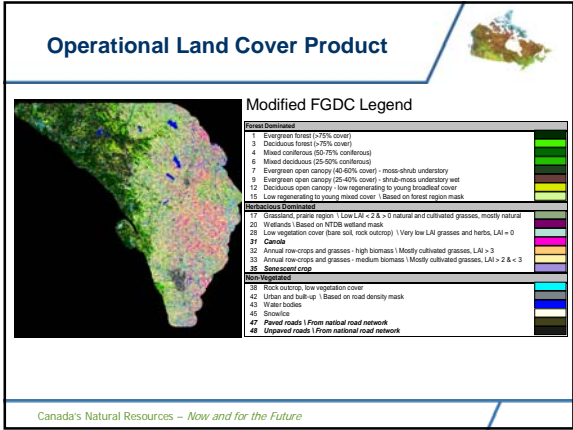
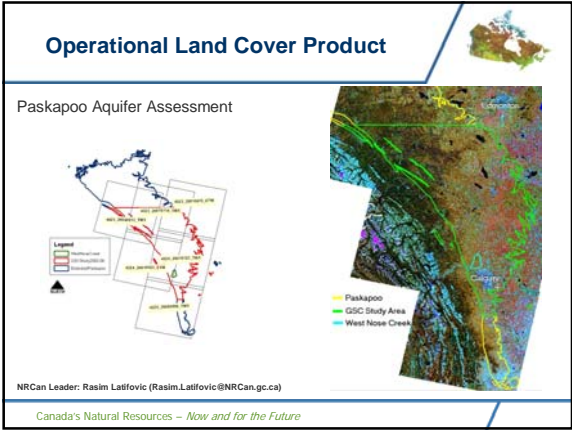
Recharge assessment using surface parameter maps



- Land Cover
- Leaf Area Index (LAI)
- Land Cover and LAI Time Series
- Soil Moisture Pattern
- Soil Water Sensitivity
- Specific Land Use Mapping



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Soil Moisture Pattern

SAR + Doppler

Radar Difference Map (RADARSAT-1)
May 14 – Apr 9, 2007

NRCan Leader: Eric Grunsky (Eric.Grunsky@NRCan.gc.ca)

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Soil Water Content Sensitivity (RADAR)

The Target: Water content variation
Intensive Synthetic aperture radar (SAR) monitoring

NRCan Leader: François Charbonneau (Francois.Charbonneau@NRCan.gc.ca)

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Soil Water Content Sensitivity (RADAR)

Preliminary result: Soil Surface Water Content Sensitivity Map

Relative Index

Water Content Sensitivity Map

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Specific Land Use Mapping Horticulture and Viticulture

Initial Feasibility Study - Convair: Wishart distribution to discriminate orchard from forest based on the level of volumetric scattering estimated by the Freeman and Durden decomposition

NRCan Leader: Stéphane Chailfoux (Stephane.Chailfoux@NRCan.gc.ca)

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Specific Land Use Mapping Horticulture and Viticulture

Implementation of the Okanagan Valley Super Site, Kelowna, British Columbia: RADARSAT-2

Vineyard

Apple

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Potential benefits of using GEOBIA for surface parameters estimation

- By providing a quantitative basis to spatially extend field data, EO data can **improve the quality** and **reduce the uncertainty** of spatially distributed hydrogeological models.
- Within this scope, GEOBIA methods may **further improve the results**, especially in situations where pixel-based surface parameter retrieval is difficult.
- After having surveyed the limited but growing literature addressing the use of GEOBIA methods for estimating surface parameters, we found that the majority of the **studies report better results** than with pixel-based approaches.

Reference: A literature review on the use of GEOBIA methods for estimating surface parameters within hydrogeological studies prepared by Geoffrey J. Hay (PhD) and Guillermo Castilla (PhD)

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Potential benefits of using GEOBIA for surface parameters estimation



- However, GEOBIA may not be suited for phenomena that vary continuously at the operational scale, or for parameters weakly related to the available EO data. Notwithstanding, there are **good prospects** for the successful application of GEOBIA within water-related studies.
- In the case of **SAR** imagery, a GEOBIA approach based on image segmentation **may facilitate** the inference of geophysical parameters such as surface roughness and soil moisture, since model inversion techniques are more efficient when applied on the backscatter characteristics of large homogeneous regions than on a pixel-by-pixel basis.
- GEOBIA is more **cost-effective** than interpretation or per-pixel classification methods, and therefore is particularly suited for large-area products.

The End



Overtime, questions, and closing remarks

EO **fact sheet** 'Surface parameter maps used for recharge modeling through integrated Earth Observation (EO)' included in GW Mapping program website.
http://ess.nrcan.gc.ca/gm-ces/factsheet/surface_e.php

EO **fact sheet** 'New surface parameter products used for recharge modeling through modern EO sensors' included in GW Mapping program website.
http://ess.nrcan.gc.ca/gm-ces/factsheet/recharge_e.php

Groundwater next Phase:
April 1, 2009 (5 years)

- Many Thanks

