



Enhancing Resilience in a Changing Climate/ Renforcer la résilience en face de changements climatiques
Earth Sciences Sector /Secteur des Sciences de la Terre



Developing AVHRR and MODIS Long-Term Data Records at the Canada Centre for Remote Sensing (CCRS)

**A.Trishchenko, R. Latifovic, Y. Luo, B. Park,
K.Khlopenkov, S.Wang, R.Fernandes**

**Canada Centre for Remote Sensing, CCRS
Earth Sciences Sector
Natural Resources Canada**



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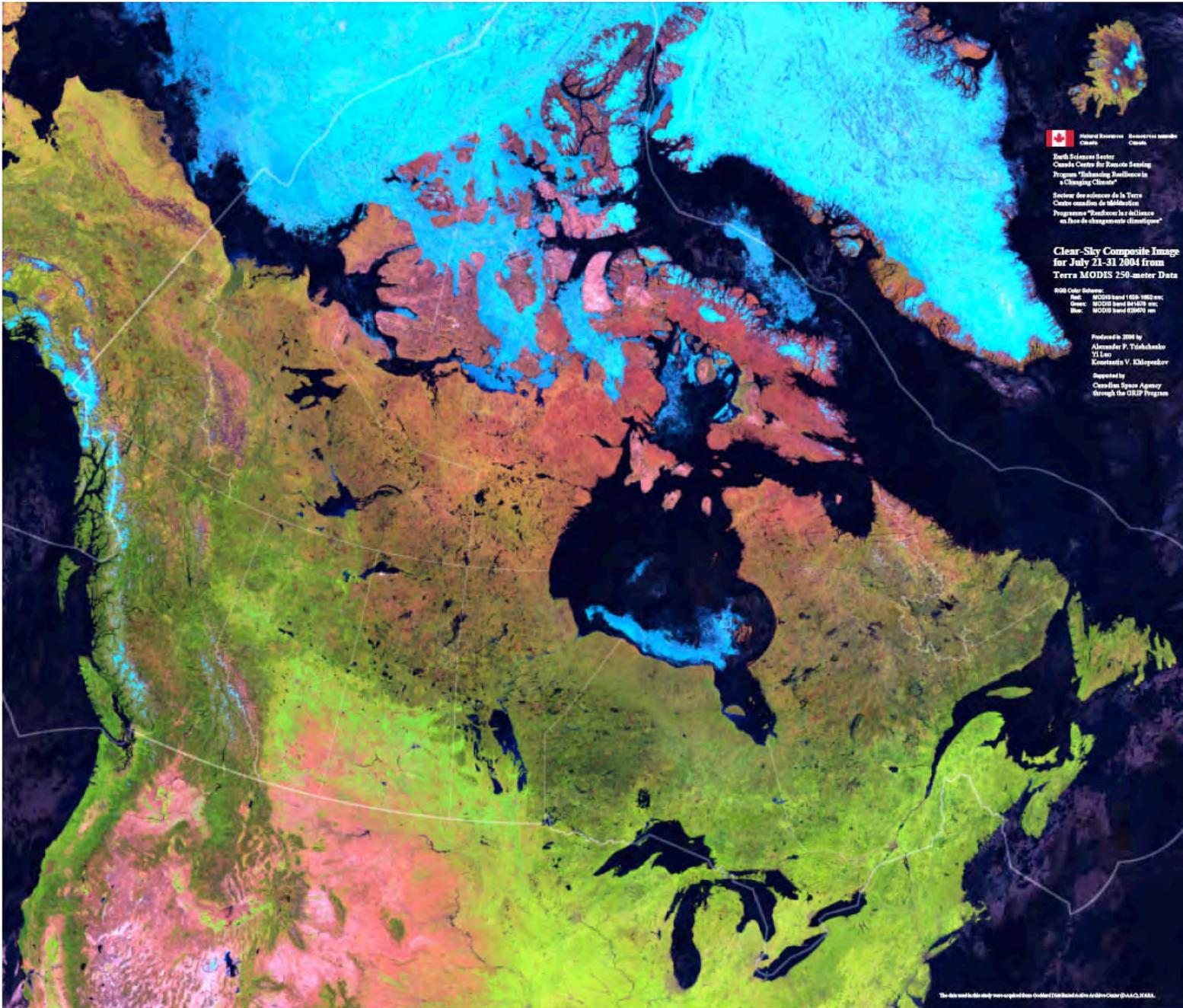
Objectives of CCRS Project

- It is a component of project **J35** “Earth Science for National Scale Characterization of Climate Change Impacts on Canada’s Landmass” of the **ERCC** Program
- Goal is to produce long-term consistent satellite based time series of land products suitable for climate change impact studies.

According to WMO approach a 30 year time span is required to produce climate norms.

Major requirements: 1km - AVHRR, 250m – MODIS
10-day intervals (3 per month)
LCC projection






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 Earth Science Sector
 Canada Centre for Remote Sensing
 Program "Understanding Impacts in a Changing Climate"
 Secteur des sciences de la Terre
 Centre canadien de télédétection
 Programme "Recherche et réflexion en face de changements climatiques"

Clear-Sky Composite Image for July 21-31 2004 from Terra MODIS 250-meter Data

RGB Color Scheme:
 Red: MODIS band 1 (630-1000 nm)
 Green: MODIS band 2 (645-865 nm)
 Blue: MODIS band 3 (660-1240 nm)

Produced in 2006 by
 Alexander P. Trishchenko
 & Konstantin V. Khlopenkov
 Sponsored by
 Canadian Space Agency
 through the ORIP Program

The data used in this study were supplied from the Global Data Base for the Arctic Circle (GADBAC) team.

Canada-wide coverage is available now at 250m spatial resolution using MODIS data processing at CCRS July 21-31, 2004

Trishchenko et al., 2006



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Parameters of terrestrial ecosystems required by Global Climate Observing System (GCOS) (2006) (GCOS-107, WMO/TD-1338)

Altogether, there are 16 parameters identified by GCOS that can be retrieved from satellite data from observations in optical, thermal and microwave bands. We are presently targeting 11 parameters listed in the Table below. Albedo is one the most fundamental parameters

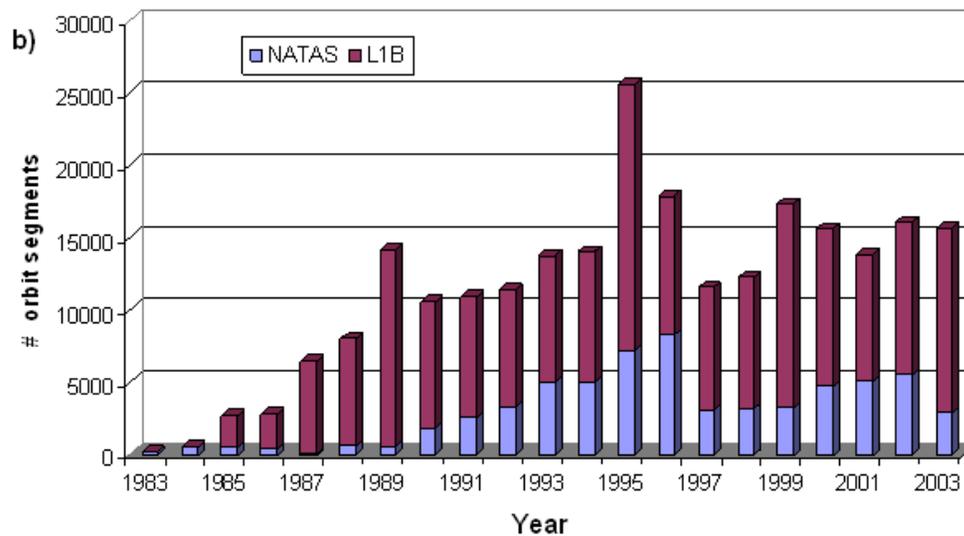
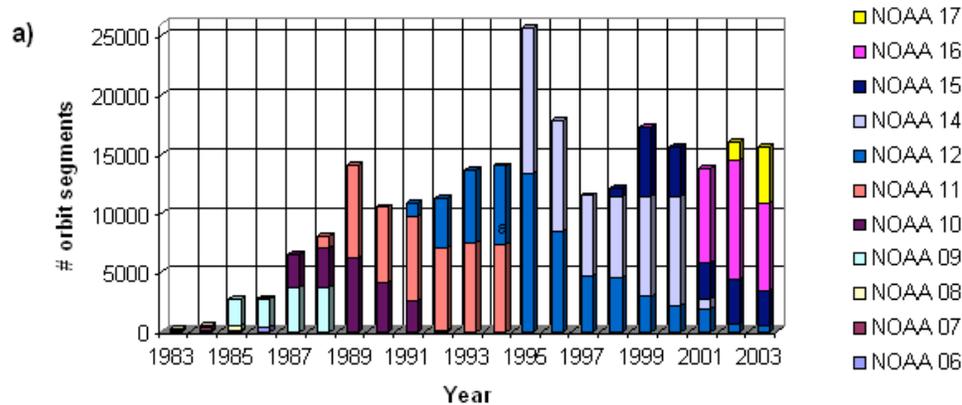
Parameter	Spatial resolution	Obs. cycle	Req. Accuracy	Min accuracy
Surface Albedo	250m	1day	5%	10%
Surface radiation budget (SW and LW)	25km	3h-1day	5Wm ⁻²	10Wm ⁻²
Land cover (incl. vegetation type)	10m-1km	1yr	5%	10%
Leaf Area Index (LAI)	250m	1day	5%	10%
Fraction of Absorbed Photosynthetically Active Radiation (fAPAR)	0.1-2km	10day	5%	10%
Snow/ice cover	250m	1day	5%	10%
Fire disturbance	250m	30d	5%	10%
Biomass	250m	1d	5%	10%
Wetland extent	250m	7d	5%	10%
Glaciers and ice caps extent *	0.01-0.1km	1yr	5%	10%
Lake level/extent*	0.01-0.1km	7d	5%	10%

* Presently can be derived at 0.25-1km spatial resolution





AVHRR 1-km data

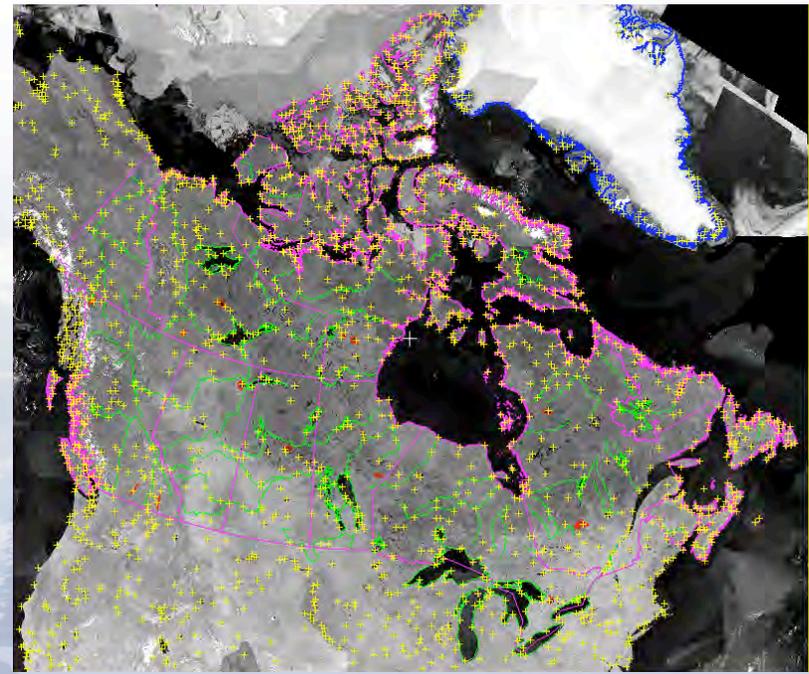
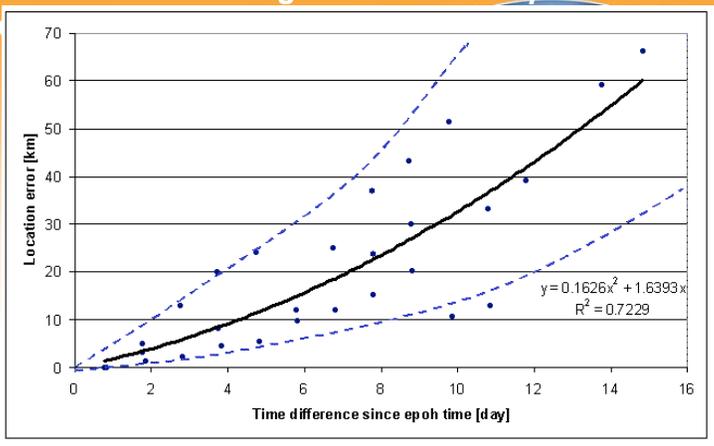
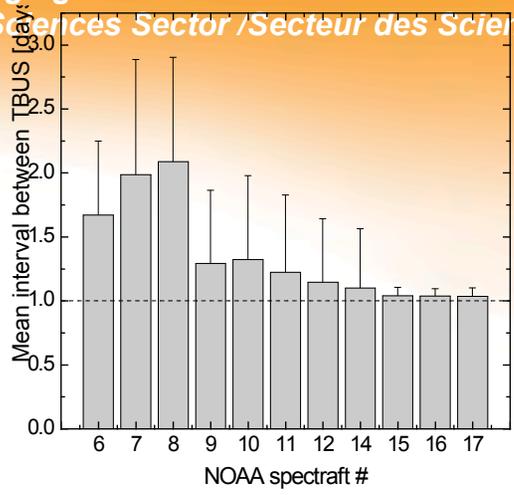
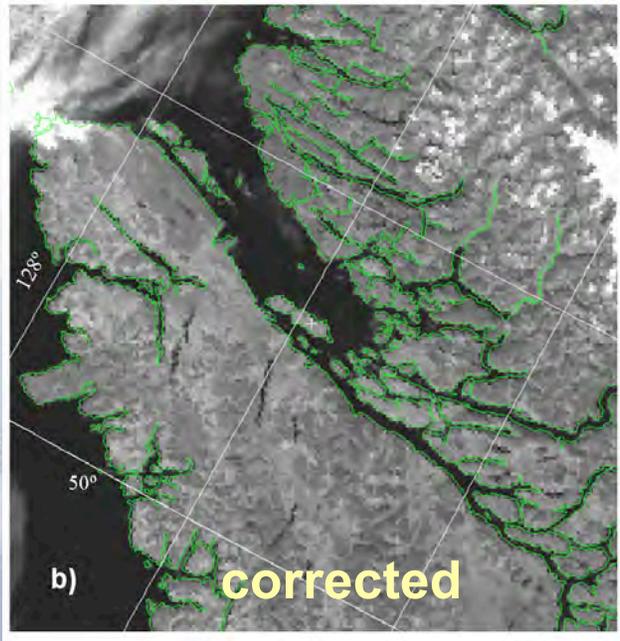
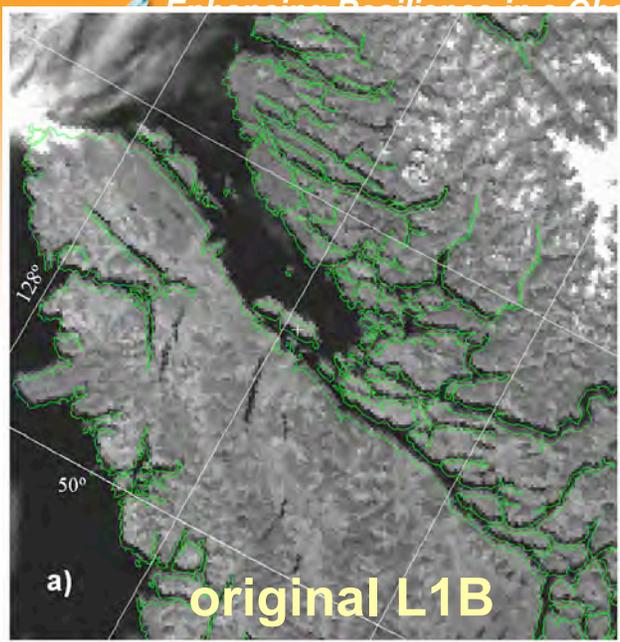


**~ 20 TB of
raw/L1B data
HRPT and LAC
~300,000
scenes over
Canada**

processed with new
CCRS developed
data processing
system

**Sources of data:
NOAA CLASS
CCRS PARS**





New:
 GCP database
 cloud detection
 compositing
 atm correction
 product algorithm
 60 CPU system



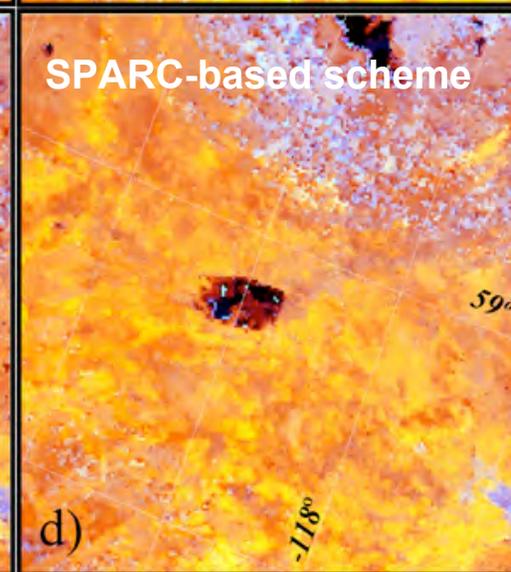
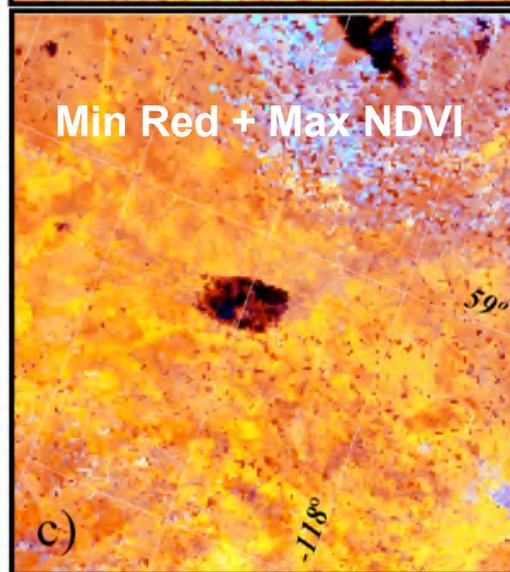
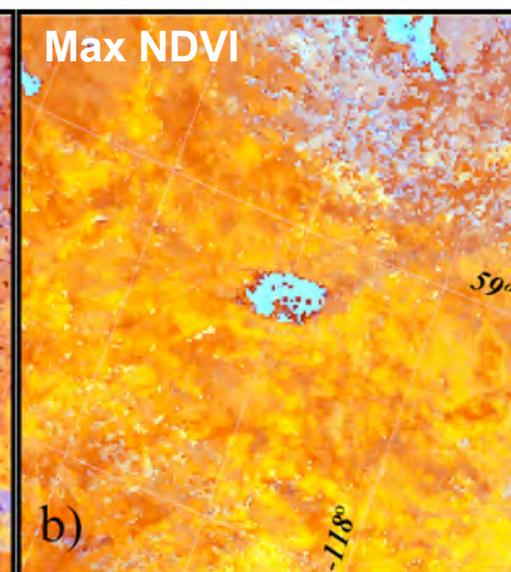
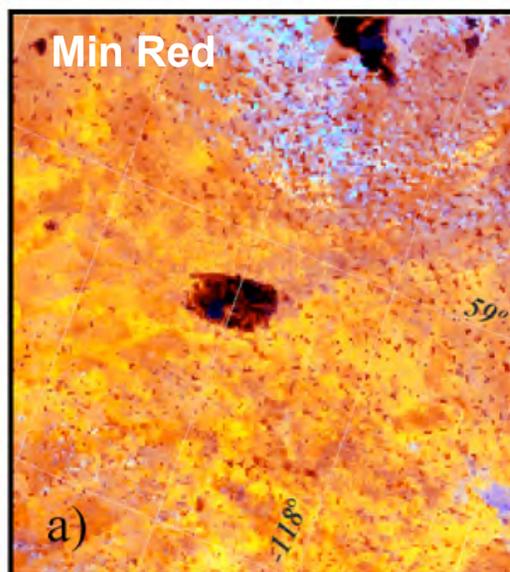
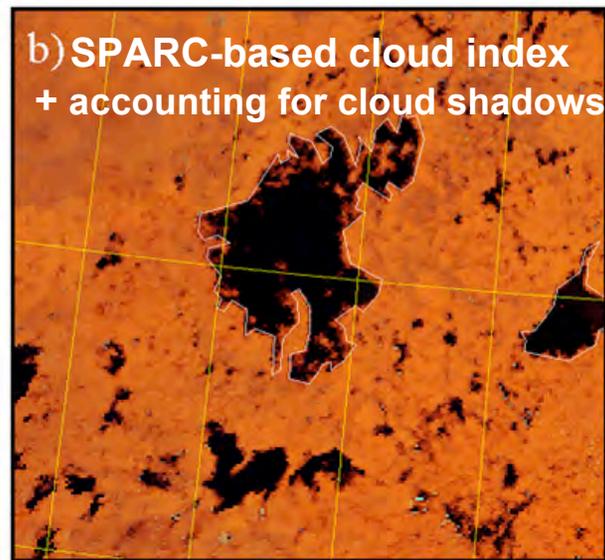
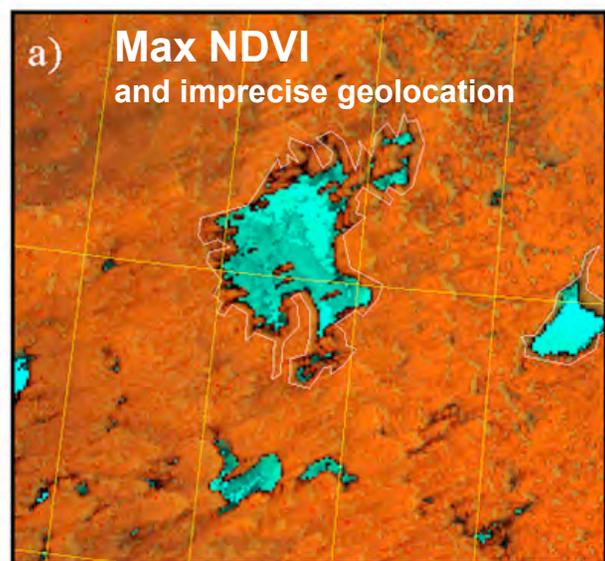
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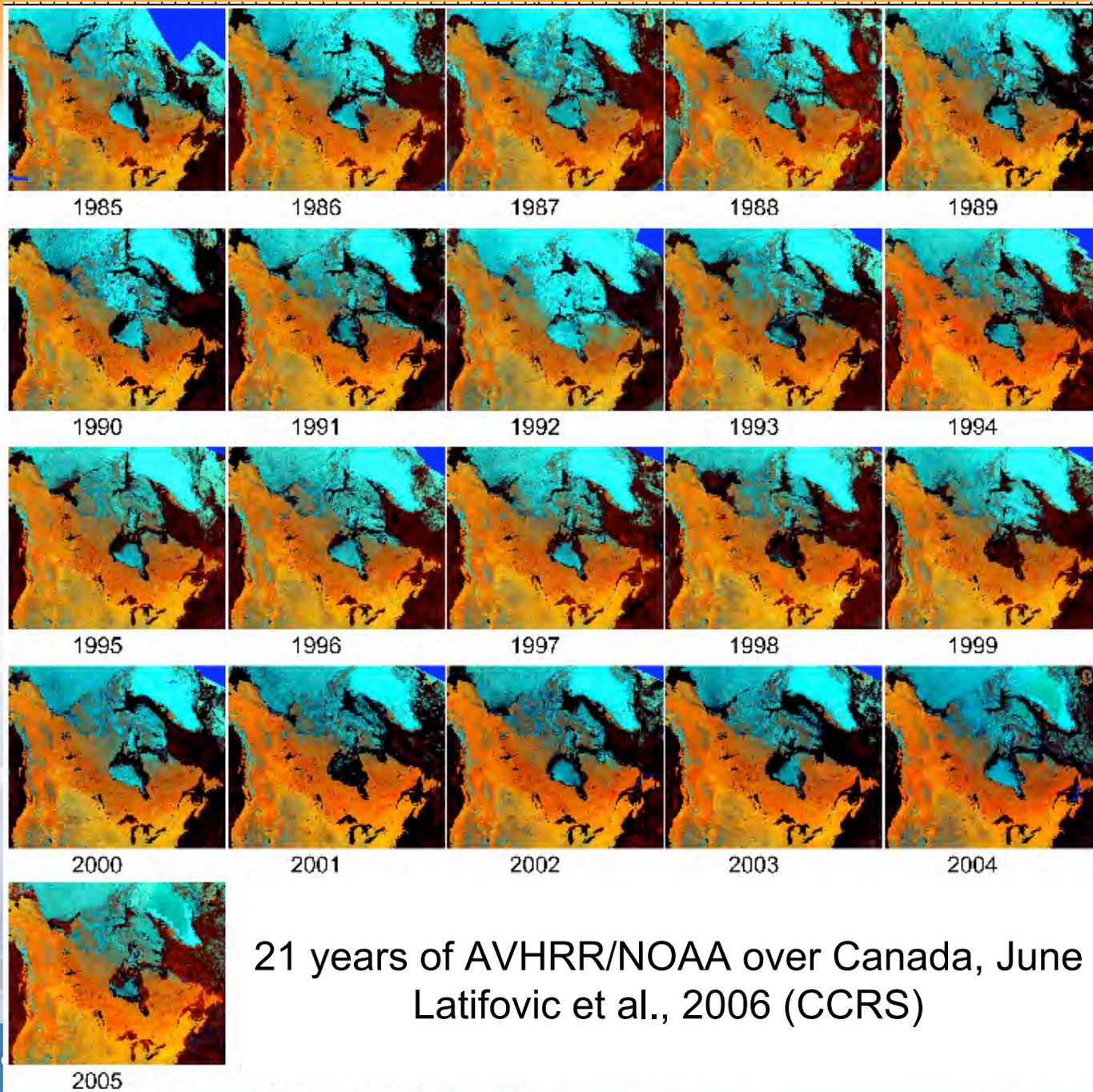
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Clear-sky compositing



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21 years of AVHRR/NOAA over Canada, June
Latifovic et al., 2006 (CCRS)



Mapping Canada's territory at 250-m spatial scale from MODIS (under development)

- 10-day time intervals compositing from L1B swath data (no ISIN projection step);
- Contains 7 spectral bands: VIS and NIR [0.85 μm] + 5 more channels down-scaled from 500m to 250m. Very rich spectral and detailed spatial information for land cover classification;
- Product is generated from original swath imagery and retains all spatial details;

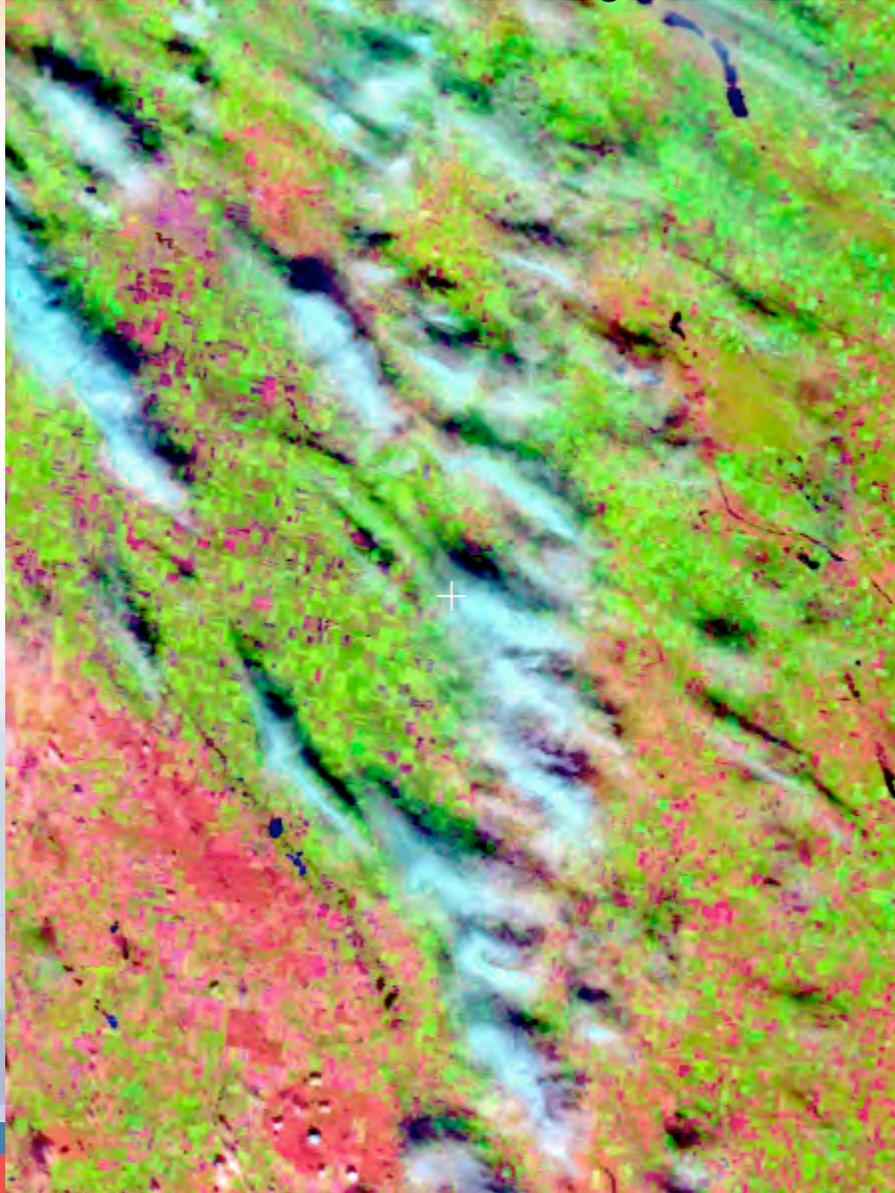
Trishchenko et al *SPIE*, 6366, 2006



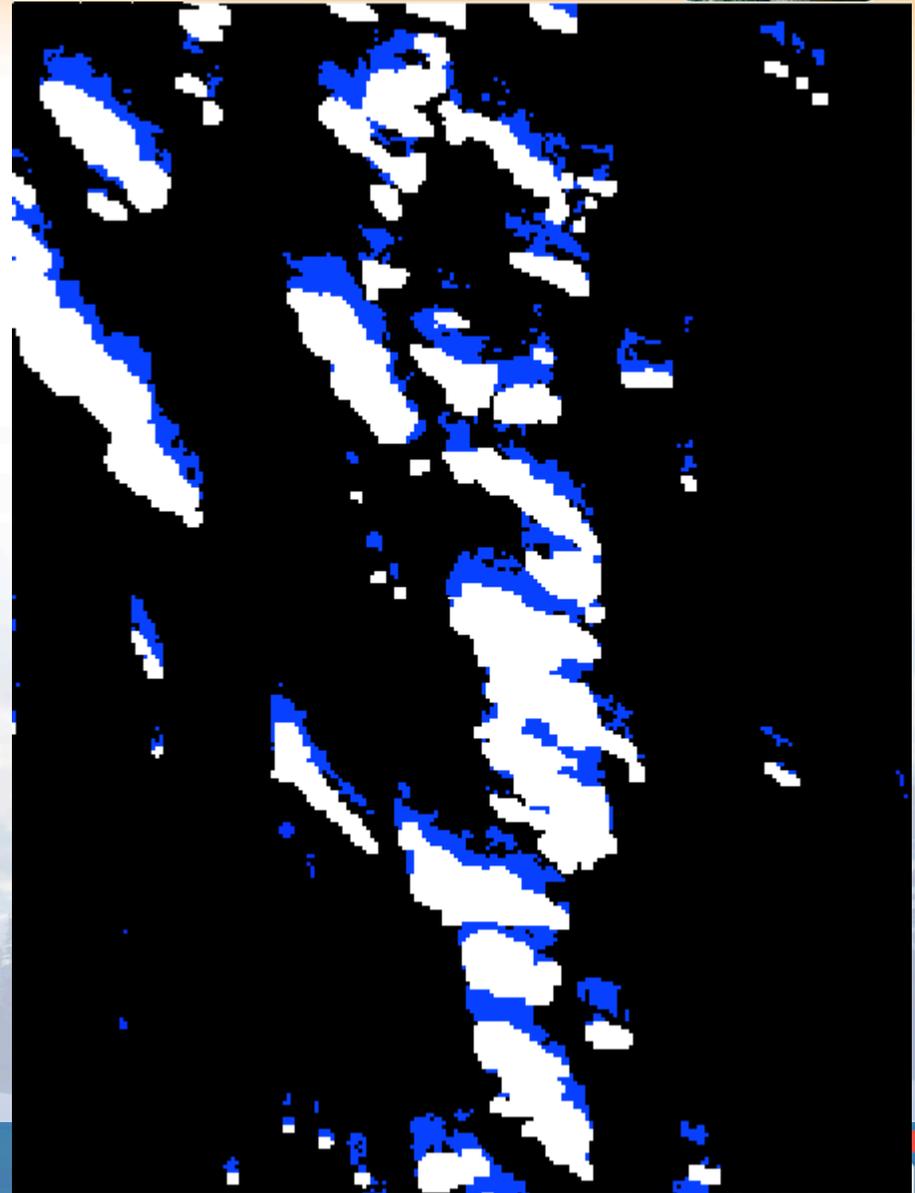
MODIS Composite Process: Cloud and Cloud Shadow Detection



MODIS RGB Image



Cloud and Cloud Shadow Mask



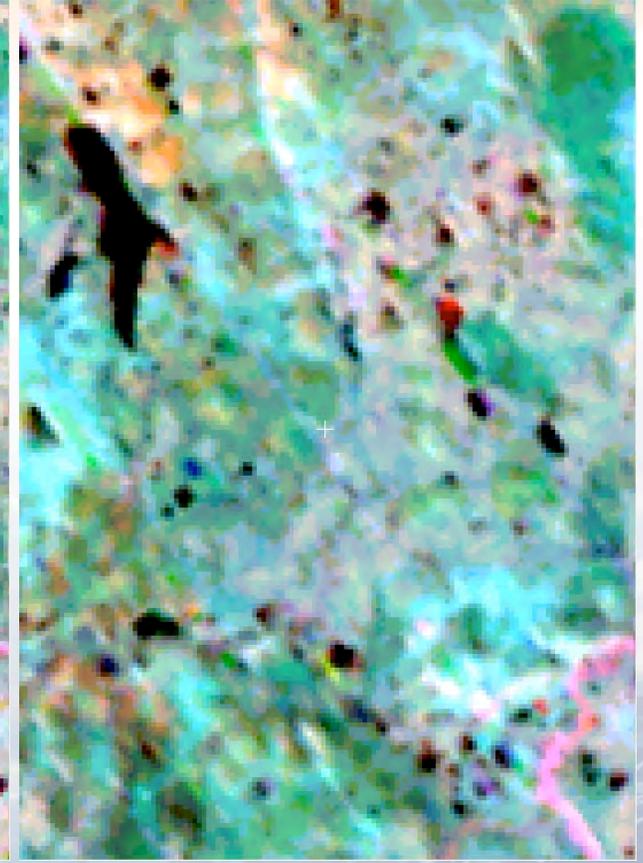
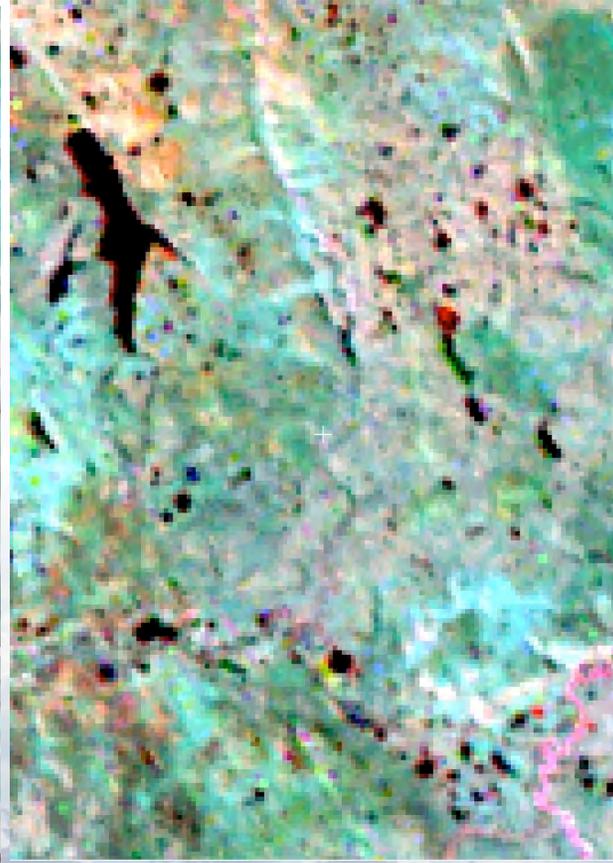
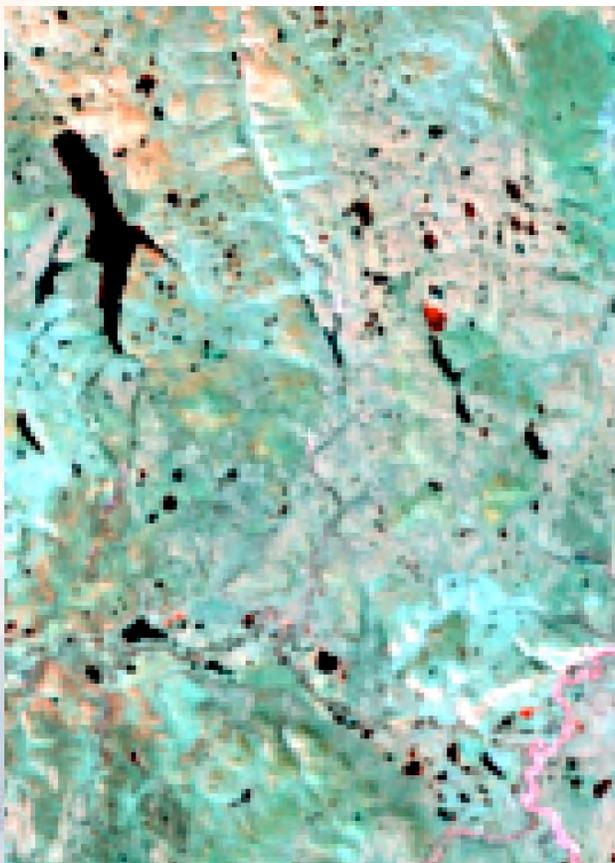


Comparison MODIS-Landsat

Landsat aggregated to 250m

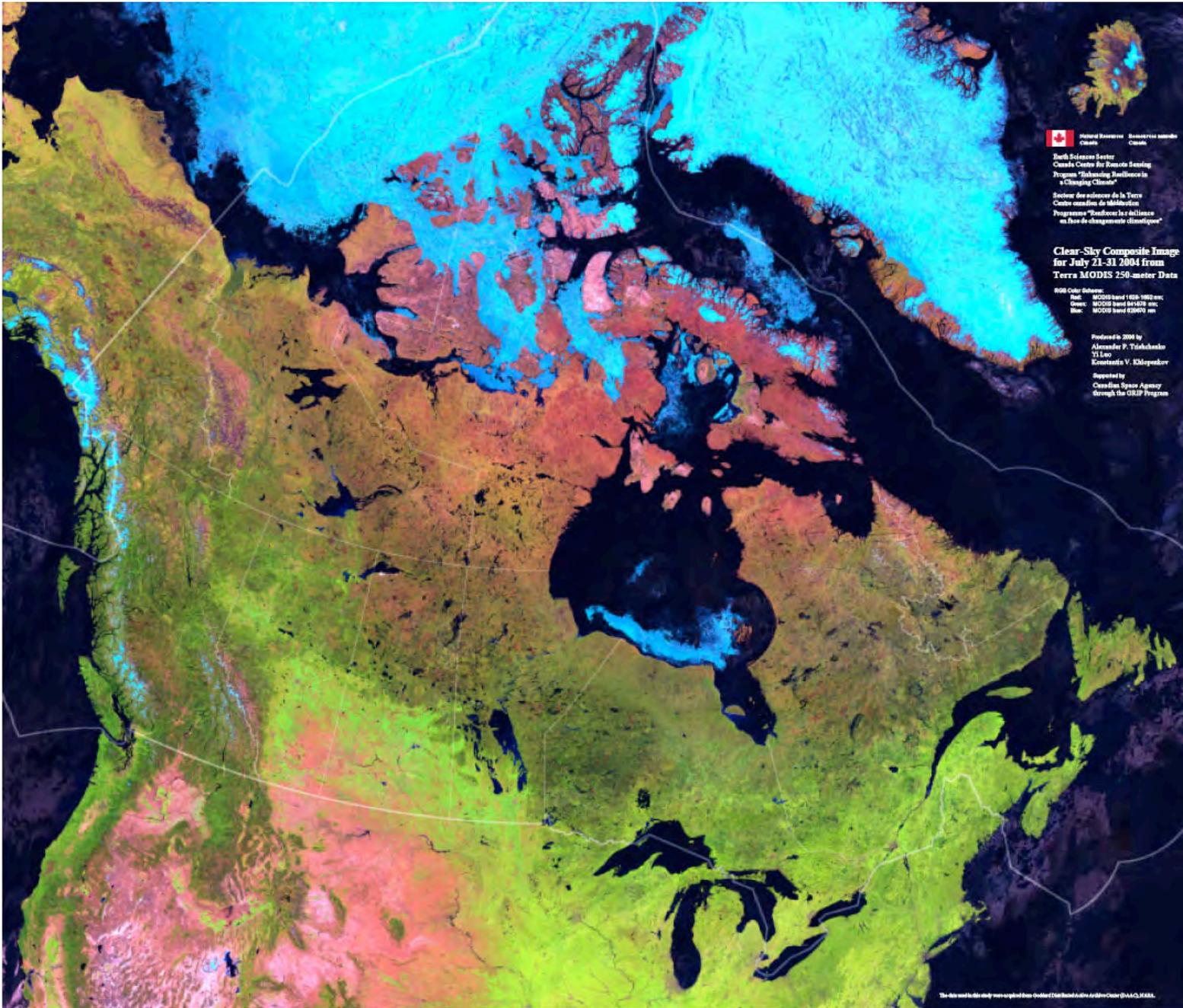
MODIS 250m

MODIS 500m



R-B4 (0.55 μ m) G-B6 (1.6 μ m) B-B7 (2.1 μ m)





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Trishchenko et al., 2006



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Conclusions

- Approx. 25 years of AVHRR data over Canada are available at **1-km** resolution (looking to start AVHRR FRAC/METOP);
- MODIS data over Canada are processed at **250m** spatial resolution
- Compositing is done at **10-day time intervals** (3 per month) ;
- Some additional efforts and international consensus are required to regarding **AVHRR calibration** (ch. 1, 2, 3A).
- CCRS is willing to share data/results with all interested parties and is interested in participation in various product intercomparison activities and preparation for VIIRS/NPOESS.

Acknowledgements

- Substantial amount of AVHRR and all original MODIS data were acquired from the NOAA and NASA archives.
- Work is supported by the CSA under the GRIP Program.

