Vegetation Continuous Fields and the new Land Water Mask

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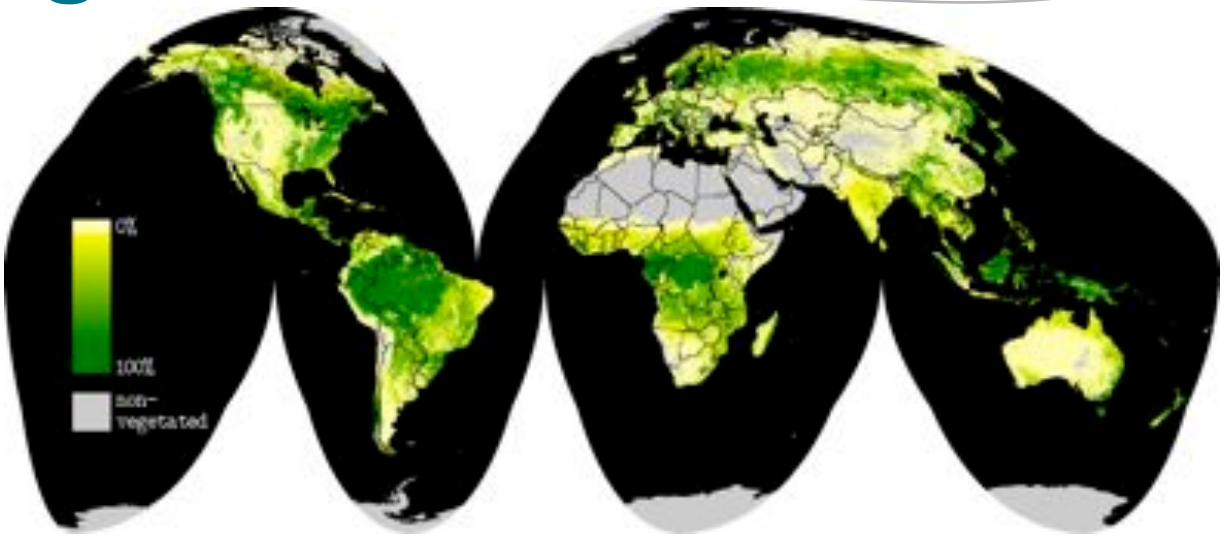
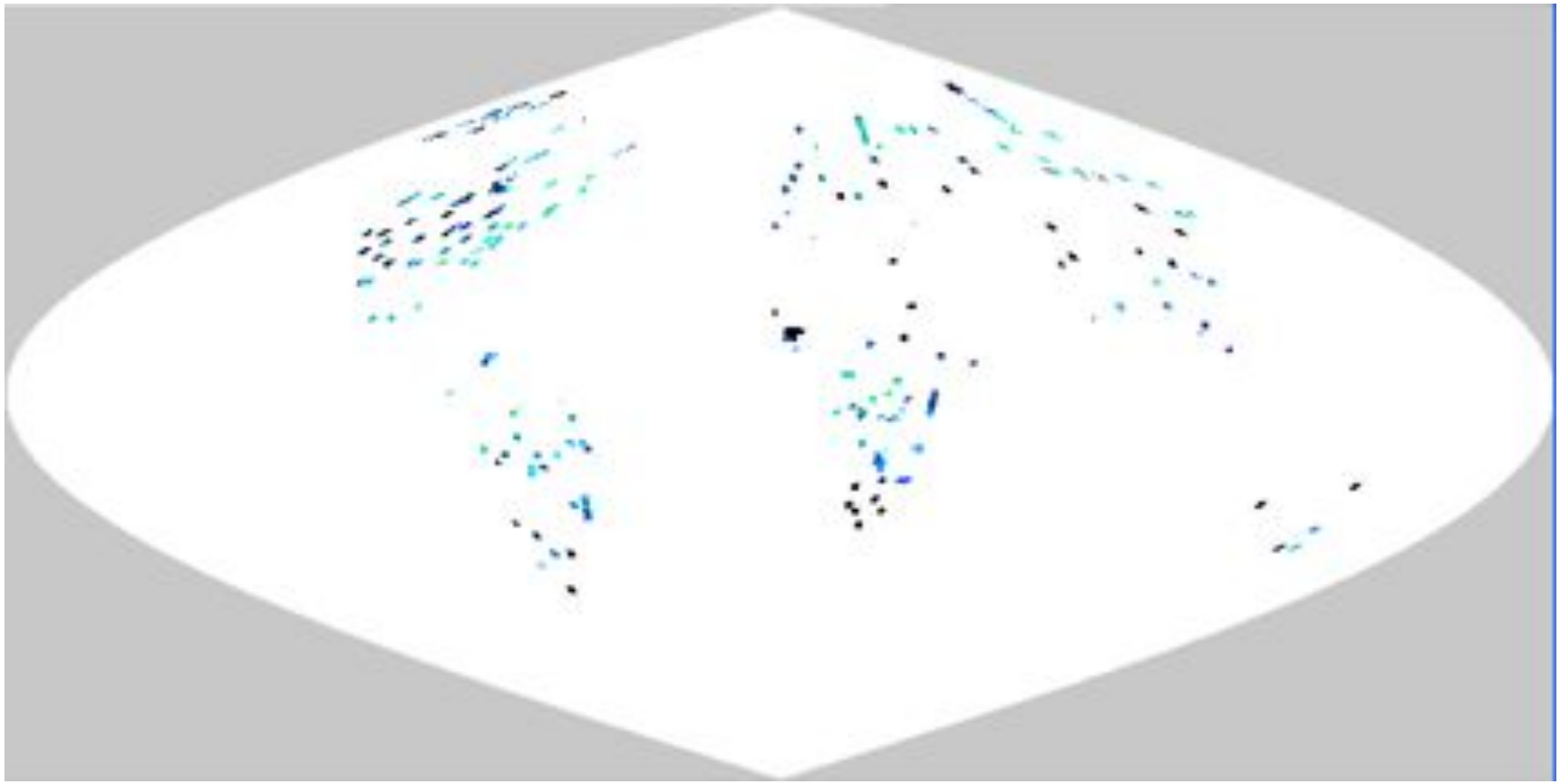
Vegetation Continuous Fields



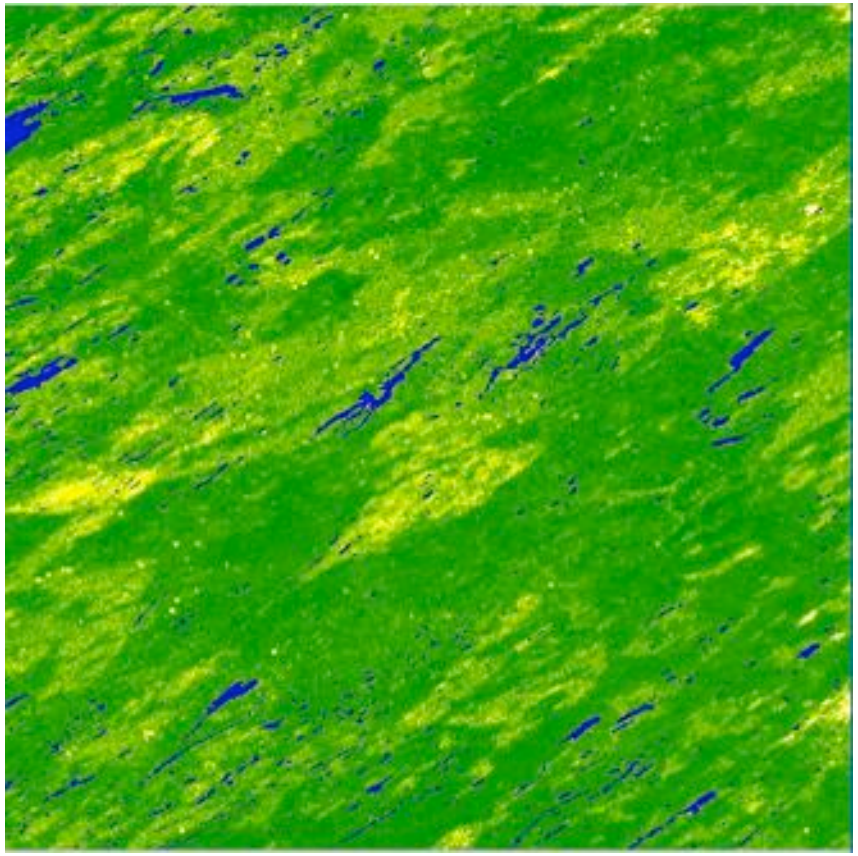
- Vegetation Continuous Fields (VCF) is a sub-pixel estimate of percent ground cover in three primary layers percent trees, percent non-tree vegetation, and percent bare
- Employs annual metrics based on reflectance, rather than raw spectral values, and temperature variations
- Regression tree model trained with 30m resolution Landsat data provides cover estimate in 1% steps at 250m spatial resolution
- Alternative to discrete classification to represent the heterogeneous surface of Earth

Vegetation Continuous Fields



- Geographic distribution of fine resolution training sites for VCF
- Training data derived from landsat TM and ETM+ data
- Aggregated to MODIS resolution to produce percent cover

Vegetation Continuous Fields



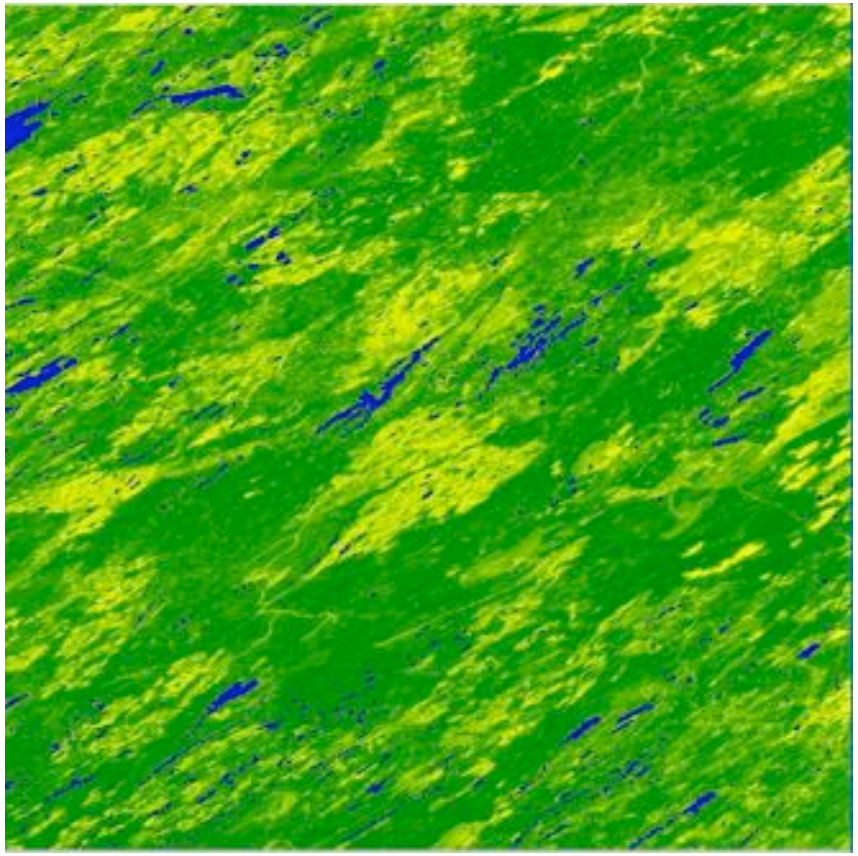


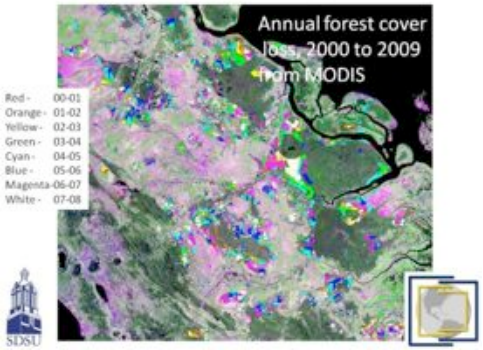
Image above left shows VCF tree cover 500m resolution, above right shows same area of Quebec with the VCF 250m. Water mask has been applied to both images. Note enhanced detail in the 250m version particularly in fragmented landscapes.

Vegetation Continuous Fields

- Highlights from current effort
  - Migration of VCF development code to the production system at MODAPS
  - Complete overhaul of the training data to match the time of acquisition more closely with MODIS
  - Improved usage of quality bits in annual metrics
  - Multiple years of output products
    - Integrated into science efforts such as Measures Global Forest Cover Change (GFCC) EDR for long term forest monitoring
- New results expected Spring 2010

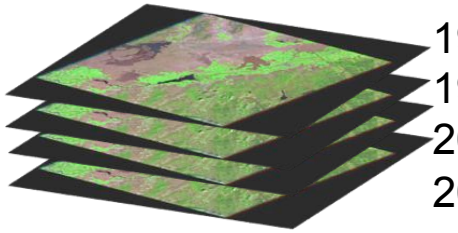
GFCC Deliverables

Forest cover change (MODIS)

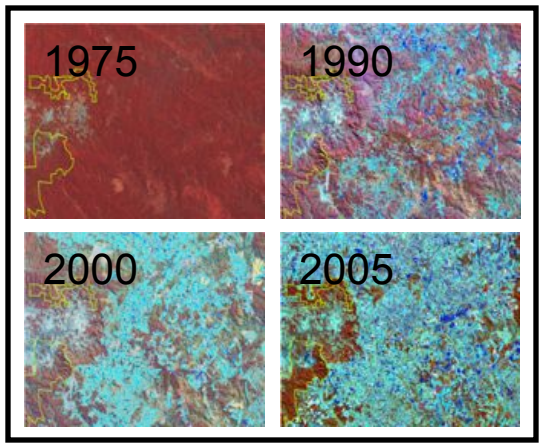


MODIS VCF (2000-2005)

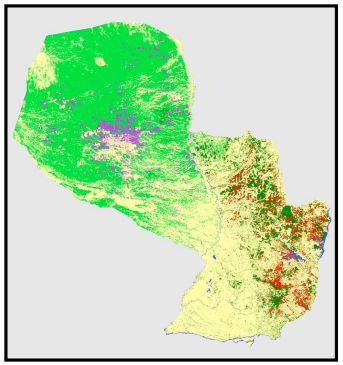
Global Land Survey (GLS)



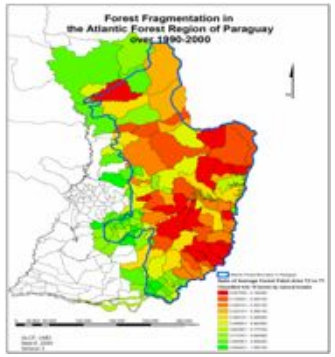
Landsat-MODIS consistency



Surface reflectance

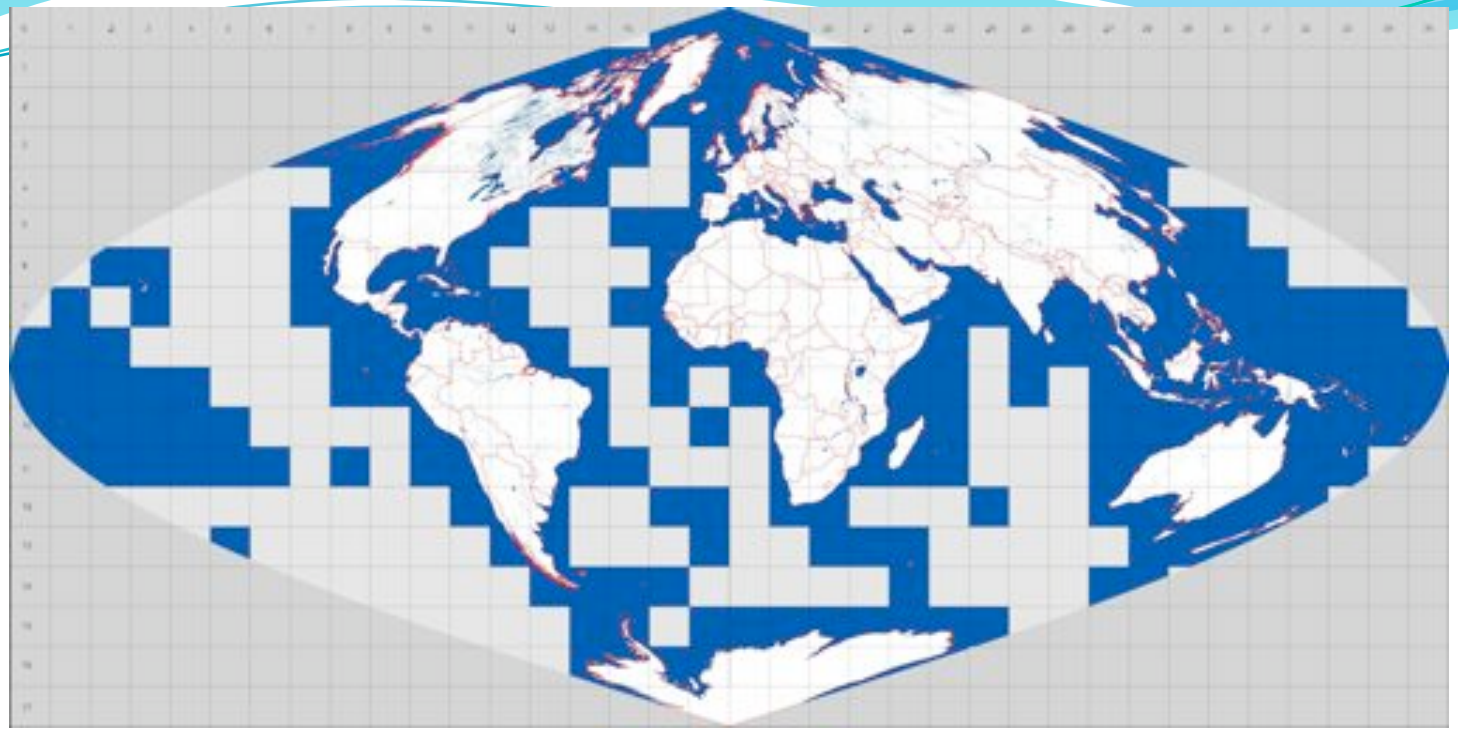


Forest cover change (Landsat)



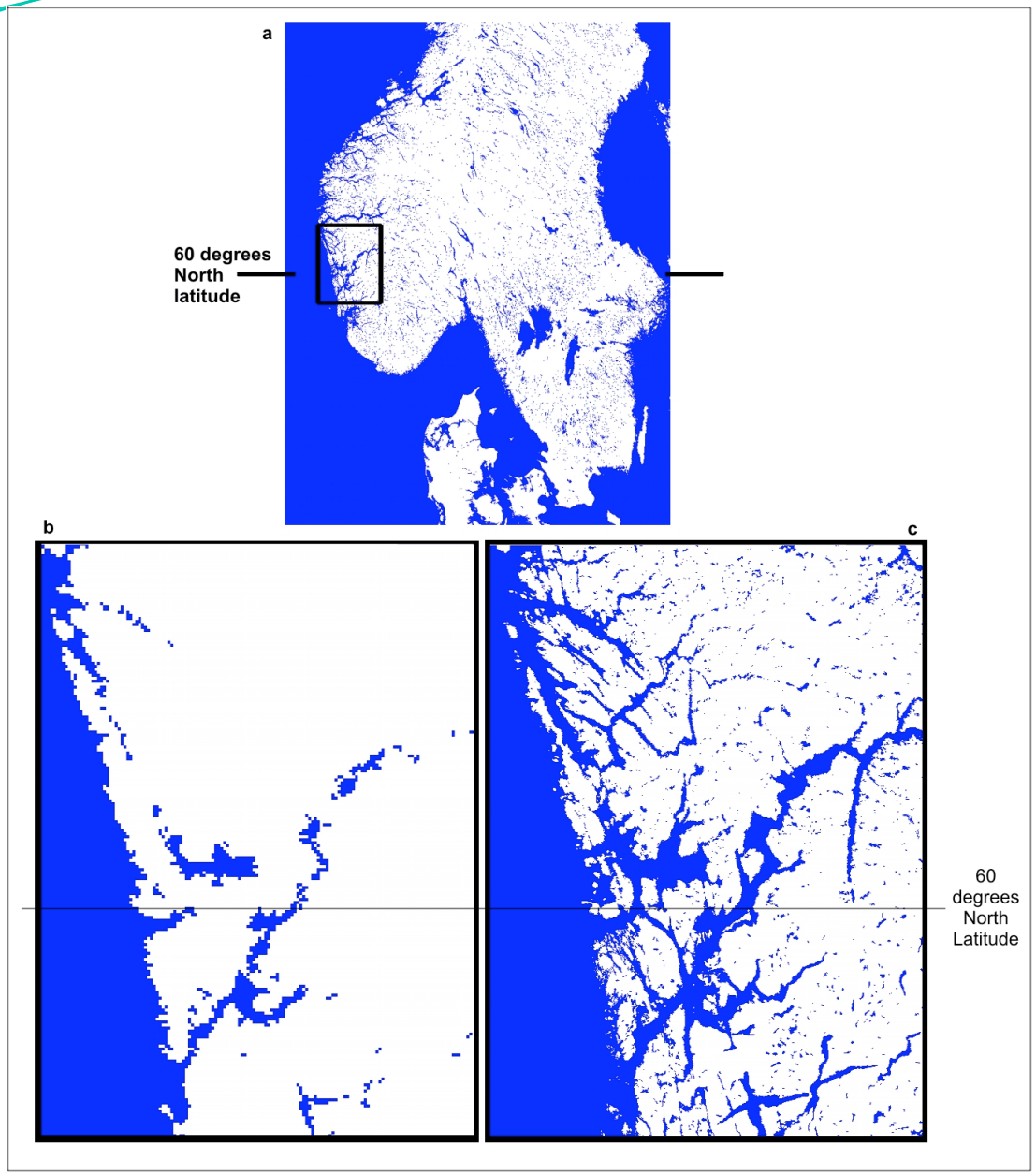
Fragmentation & change

Global Land - Water Mask



- Global land water mask created at 250m spatial resolution released Aug. 2009
  - Generated from remotely sensed data from the Shuttle Radar Topography Mission (SRTM) and data from the MODIS instrument
  - Represents a vast improvement over the 1km spatial resolution product that is currently in use
    - Corrects numerous errors in locations of rivers
    - Identifies whole new landscapes of small lakes in the far North
    - Is generated from only 3 sources of information

Global Land - Water Mask



New 250m water mask for Scandinavia.

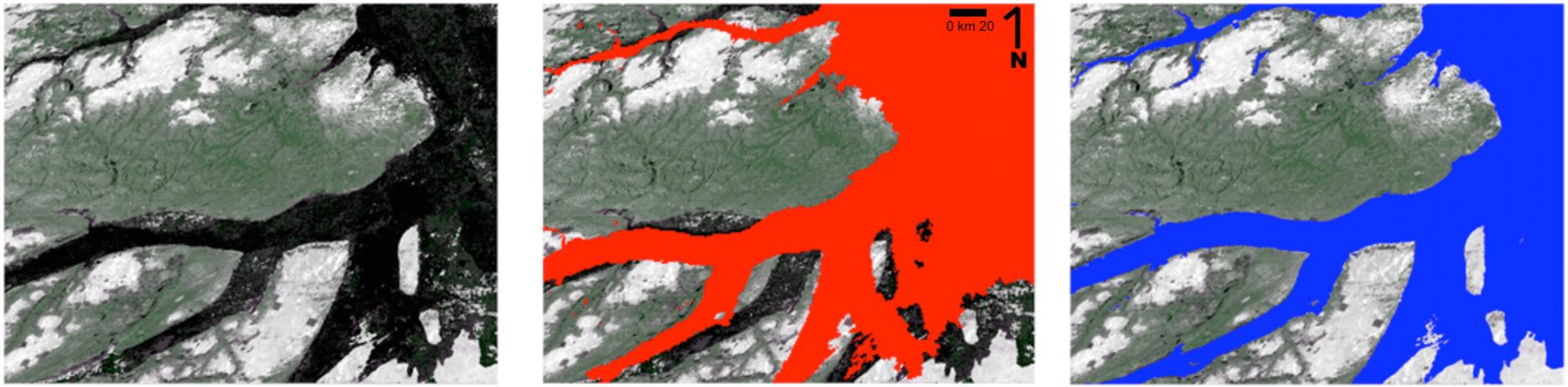
a) Shows overview of the peninsula

b) Shows the old 1km water mask near the 60 degree north line

c) Shows the new 250m water mask across the 60 degree line

- The SWBD ends at 60 degrees north.
- MODIS 250m data used above this point.
- Nearly seamless transition between the 2 products.

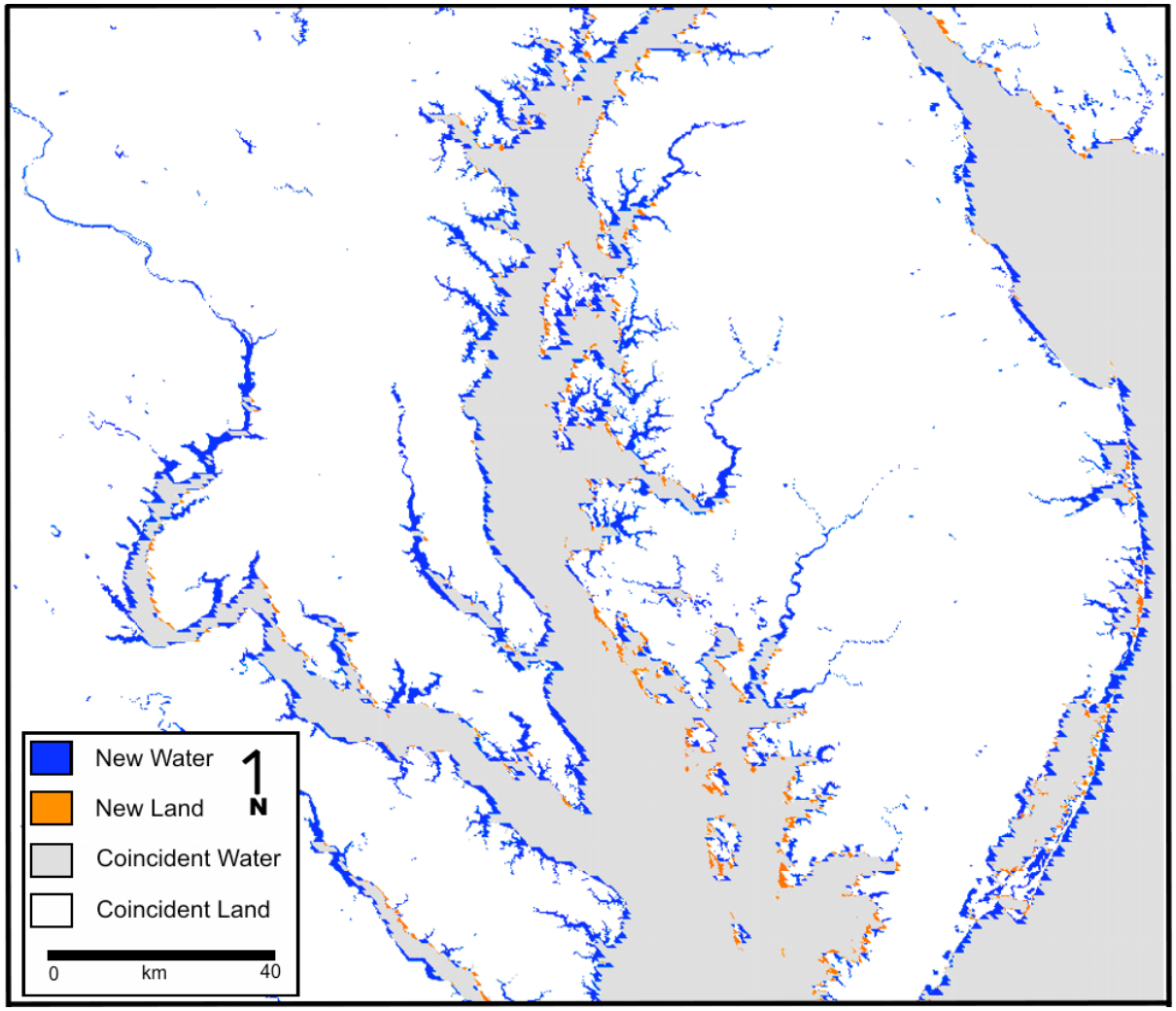
Global Land - Water Mask



- Images above show an area of northern Greeenland near the McKinsey Sea
- Background image is a false color composite of MODIS data at 250m spatial resolution
- Center image shows the old EOS 1km water mask overlain in red
- Right image shows the new 250m water mask overlain in blue
- The new mask corrects a 30km shift that was pervasive north of 80 degrees

Global Land - Water Mask

- Quantitative comparison of the old 1km water mask and the new 250m water mask was undertaken for the Mid-Atlantic region of the United States
- A total of 6,369,127 pixels were mapped as inland water in the new 250m water mask.
  - Ocean pixels were excluded from the statistical analysis.
- The new water mask identified 1,274,106 pixels as water that were previously mapped as land. (>68,000 km^2, 20% more water)



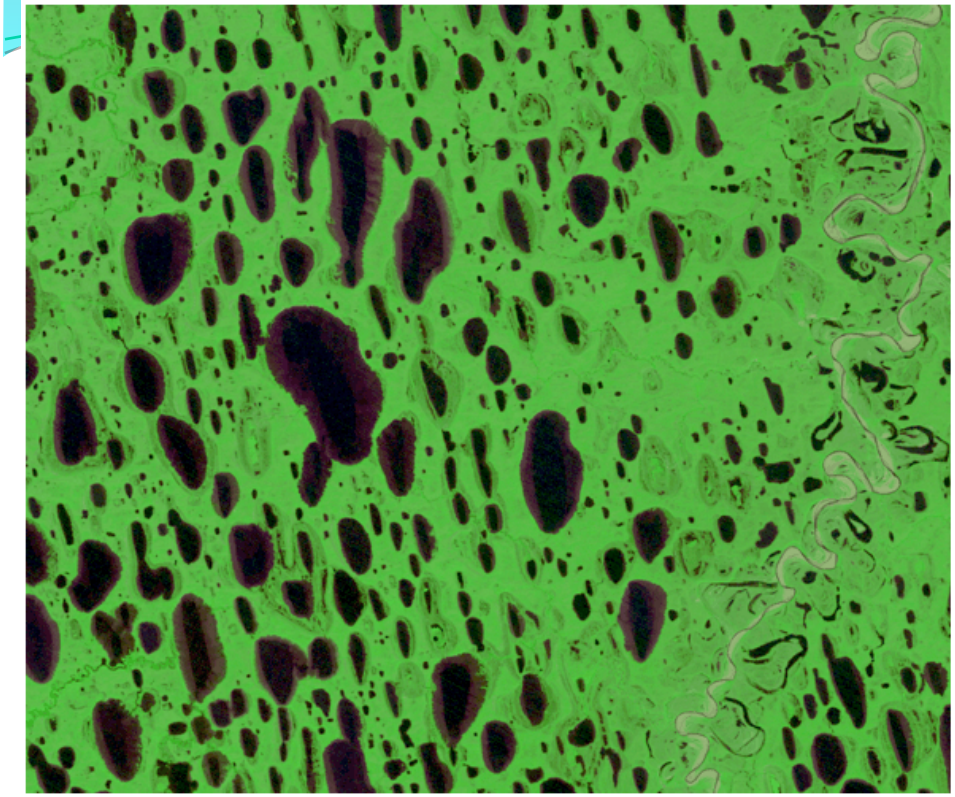
- Nearly 330,000 pixels that were previously mapped as water were re-mapped as land in the new mask. (nearly 18,000 km^2 or over 5% of pixels)

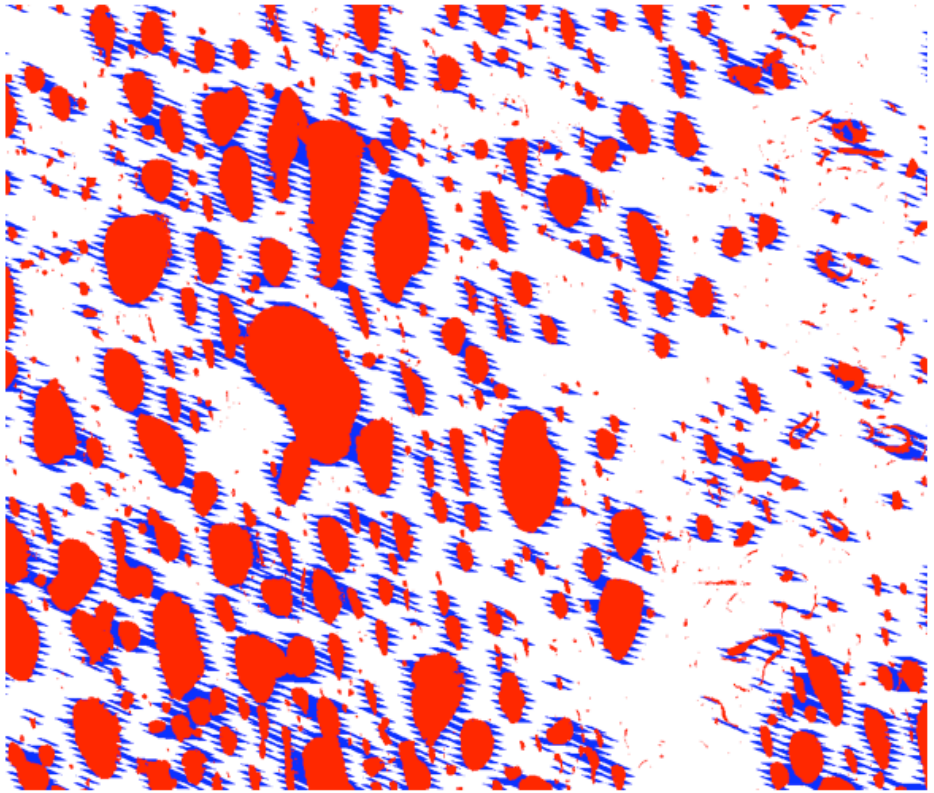
Global Land - Water Mask

Data set	Total # of polygons	# of polygons intersecting NLCD	Commission Error	Omission Error
Total NLCD water polygons	122114			
New 250m water mask polygons	98514	96552	1.99%	20.93%
Old EOS water mask polygons	4227	3043	28.01%	97.51%

- Water mask validation effort in Alaska, USA
- National Land Cover Dataset (NLCD)
  - 30m landcover derived from Landsat
  - Selected all pixels identified as “water”
  - Aggregated to 250m resolution using exact averaging
- Size analysis
  - New 250m water mask gets ~79% of the lakes that the NLCD gets
  - Majority of those that are missed are smaller than 2 MODIS pixels or 10ha in size
- Area analysis
  - Though the new water mask does miss ~20% of the individual lakes it is able to capture >90% of the surface area compared to the NLCD water map

Global Land - Water Mask





0 km 5

•Image to left show 3,4,1 (R,G,B respectively) image from Landsat 5 path 079 row 010 near Barrow, Alaska darkest colors indicate water

•Image to right shows classification of water bodies: red derived from the Landsat scene, blue derived from MODIS 250m and displayed at 30m resolution

•>79% of the water bodies are detected by MODIS and >90% of the area of water is represented as well

Global Land - Water Mask

- **New 250m water mask released August, 2009**
  - Available at the LP-DAAC in MODIS tile format and from the GLCF in alternative formats
  - Methodology publication in press
  - *Carroll, M., Townshend, J., DiMiceli, C., Noojipady, P., Sohlberg, R. 2009. A New Global Raster Water Mask at 250 Meter Resolution.* ***International Journal of Digital Earth****. V.2 Issue 4*
  - Re-prints available upon request
- Replaces the current 1km water mask for use in MODIS C6 operational processing stream
  - Used as operational water mask in Global Agriculture Monitoring (GLAM)
- Currently under consideration by VIIRS team for use in VIIRS processing

Change results from MODIS

Change results from MODIS

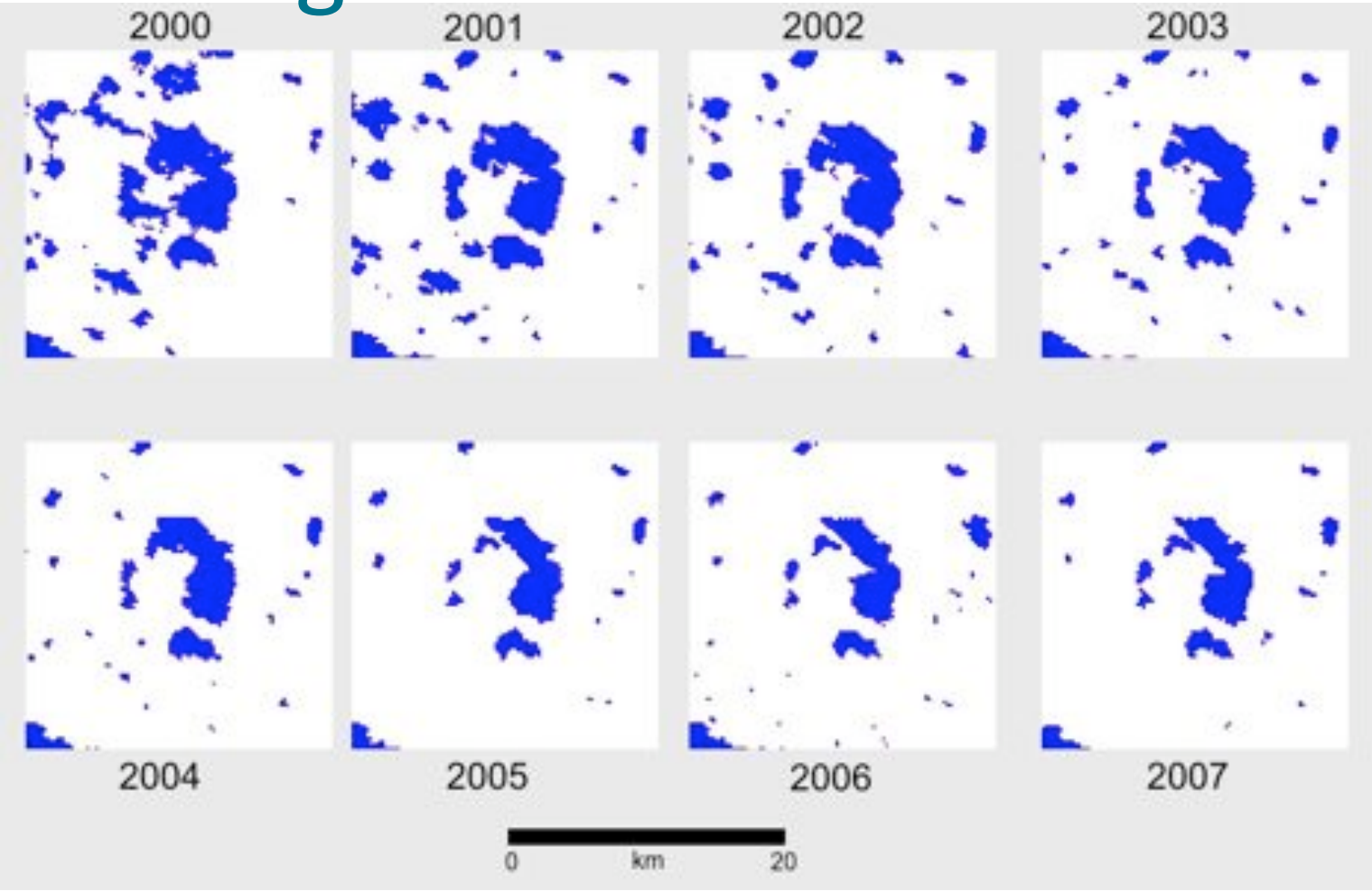


Image above shows drying of a lake complex in the northern Canadian Shield, northeast of Lake Athabasca.

Change results from MODIS

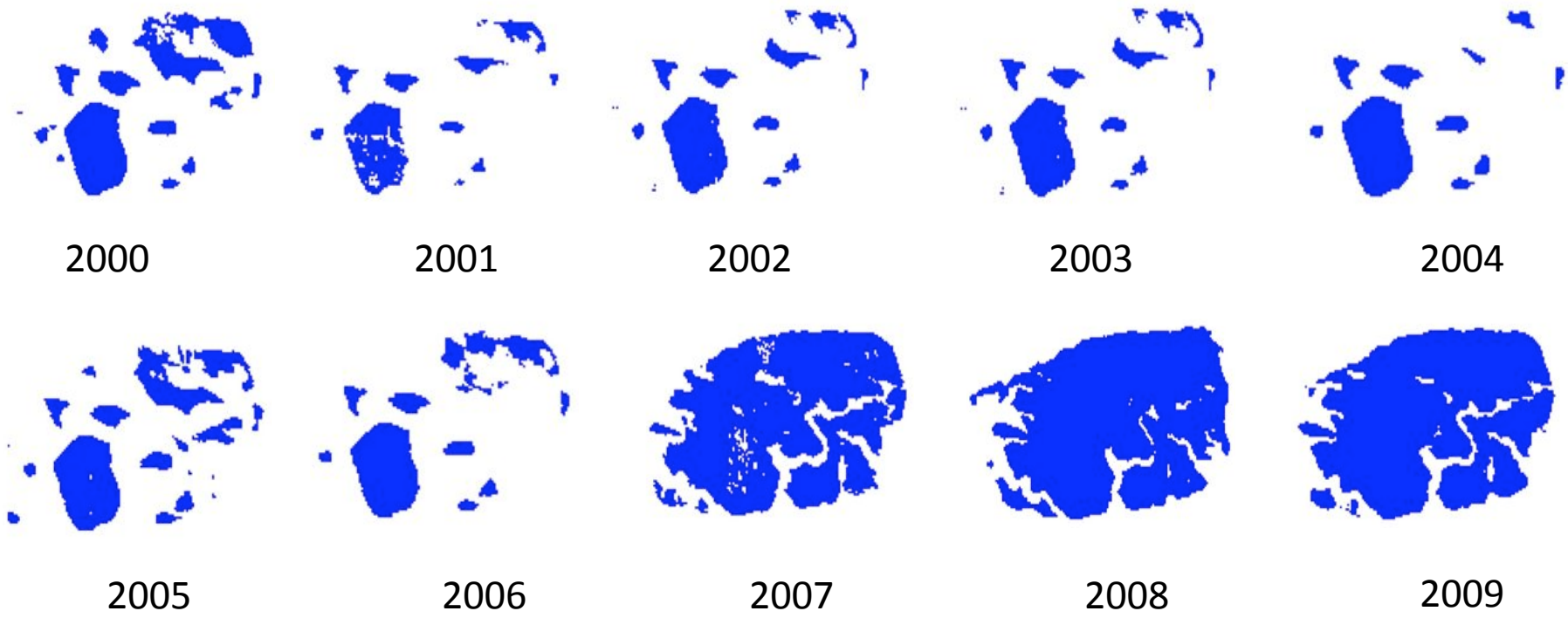
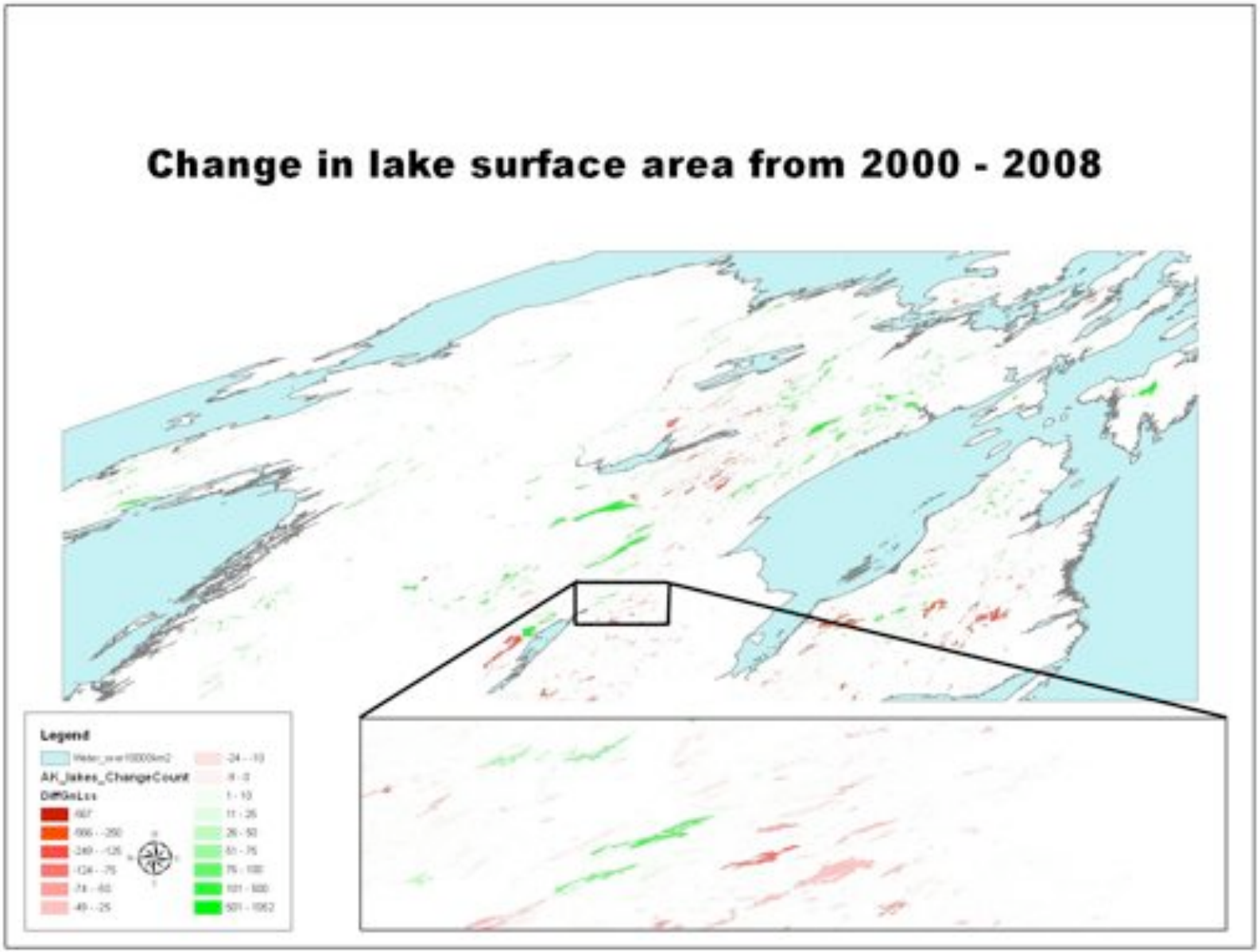


Image above shows the interannual changes in the Hay Lake Region in Alberta, Canada.

Change results from MODIS



VCF and Land-Water Mask (summary)

- VCF continued refinement of operational code
- Revise training for Leaf type and Longevity
- Improve usage of Aqua in cloudy or low quality data regions
- Water is not, in fact, static; it is constantly changing
- Rivers meander over relatively short time steps and lakes change due to human and environmental conditions
- Next step is to produce updated Land water mask through time
- Suggested updates
    - Updated water mask at least on 5 year time step
    - Identify areas of ephemeral water
        - May include seasonally flooded river flood plains

Acknowledgements

•MODIS Science team activities funded under NASA grant #NNX08AH05A

•MODIS Water mask funded through the NASA Earth Sciences Division, Terrestrial Ecology Program grant/cooperative agreement #NNX08AT97A

Questions?