

# Determining the Extent and Dynamics of Surface Water for the ABoVE Field Campaign

Carroll – 01

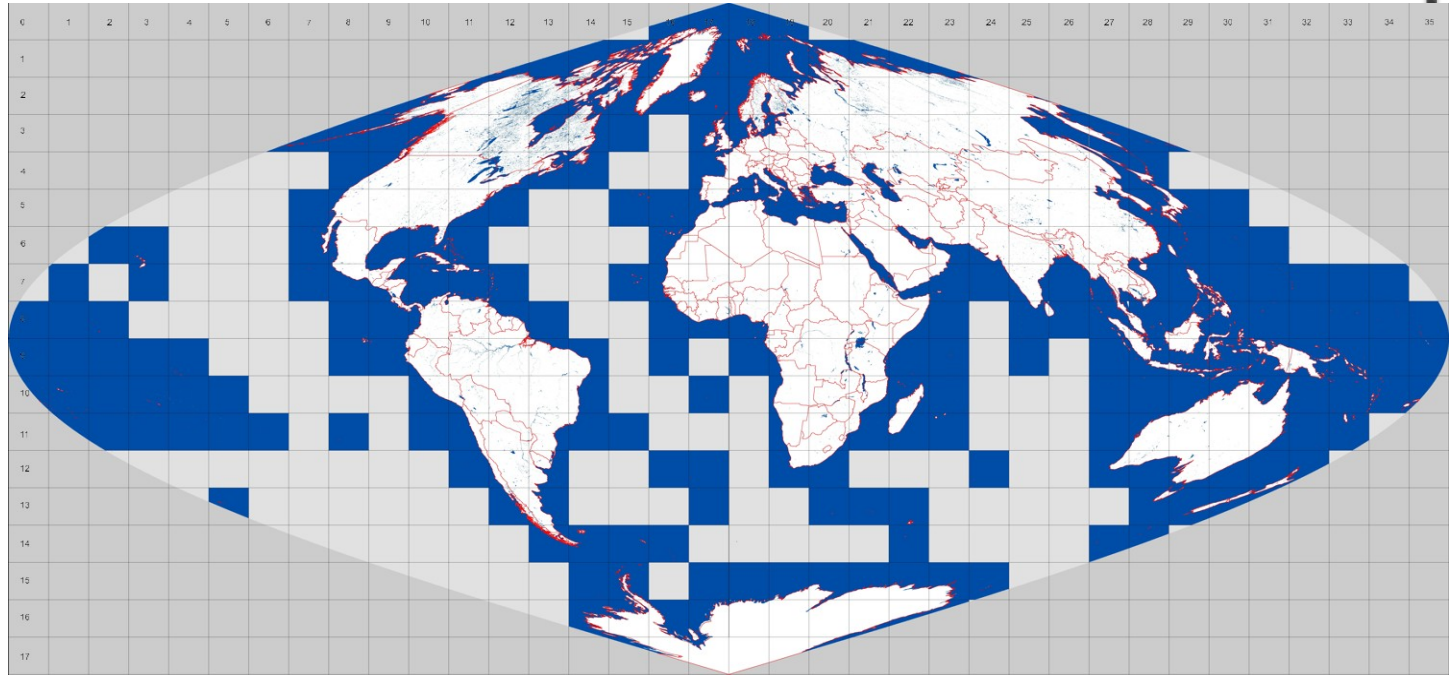
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# Global 250 Meter Water Map

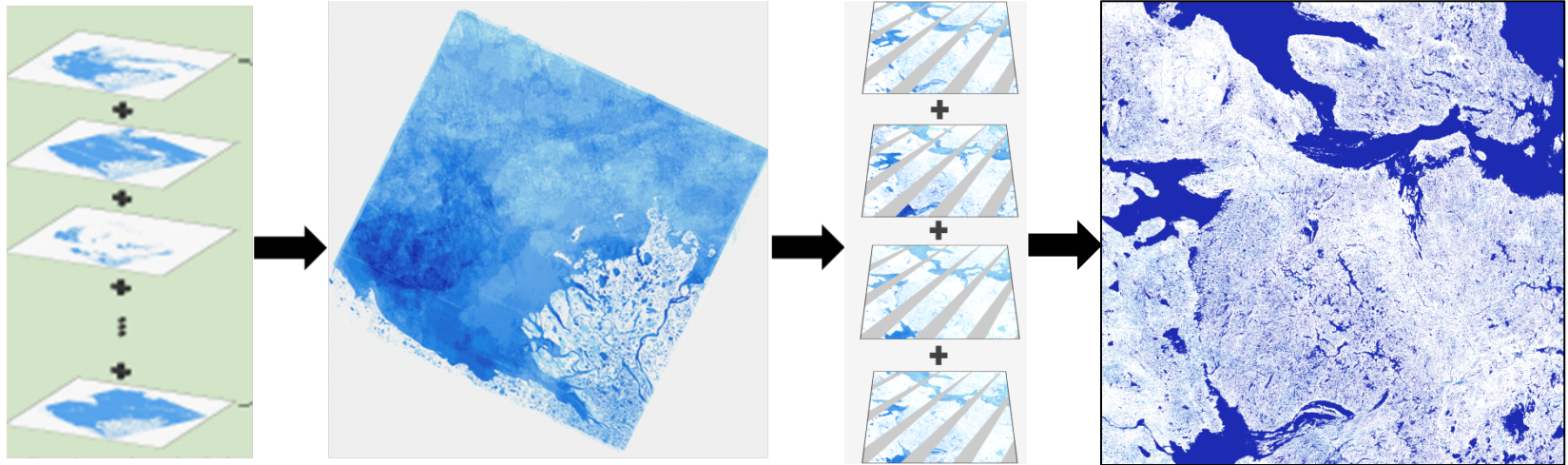


- Global water map created at 250m spatial resolution released Aug. 2009
- MODIS methodology used daily observations accumulated over a year or more to generate a “nominal” extent of water

# Determining the Extent and Dynamics of Surface Water for the ABoVE Field Campaign

- ▶ Landsat time series in the North American Arctic is extensive
- ▶ We use the full available time series to minimize the impact of anomalous weather events (drought, flood) in individual scenes
- ▶ Maps will represent surface water extent for 3 epochs 1990 – 1992, 2000 – 2002, and 2010 – 2012
- ▶ These maps can be used to identify hotspots of change and to identify field sites for study during the ABoVE campaign

# Determining the Extent and Dynamics of Surface Water for the ABoVE Field Campaign

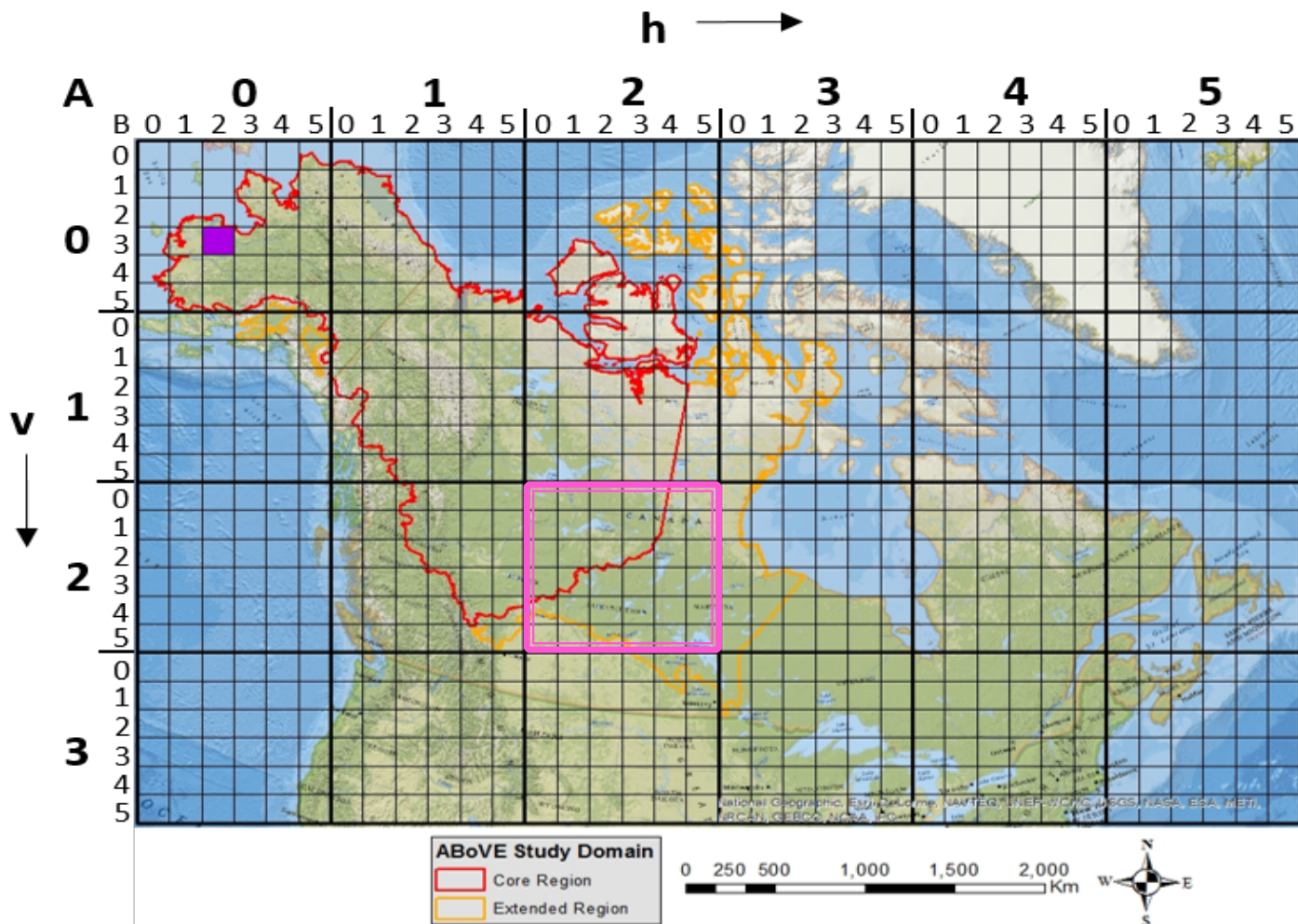


- ▶ Decision tree classification on each Landsat scene
- ▶ Extract theme (water) from each date, build data stack
- ▶ Sum water observations for entire epoch
- ▶ Mosaic each themed scene into ABoVE tile (no overlap)
- ▶ Sum mosaicked tiles to create a total per theme for each ABoVE tile
- ▶ Water determined as a probability of water



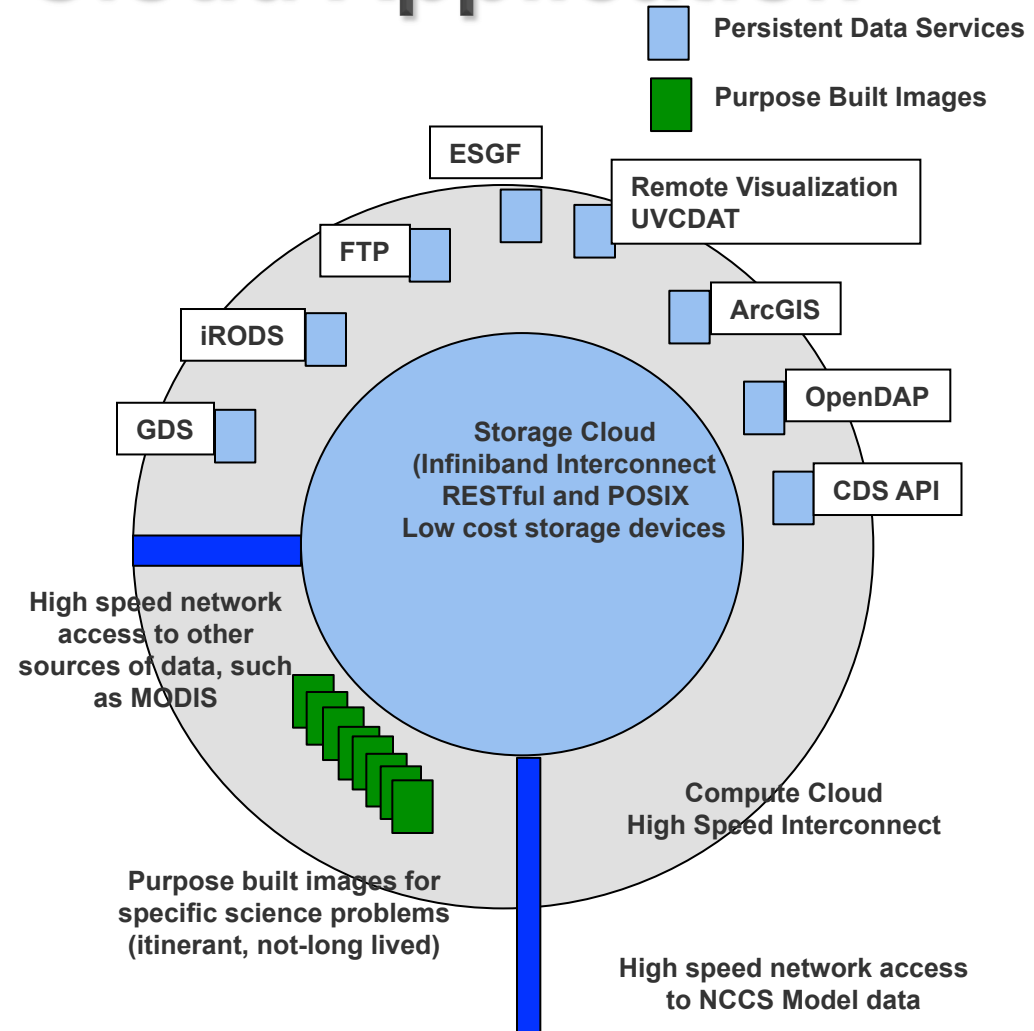
# Determining the Extent and Dynamics of Surface Water for the ABoVE Field Campaign

- Working with other pre-ABoVE scientists and the CCE project office, agreed on common projection (Canada Alber's Equal Area) and a grid to reduce the file size for ease of distribution

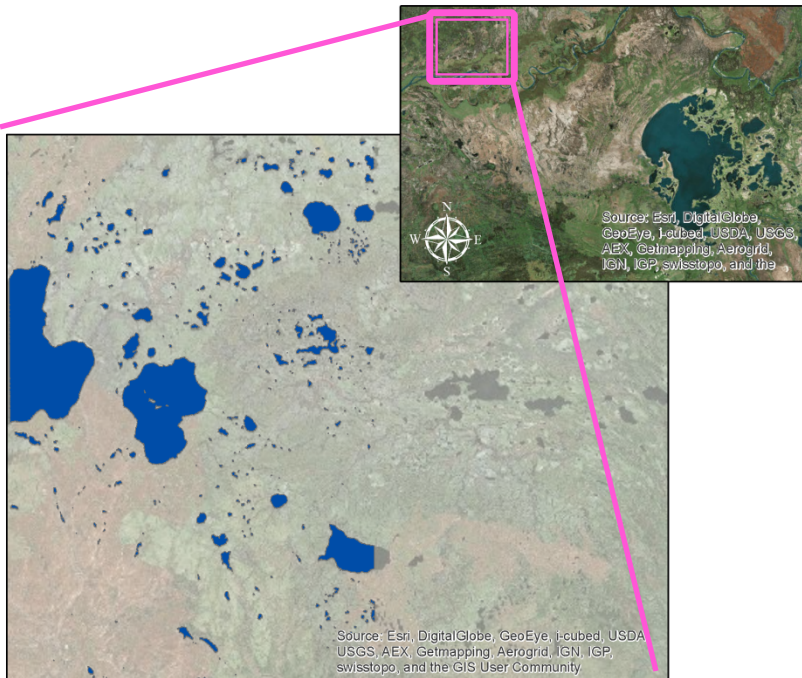


# ABOVE Science Cloud Application

- ▶ Original processing plan involved a couple of workstations and rotating data through an 8TB RAID
- ▶ Anticipated processing time 9 - 12 months
- ▶ Only final outputs would be kept online
- ▶ No time available for reprocessing
- ▶ Enter the Science Cloud at NCCS and GSFC High Performance Computing



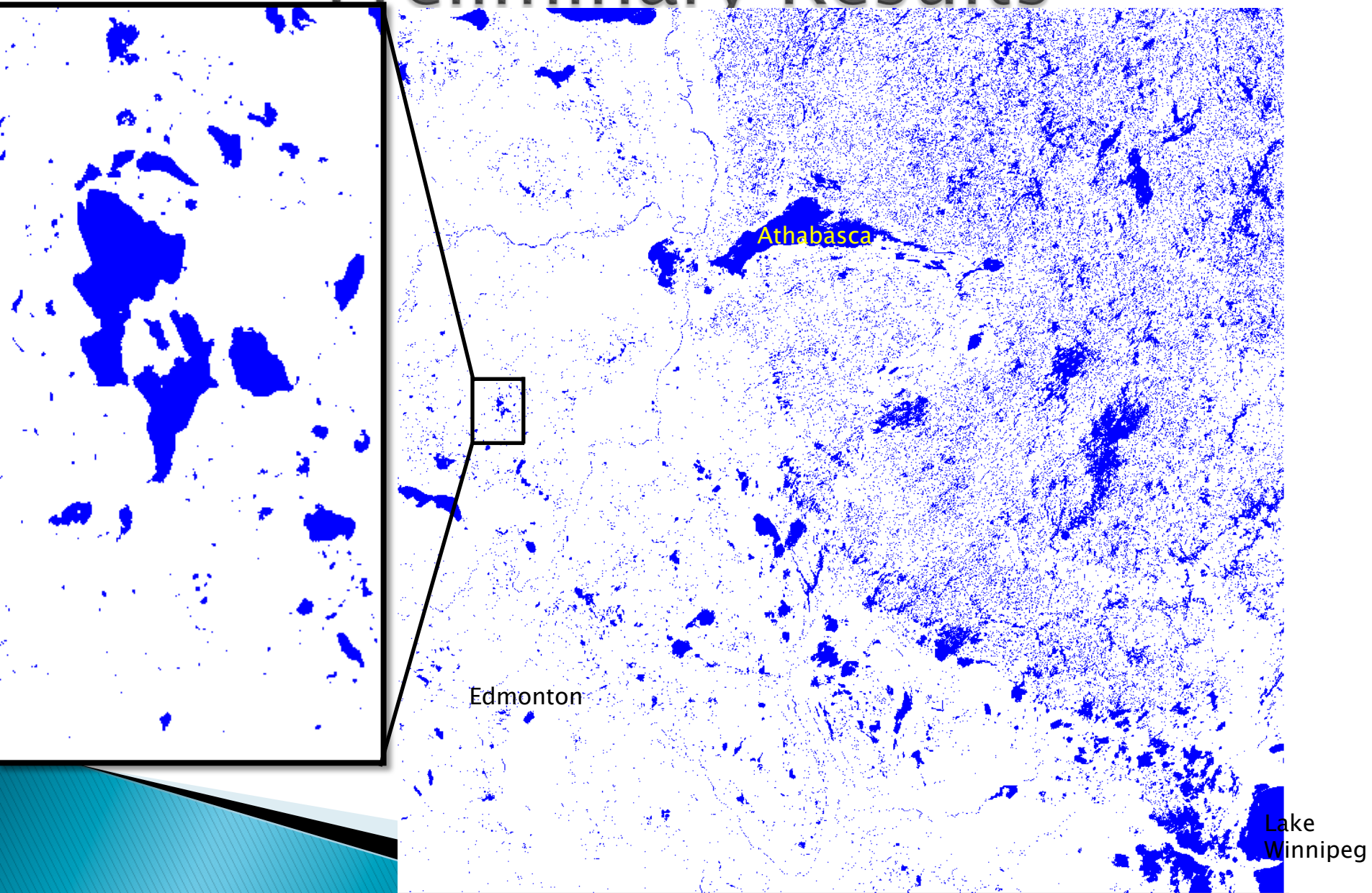
# Method Verification



- ▶ Small area northwest of Lake Claire in Alberta, Canada
  - ▶ ABoVE water maps identified 450 water bodies
    - 95% (427) matched WV02 result
  - ▶ WV02 identified 565 water bodies  $>225 \text{ m}^2$  (i.e.  $\frac{1}{4}$  Landsat pixel)
- 
- ▶ Of the water bodies that did not match WV02 result
    - 64% were 1 Landsat pixel or smaller
    - 90% were 3 Landsat pixels or smaller



# Preliminary Results



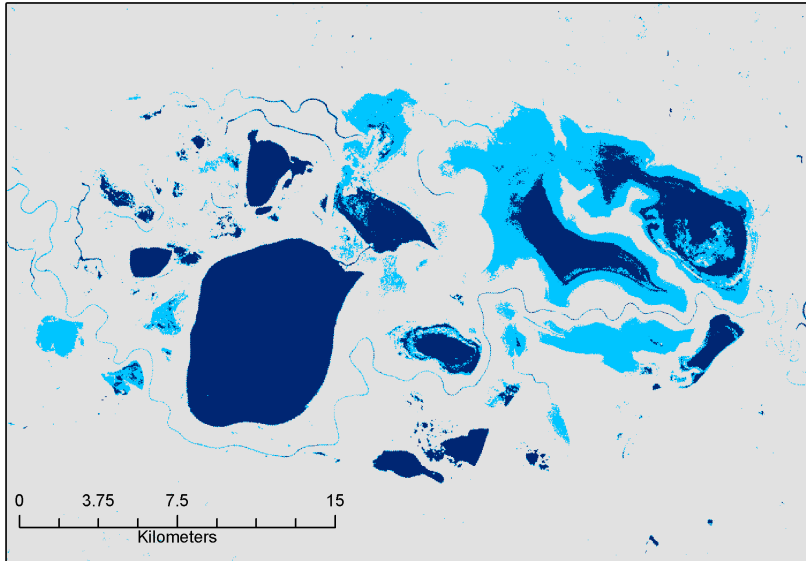


# Preliminary Results

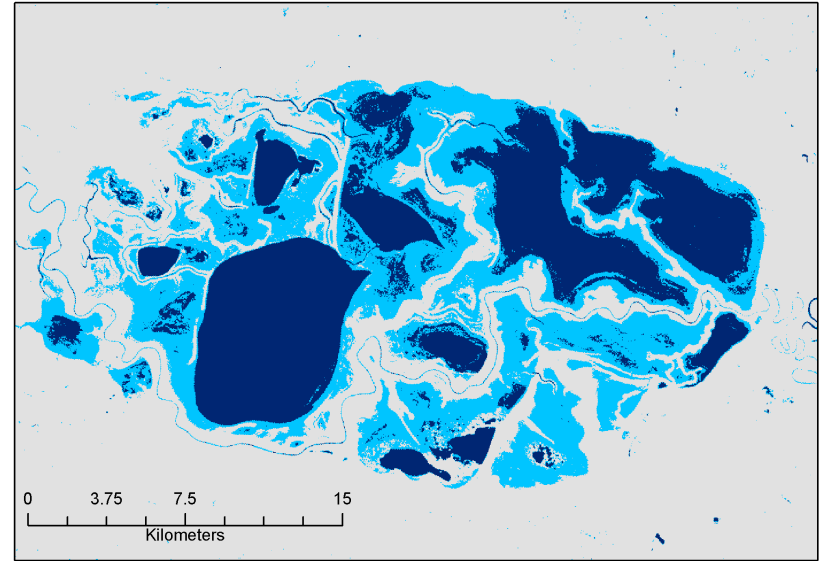
- ▶ Over 500,000 water bodies identified in ABoVE Water Maps (2011) in tile h02v02
- ▶ ~360,000 water bodies identified in GlobeLand30 (30m Landcover 2010)
  - Water bodies missed by GlobeLand30 ranged in size from 8 km<sup>2</sup> to 0.0009 km<sup>2</sup> (1:30m pixel)
  - Most misses were small and/or adjacent to other water bodies
  - Overall difference in area of any given water body ranged from 0 to >1 km<sup>2</sup>

# Preliminary Results

Hay Lake 2001



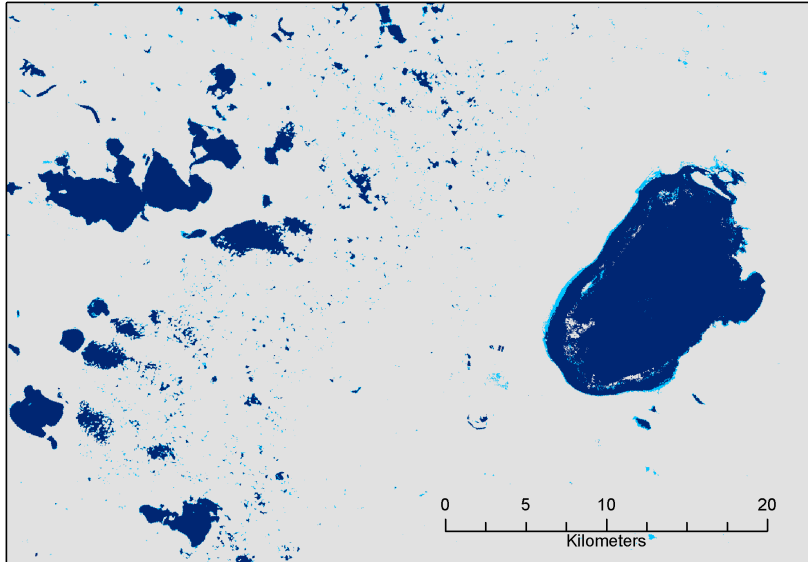
Hay Lake 2011



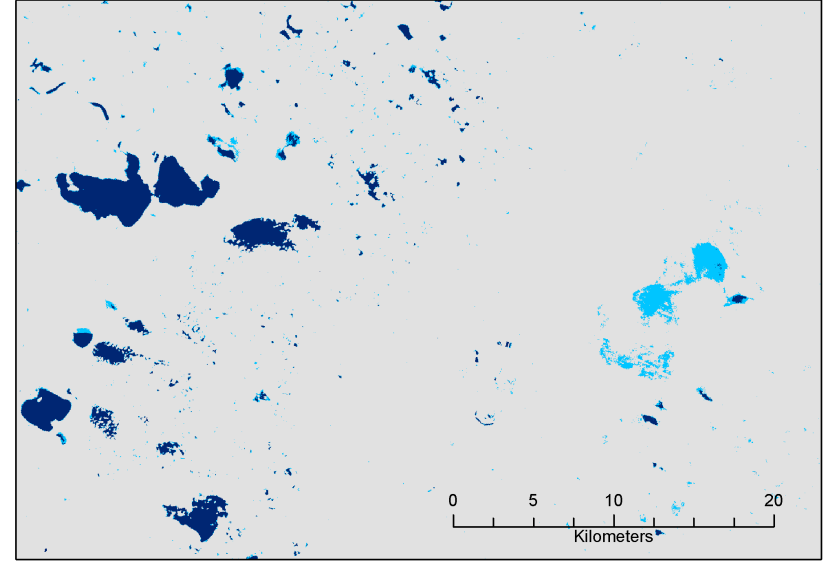
- ▶ Hay Lake in Alberta, Canada between 2001 and 2011
- ▶ Both perennial and ephemeral water surface area has expanded during the study period

# Preliminary Results

Beaver Hill Lake 2001



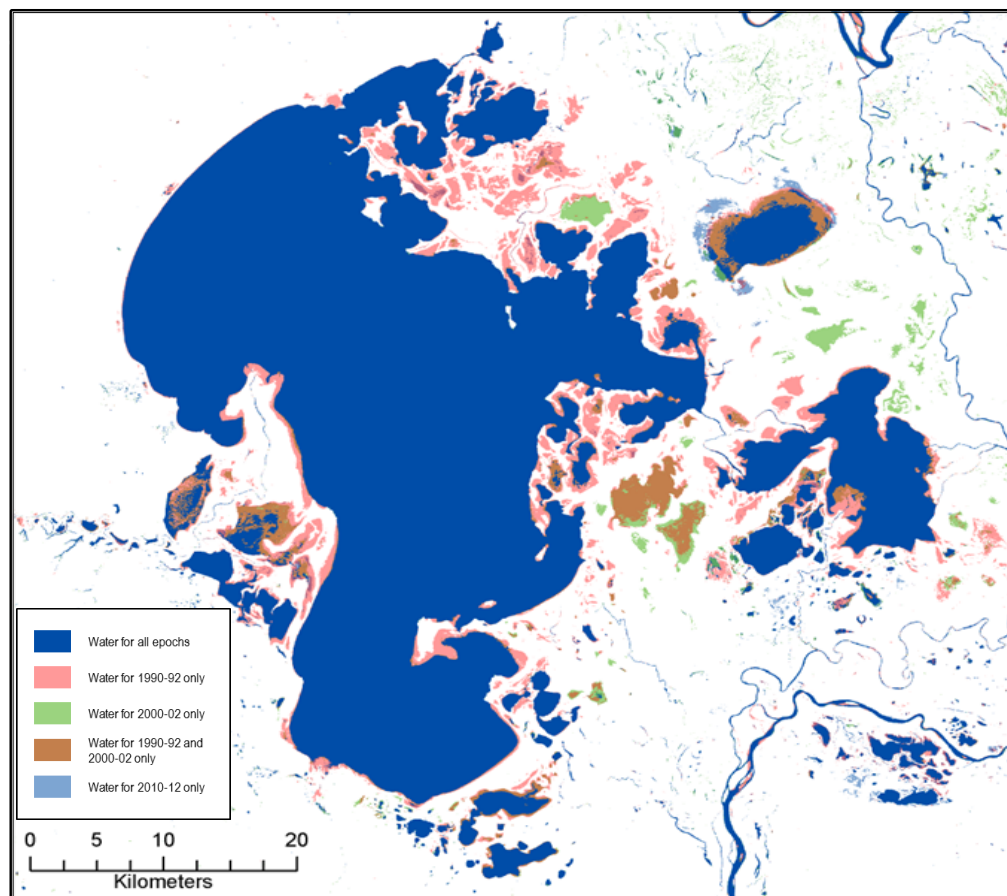
Beaver Hill Lake 2011



- ▶ Beaver Hill Lake near Edmonton, Alberta, Canada between 2001 and 2011
- ▶ Both perennial and ephemeral water surface area has declined during the study period

# Preliminary Change Result

- ▶ Series of maps at 30m spatial resolution depicting nominal water extent for a given epoch (1990–1992, 2000–2002, 2010–2012) produced from Landsat data
- ▶ Data produced operationally in the ABoVE Science Cloud (ASC)



Change in Surface water in Lake Claire, Canada 1990 – 2012 using ABoVE Decadal Water Maps



# Current Status

- ▶ Processing of >100,000 landsat scenes has been completed in the ABoVE Science Cloud
- ▶ Processing time reduced from 9 months to 6 weeks
- ▶ Alpha version of maps complete for all epochs
- ▶ Two masks have been applied
  - Oceans derived from coarse resolution data
    - 10 pixel buffer around shoreline
  - Terrain shadow mask derived from slope and elevation
- ▶ Focus for this project is on lakes, rivers may be discontinuous in places

# Current Status (cont.)

- ▶ Issues being addressed
  - Relic terrain shadows not captured by slope threshold
  - Persistent ice in the far north
  - Insufficient data in Alaska for 1991 Epoch
- ▶ First results to be released November time-frame, final results in Jan/Feb time-frame
- ▶ Final product will be raster and will include a companion raster that gives QA information
- ▶ Funding from NASA Terrestrial Ecology grant #NNX13AK57G

**Thank You!**

