ALOS K&C: Global Lake Census

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Objectives

- To use PALSAR to make a current census of the world's lakes and reservoirs and map their size and spatial distribution: a Global Lake Census
- Calibrate the census to limnological Carbon fluxes
- Establish the baseline for monitoring changes to lakes globally

State of Knowledge

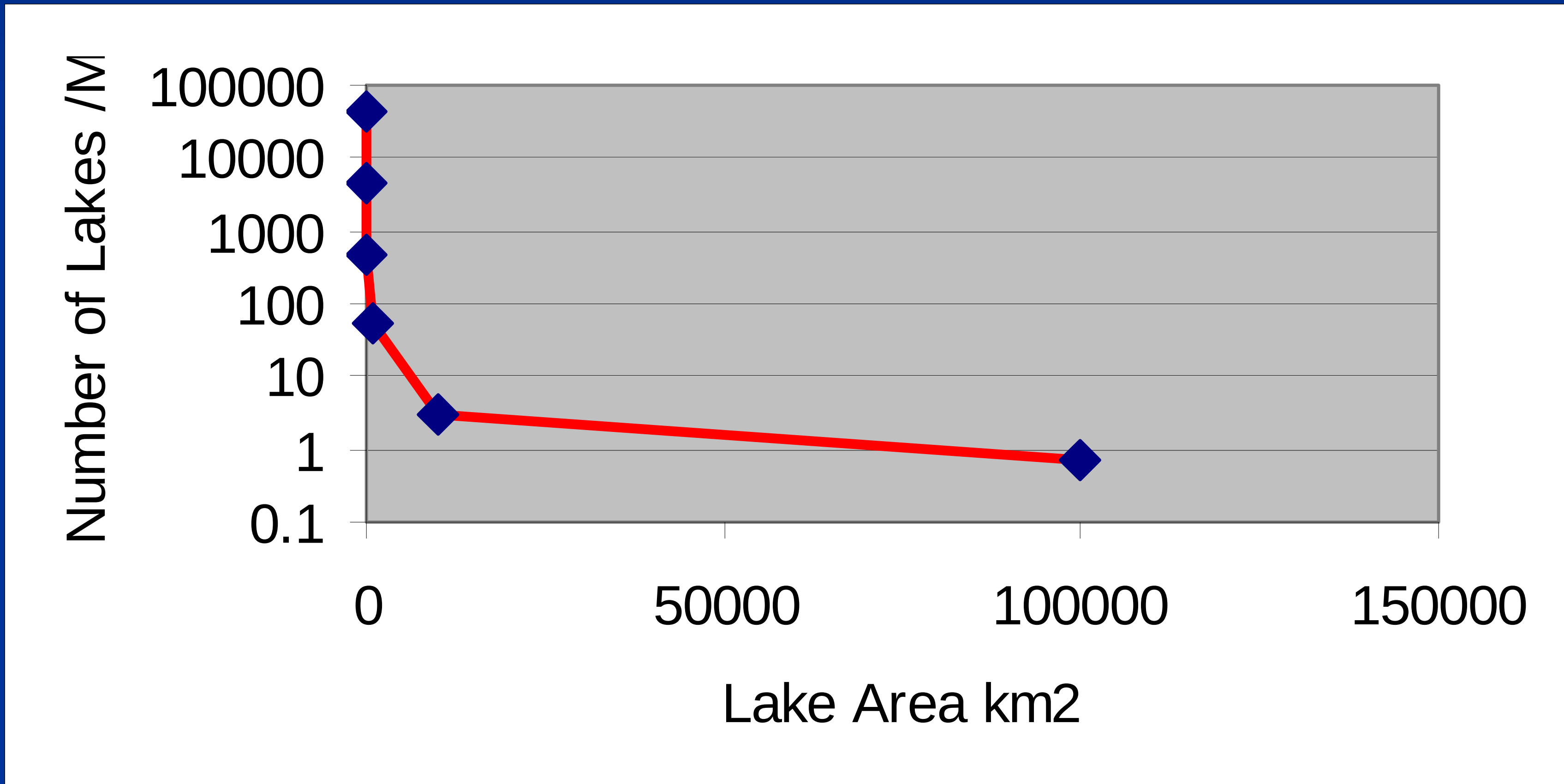
- Carbon accumulated in lake sediments is an important but poorly studied sink for atmospheric CO_2 – maybe 70 Tg/yr
- Accumulate C 50 faster than coastal oceans and sequester perhaps 25% as much as oceans (Einselle et al. 2001); reservoirs even more.
- Source of C in lakes not well known – depends on lake type and ecosystem
- Sources of CH_4
- C balance in lakes is fragile – climate change sensitive

Global distribution of lakes

- Most recent by Maybeck, 1995, based on other's but particularly Herdendorf's 1985 classification of lakes >500 km^2 (76 types)
- Extrapolated downsize using local surveys.
- Of the 133 M km^2 of unglaciated land surface, 58 M has some data on lake distribution
- Distribution for the remainder was extrapolated based on climate zones

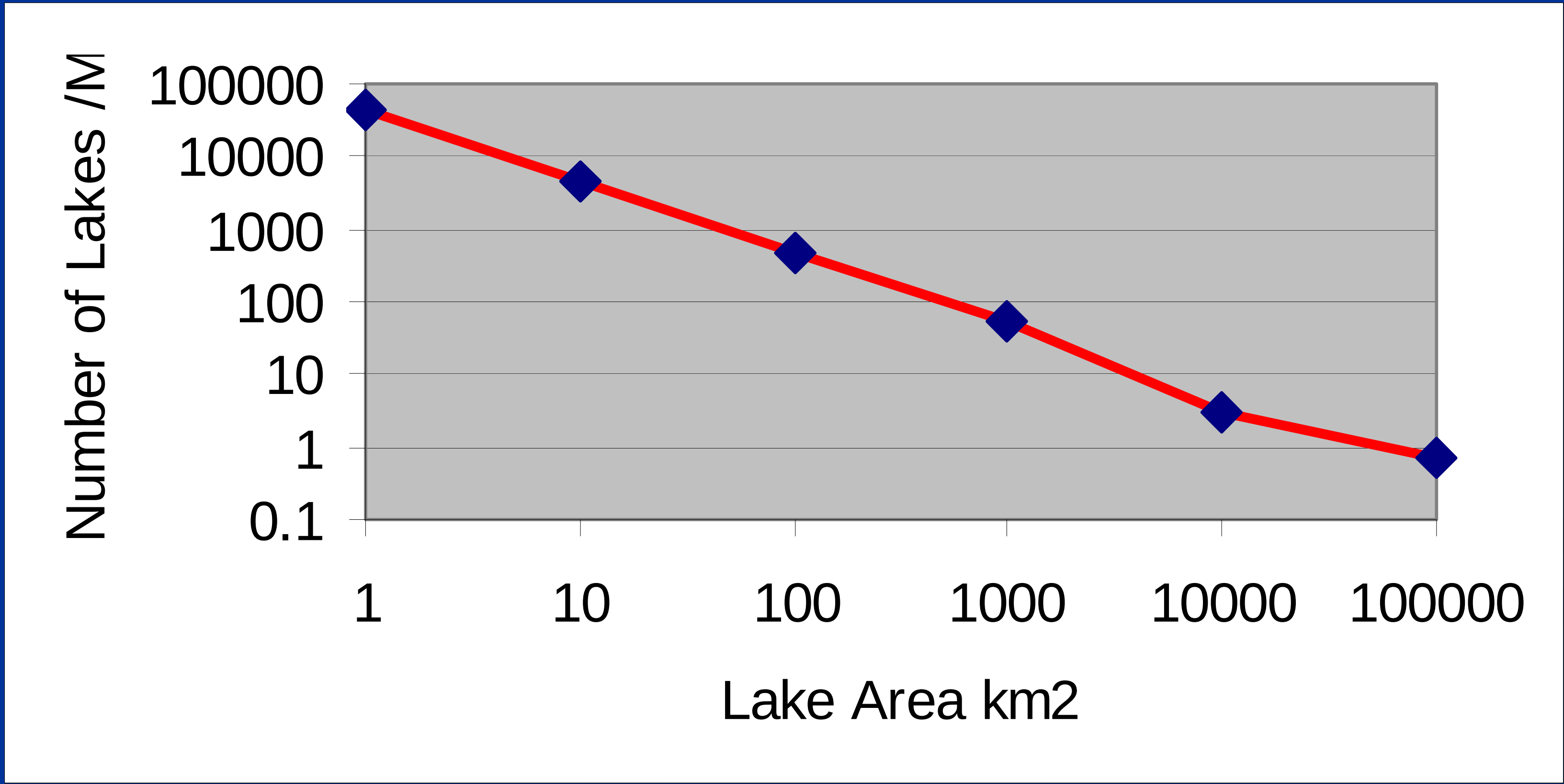
Global Distribution of Lakes

- Canada



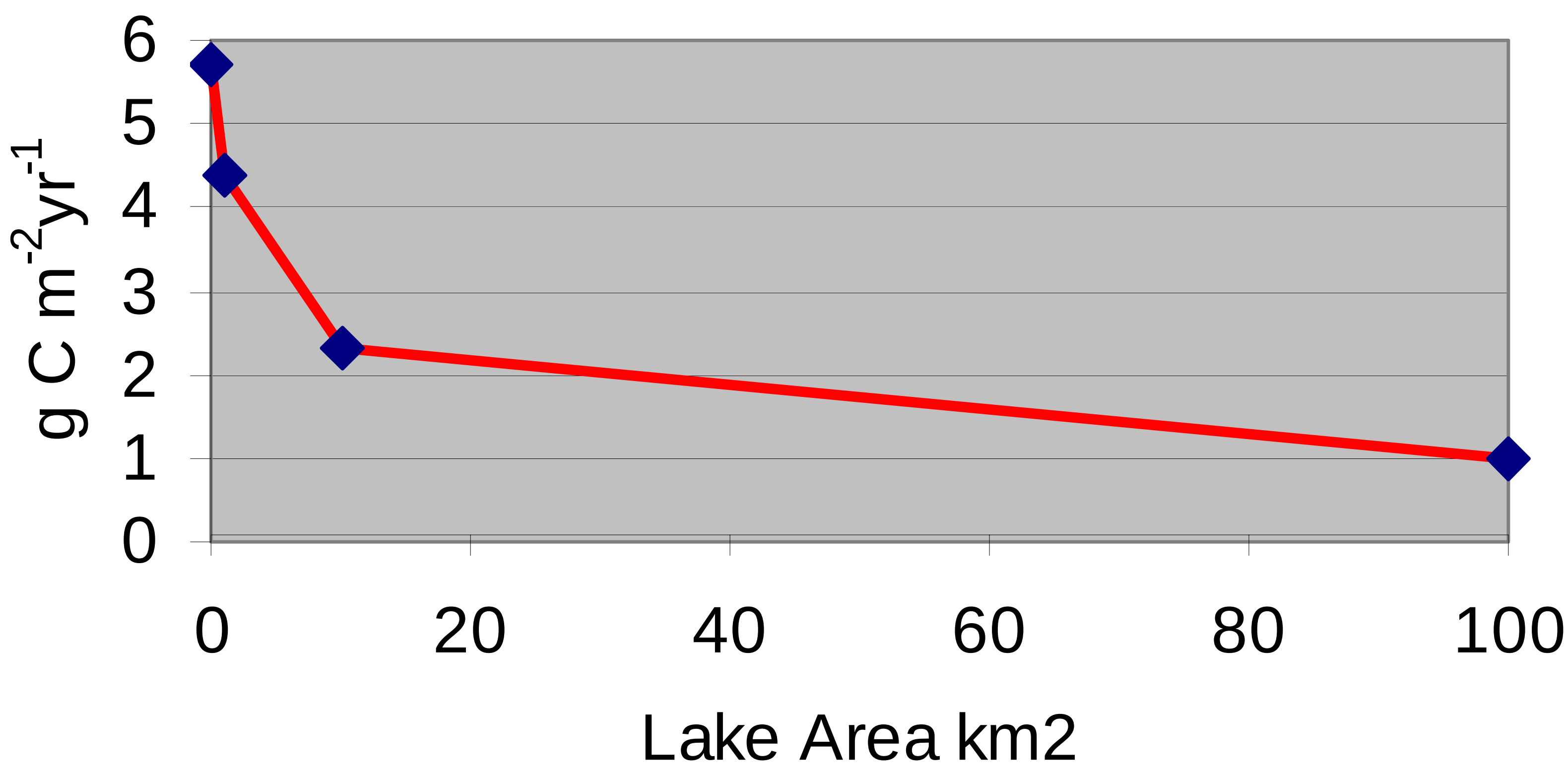
Power law for lakes

- $\log D_L = m \log A_0 + b$
- D_L = lake density; A_0 = lake area
- When m<-1 then small lakes occupy more area



C accumulation in lakes

- Smaller lakes accumulate more C (data from Pajunen, 2000)



Calibrating lakes and C

- Smaller lakes accumulate C faster
- Many small lakes are a better sink than a few large ones. ie. SMALL LAKES ARE IMPORTANT FOR C UPTAKE
- Many other factors that are related to ecosystem setting control C in lakes – topography, hydrology, geology, temperature…
- More research is required

West Coast Cores

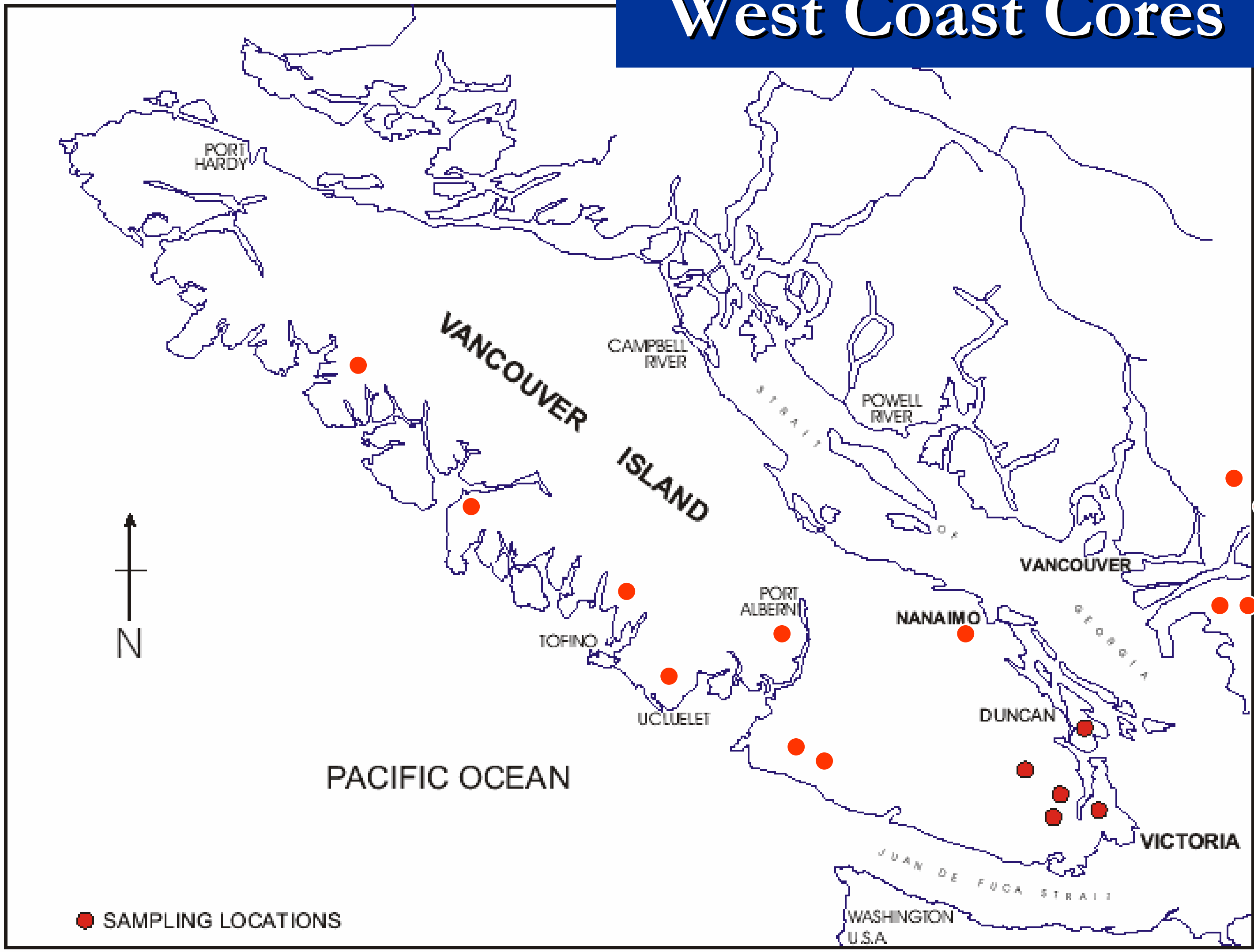


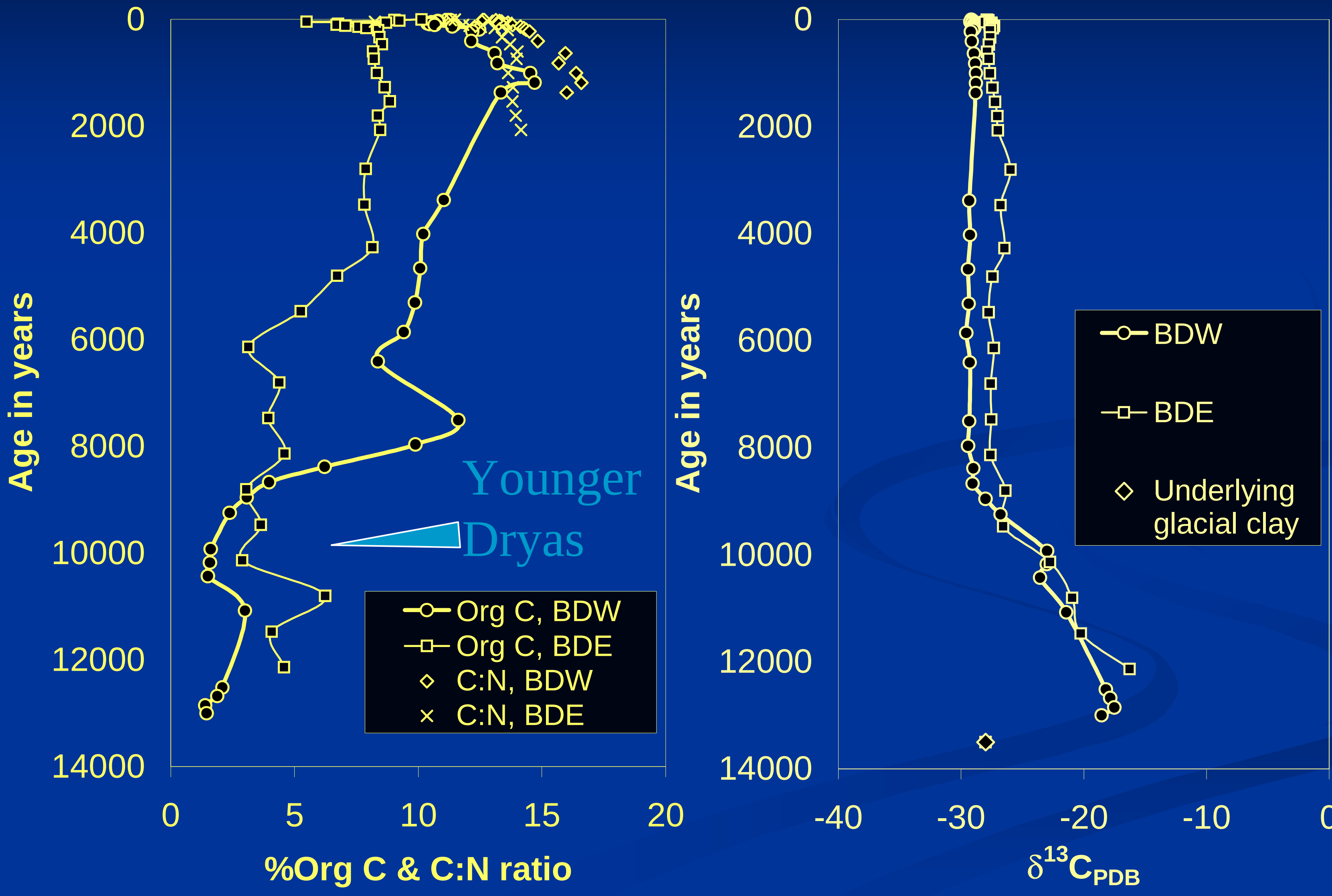
Figure 1: Map of Vancouver Island, B.C. showing sampling locations.

Long and short coring

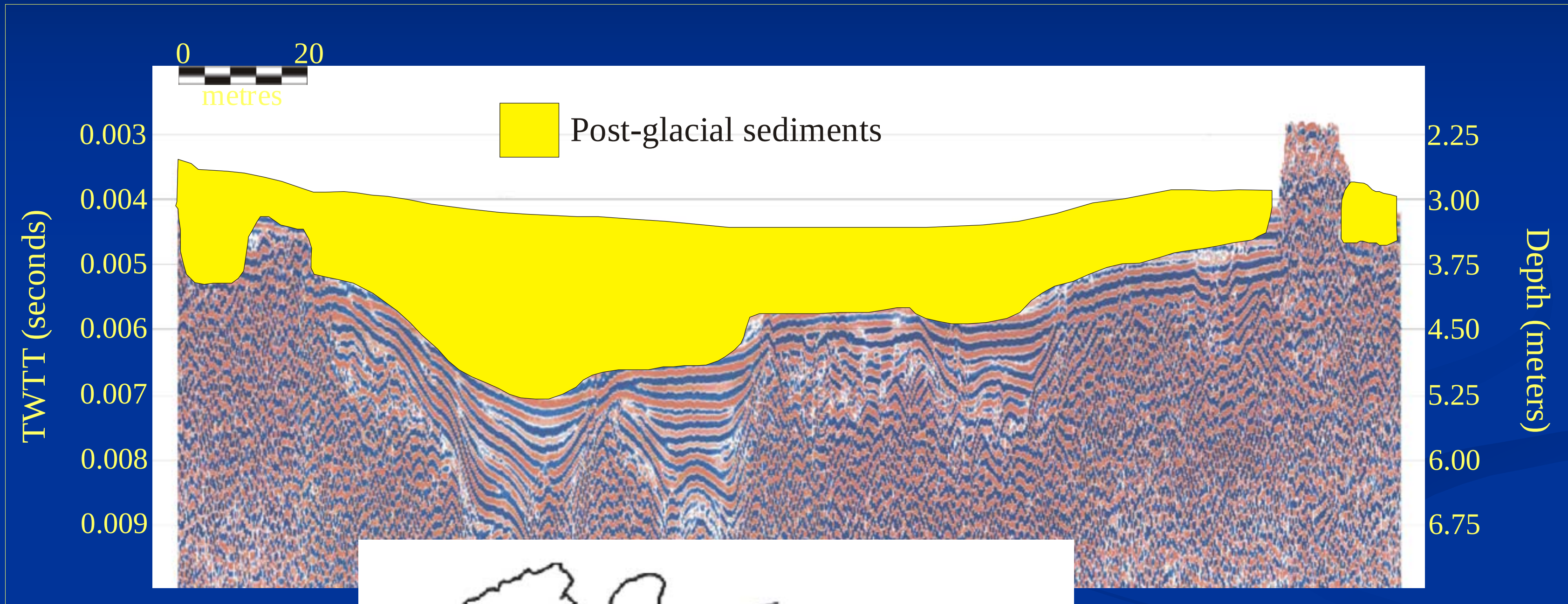
^{14}C dating

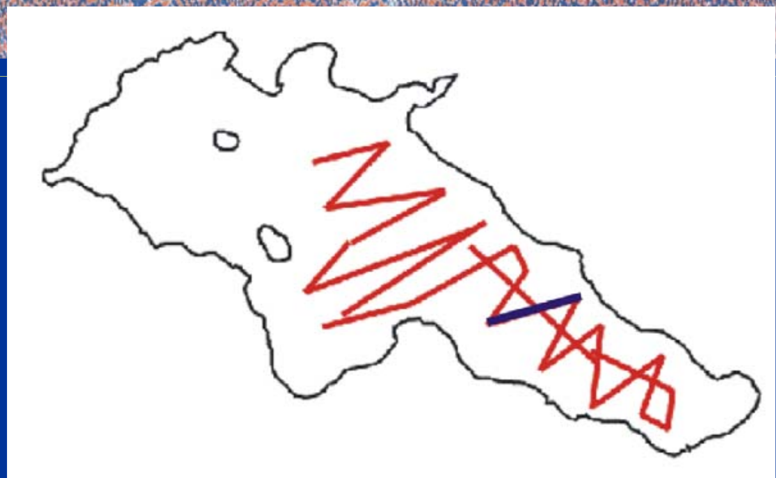
^{210}Pb dating; pollen dating

Sources and reactivity of C



Seismic reflection profile

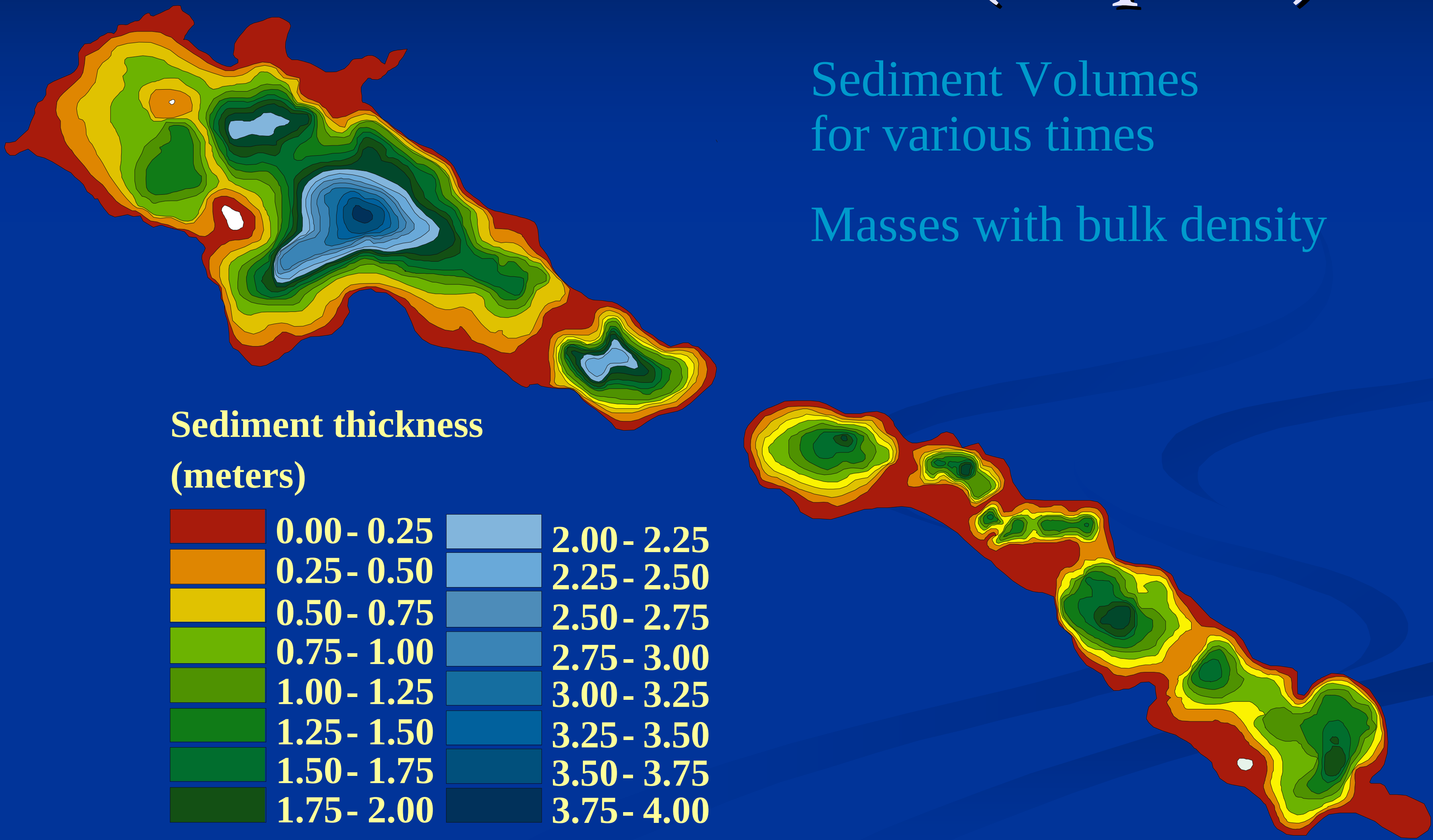




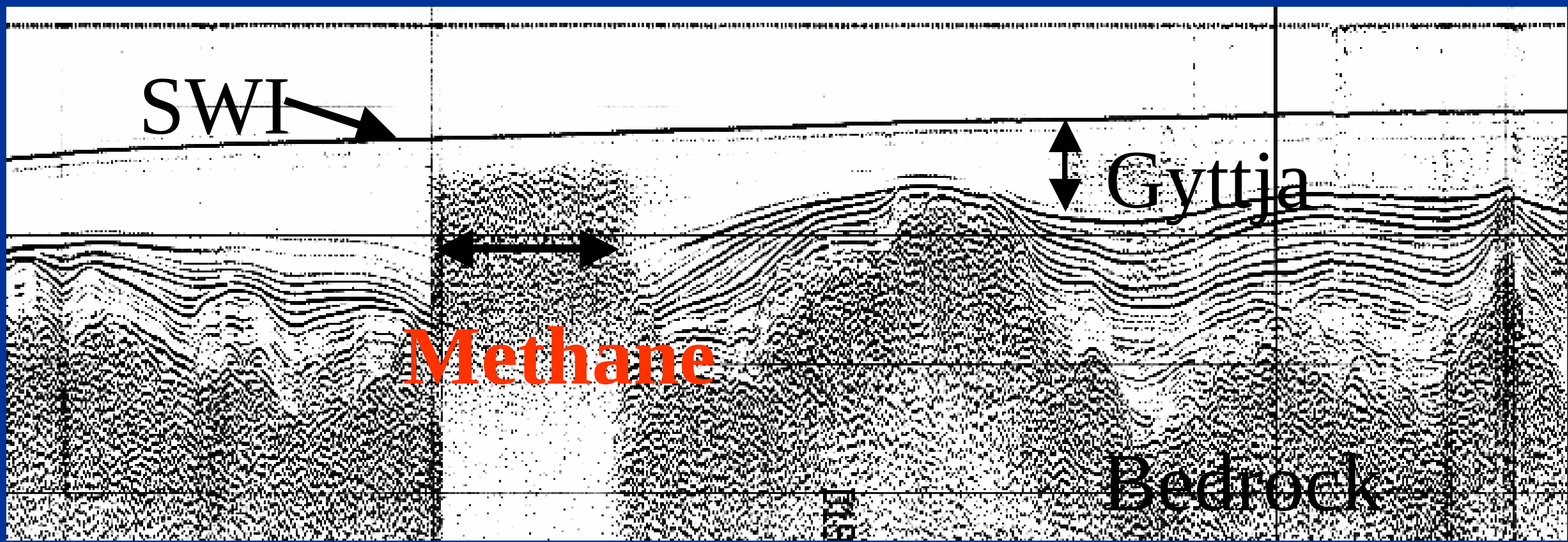
Subottom Acoustic Profiling – Sediment Thickness (isopacs)

Sediment Volumes
for various times

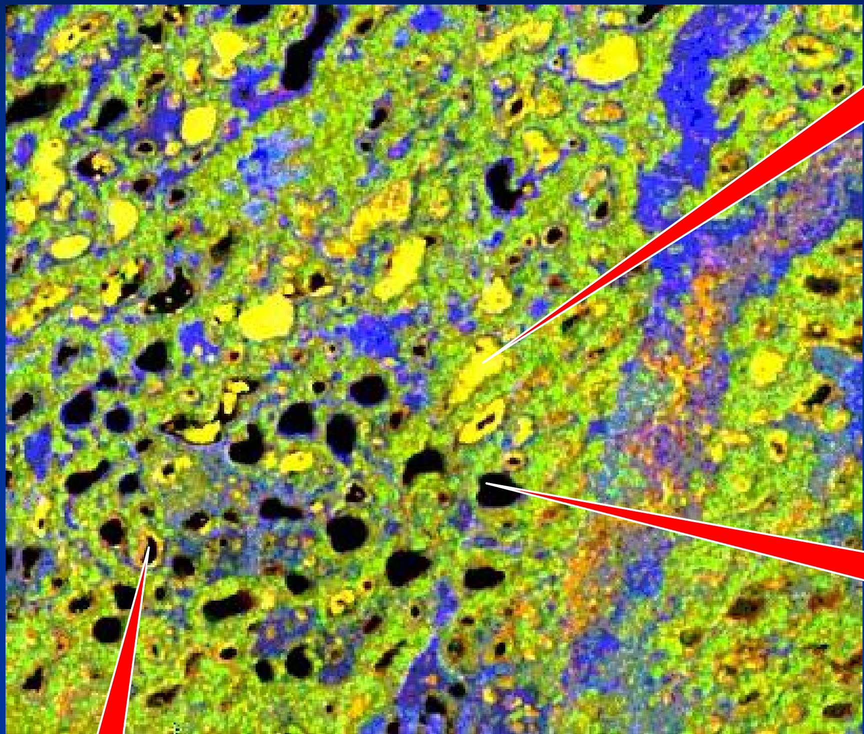
Masses with bulk density



Methane Production

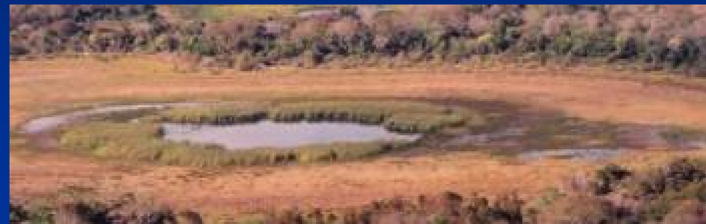


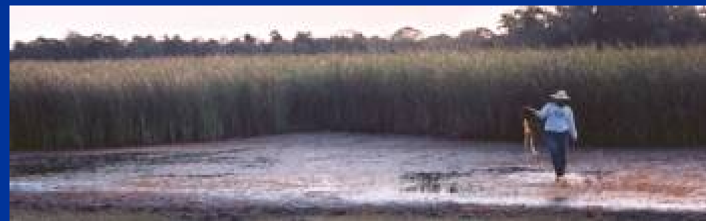
Calibrating SAR and C in lakes



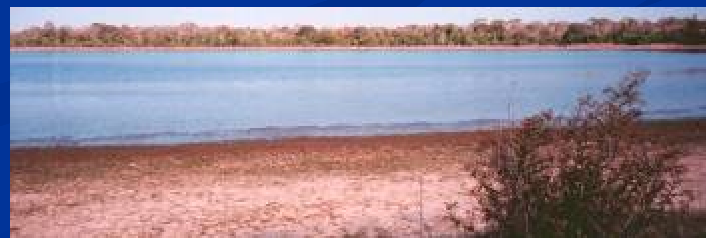
R= RadarsatS1, G=RdarsatS7, B=JERS-1

Hard

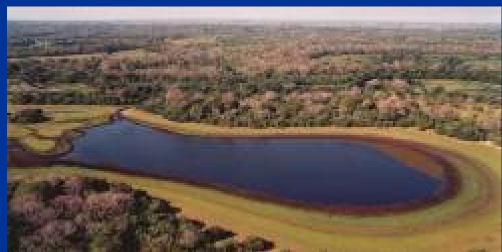




Brackish



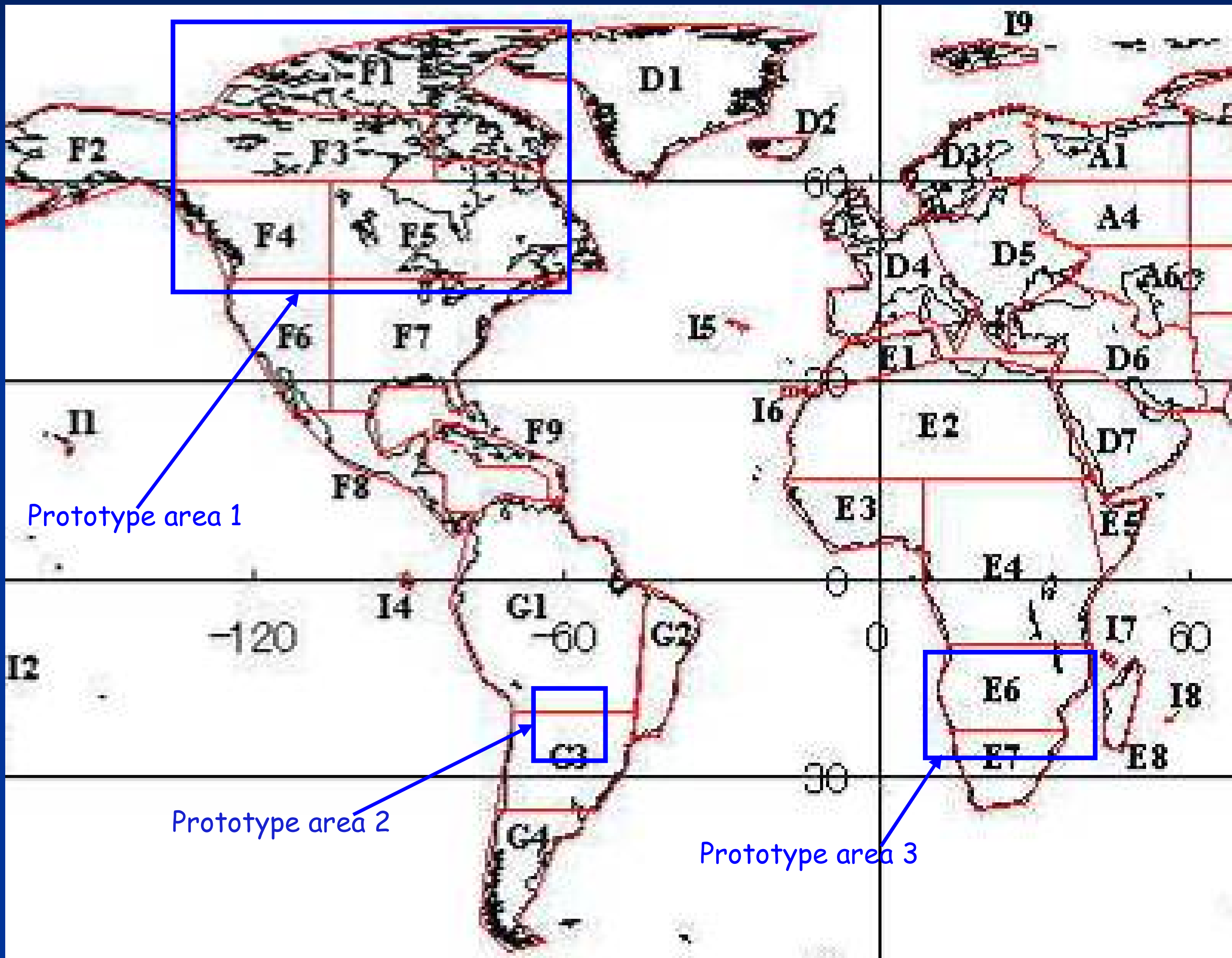
Soft



Relevance to ALOS

- Currently no robust lake inventory exists
- None from a single datasource
- Optical imagery options are limited for single season mozaics
- SAR excellent at separating open water
- L-band optimal for eliminating small emergent vegetation – important for small lakes.

Prototype Areas



Planned Output Products

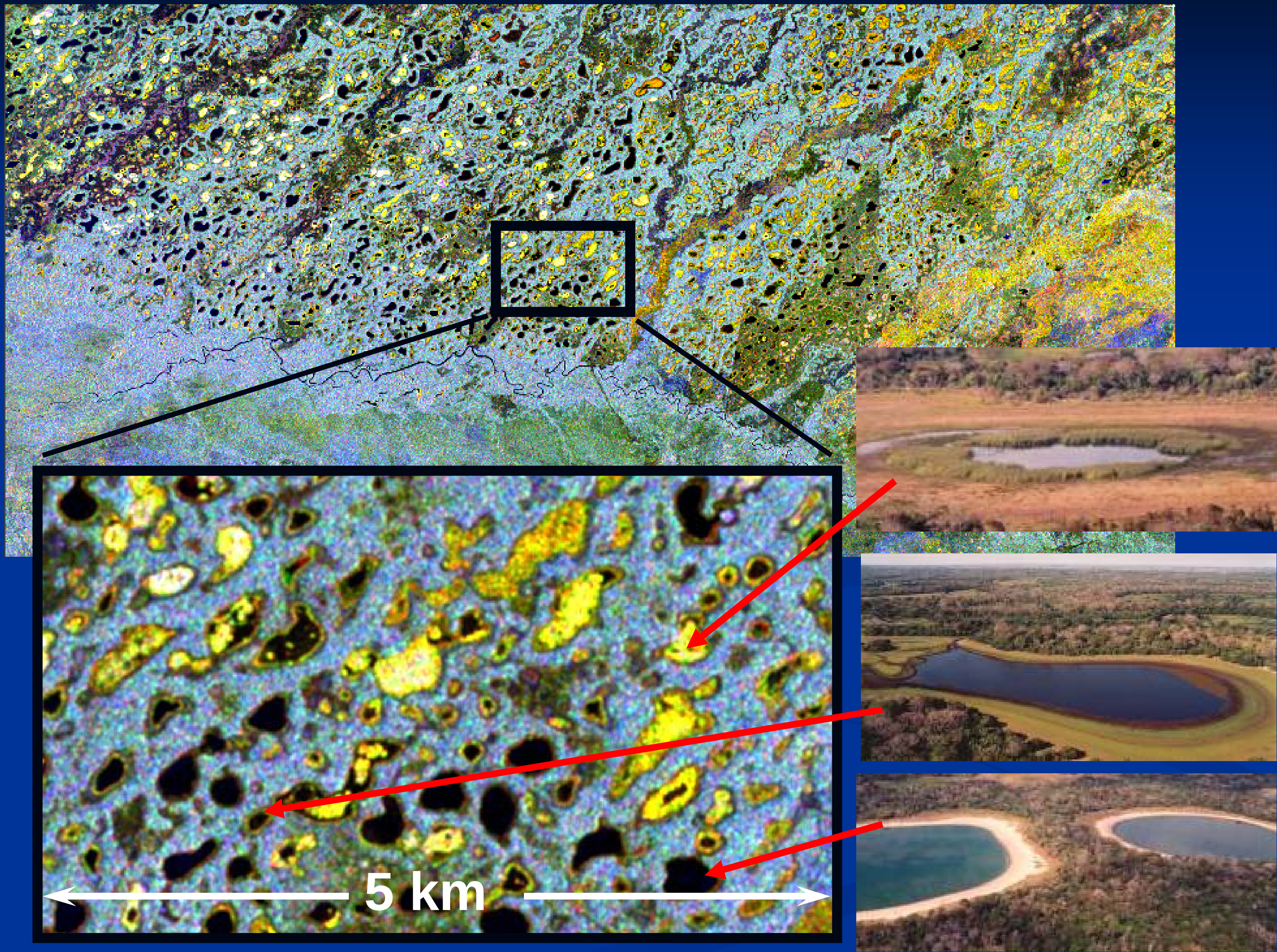
- End of Year 3:
- Maps of lake distriution, area, and number for target areas.
- Product methodology and validation report
- Estimates of regional C accumulation based on lake class distribution

- Prospects for Years 4-6 (assuming agreement extension)
- Extension to global coverage
- Rates of carbon accumulation for lakes regionally and globally
- 10-year Lake change map for Pantanal and Borela Biome and possibly other areas depending on JERS-1 availability

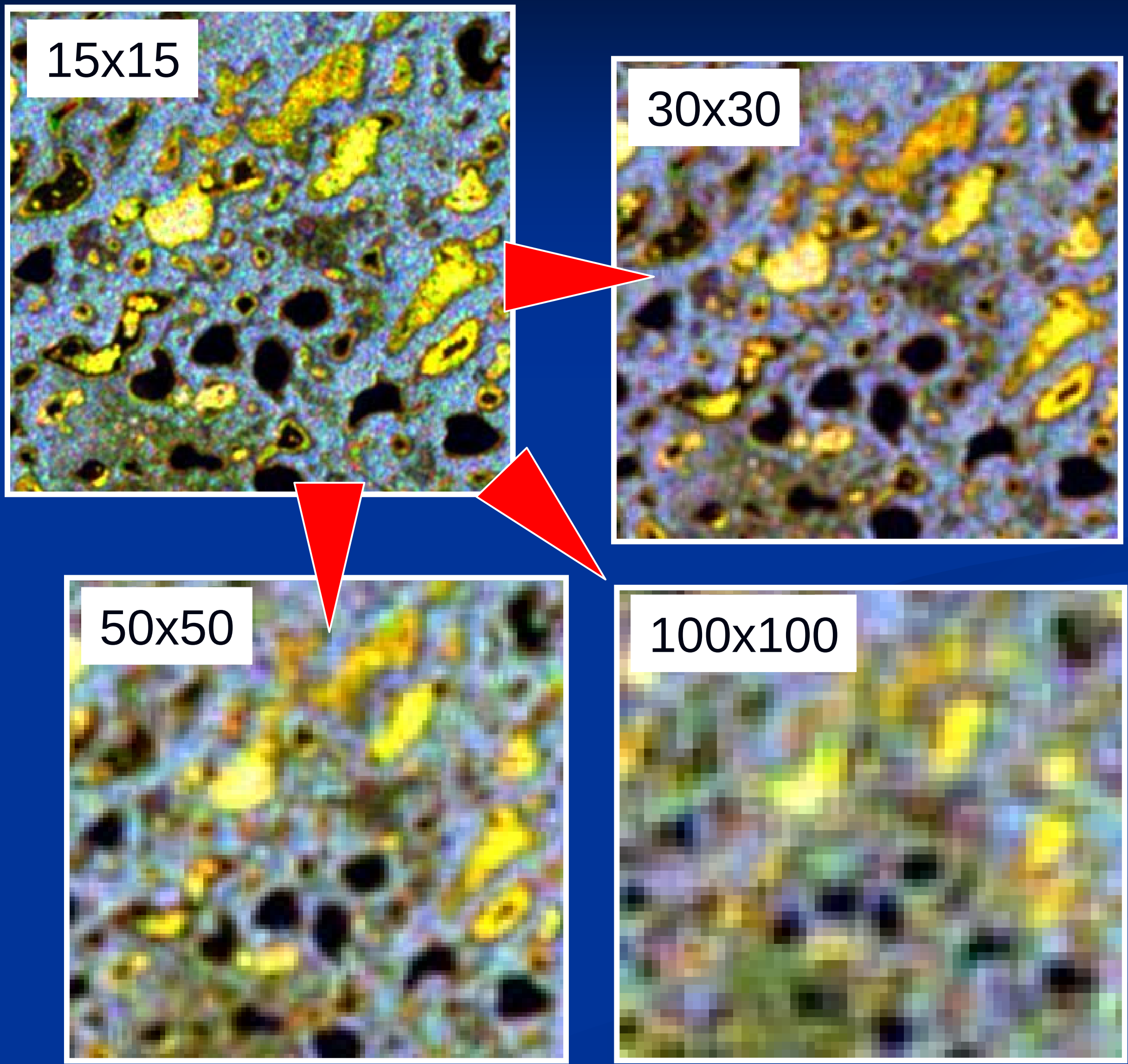
Pilot Areas

Microsoft MapPoint
180°
75°
ARCTIC OCEAN
RUSSIA
CANADA
Arctic Circle
NORTH AMERICA
EUROPE
UNITED STATES
Prime Meridian
ASIA
Gulf of Mexico
LIBYA
Tropic of Cancer
SUDAN
PACIFIC OCEAN
MALI
NIGER
AFRICA
ATLANTIC OCEAN
Equator
BRAZIL
SOUTH AMERICA
Tropic of Capricorn
©2005 Microsoft Corp.
45°
30°
15°

Brazilian Pantanal


5 km

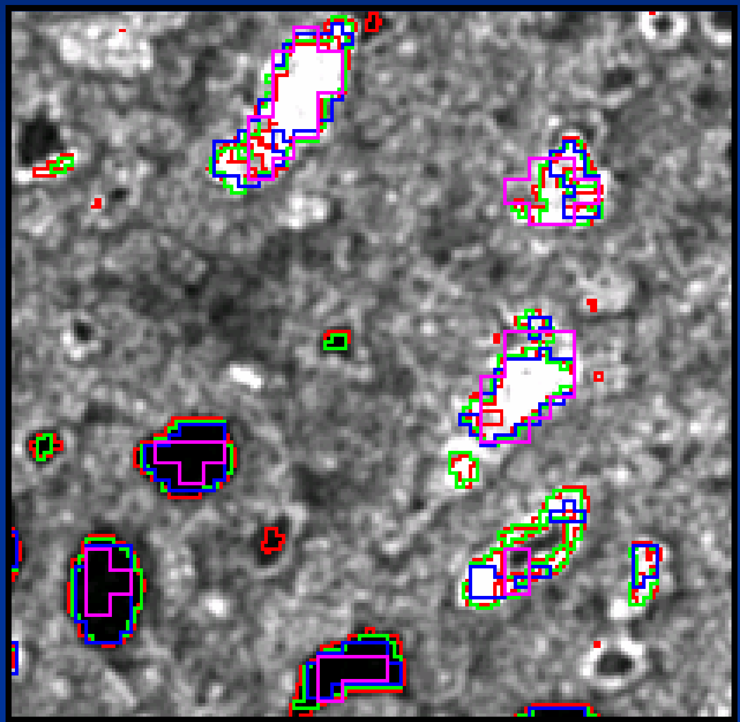
Resolution Issues

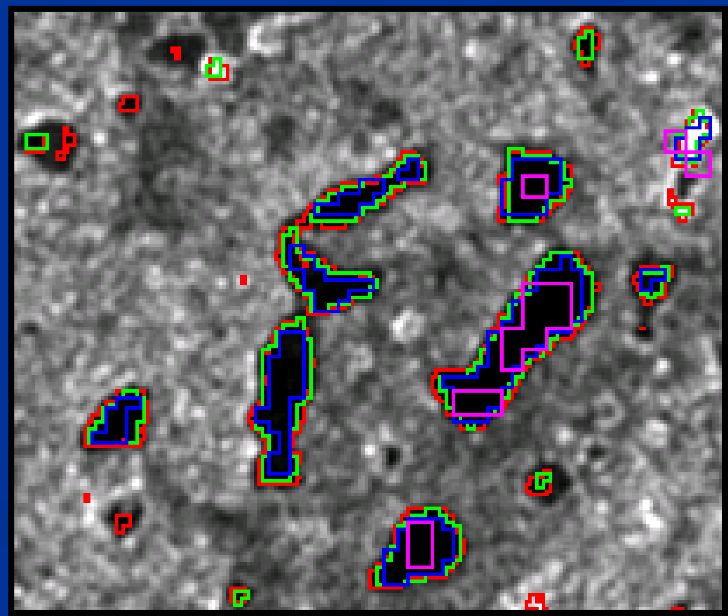


ALOS - mosaic

JERS - mosaic

Areas change at different resolution





- Worse for small lakes

Canada

Kovl/uneskin
ARCTIC OCEAN
MapPoint
GREENLAND (DEN.)
Beaufort Sea
Baffin Bay
Davis Strait
ALASKA
Fairbanks
Mount Mckinley 20,320 ft
NORTH AMERICA
NUNAVUT
Taloyoak
BAFFIN ISLAND
Nuuk
YUKON TERR.
NORTHWEST TERRITORIES
Arctic Circle
Iqaluit
Labrador Sea
Yellowknife
Baker Lake
Juneau
Arviat
Hudson Bay
Happy Valley-Goose Bay
Peace
SASK.
CANADA
BRITISH COLUMBIA
ALTA.
Prince George
Edmont
MANITOBA
QUÉBEC
Vancouver
Calgary
Charlottetown
Seattle
Halifax
Regina
ONT.
Winnipeg
Thunder Bay
Portland
Ottawa
Montréal
OREGON
MONTANA
UNITED STATES
MINN.
Boston
Boise
Syracuse
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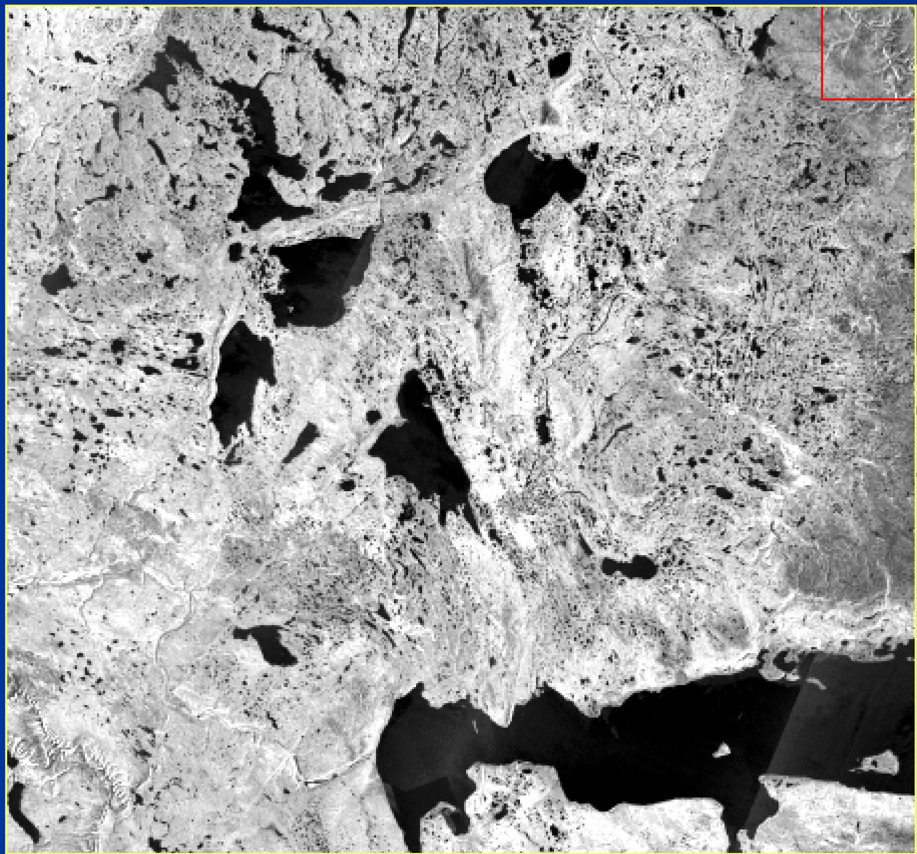
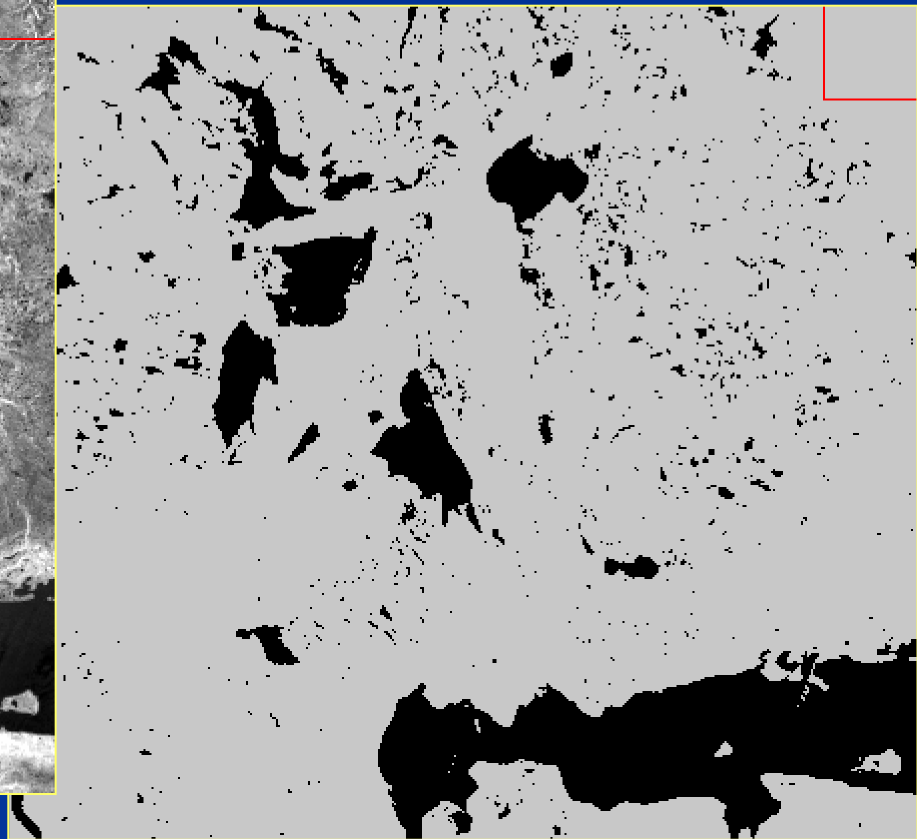
Great Bear Lake, NWT, Canada

Great Bear Lake, NWT, Canada

- Simple classification 500m resolution JERS-1 Mosaic

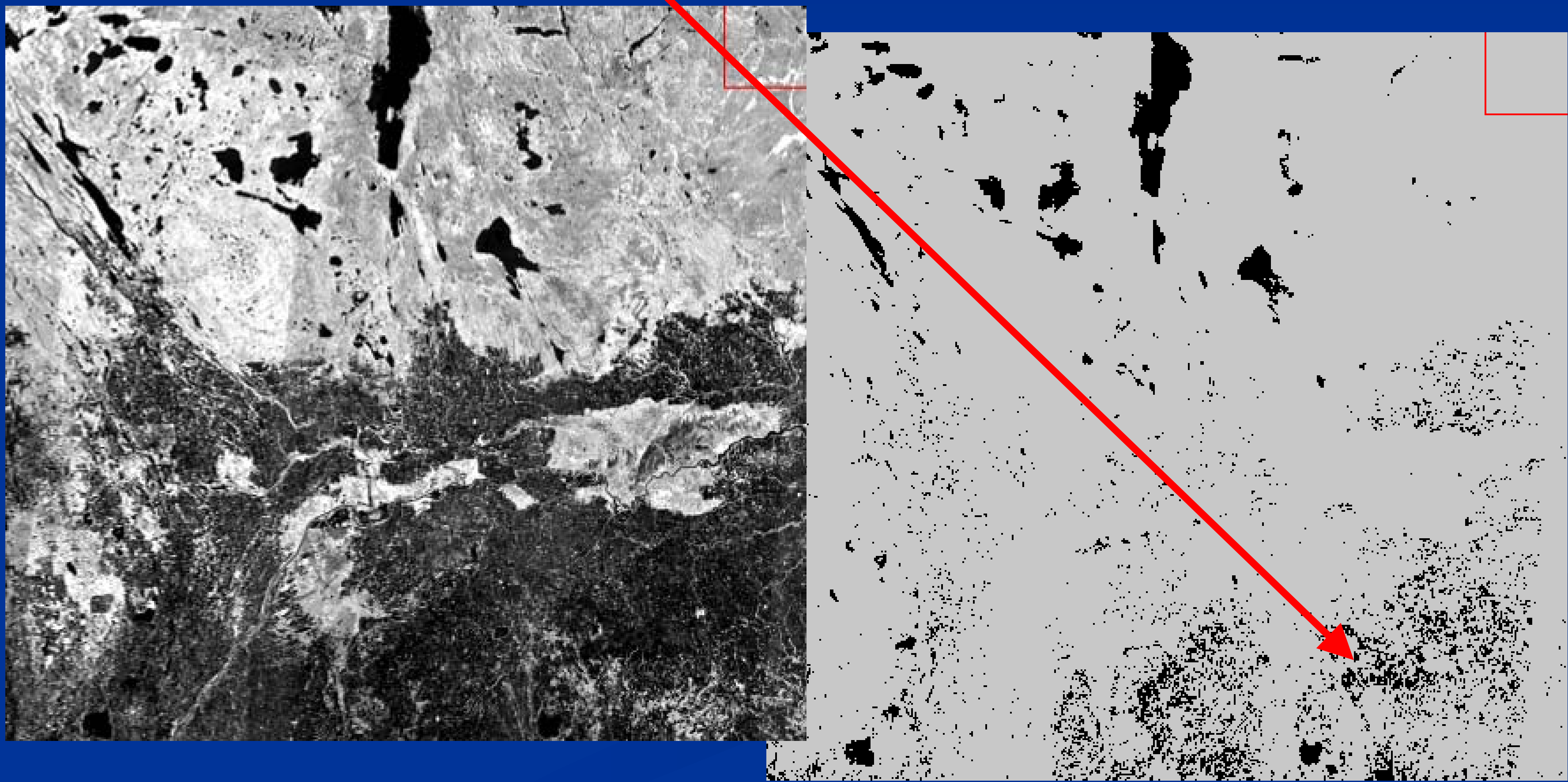




Central Saskatchewan

Central Saskatchewan, Canada

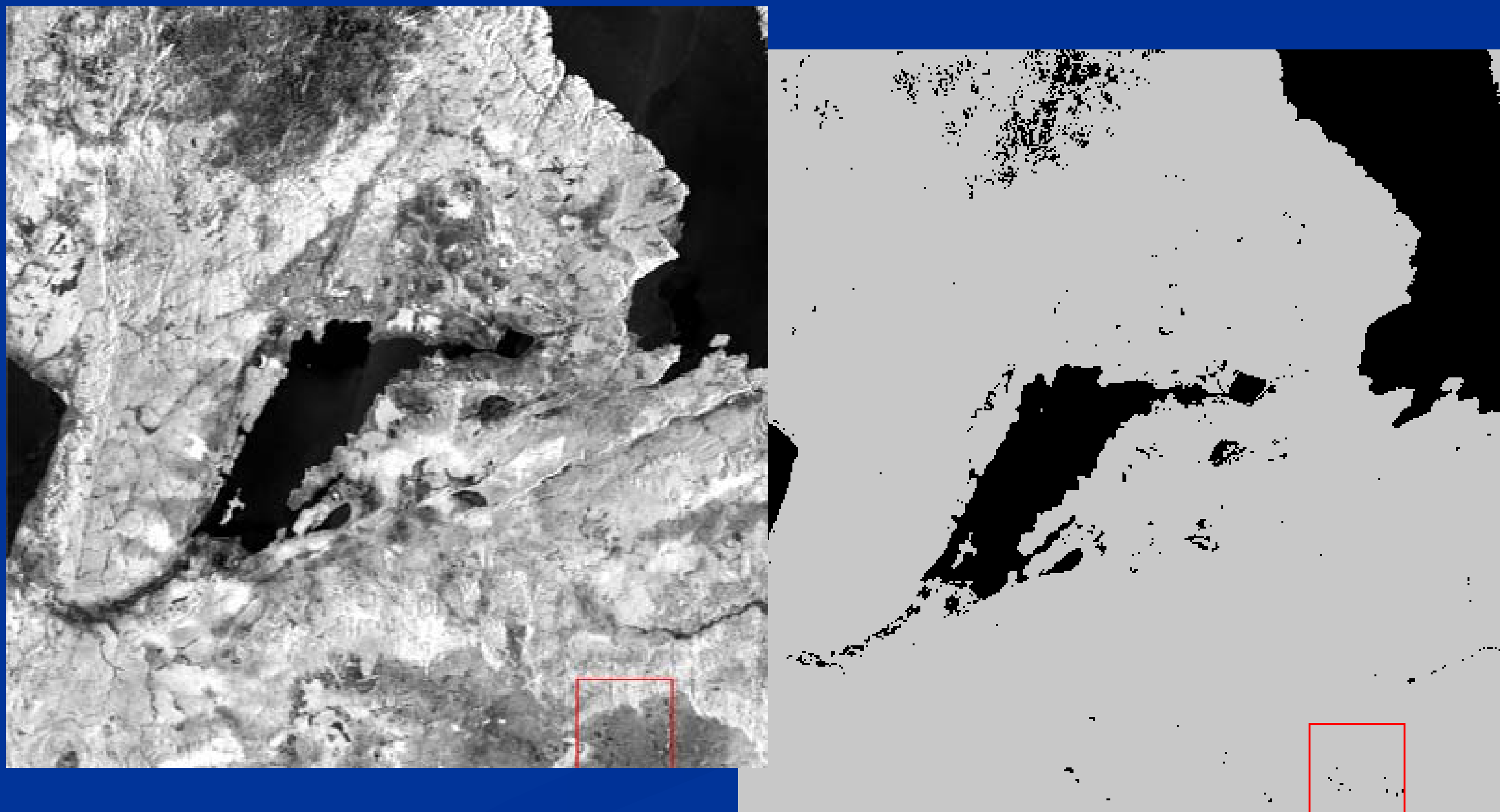
- JERS-1 Mosaic 500m resolution
- Errors in non-shield areas



Southern Africa

Great Rift Valley, East Africa

Great Rift Valley, East Africa



Thank you

Kevin and Maycira