Marine Radar Environmental Observations using Data from a Moving Vessel

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Acknowledgements:

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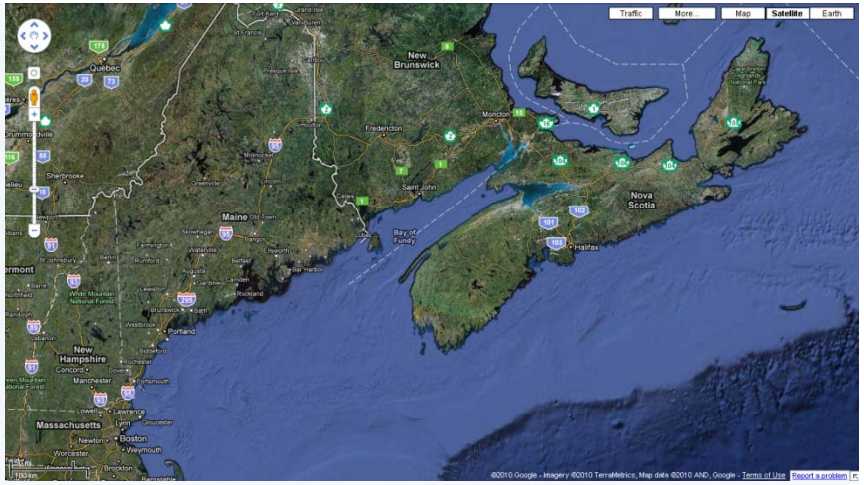
"CFAV Quest" in Newfoundland

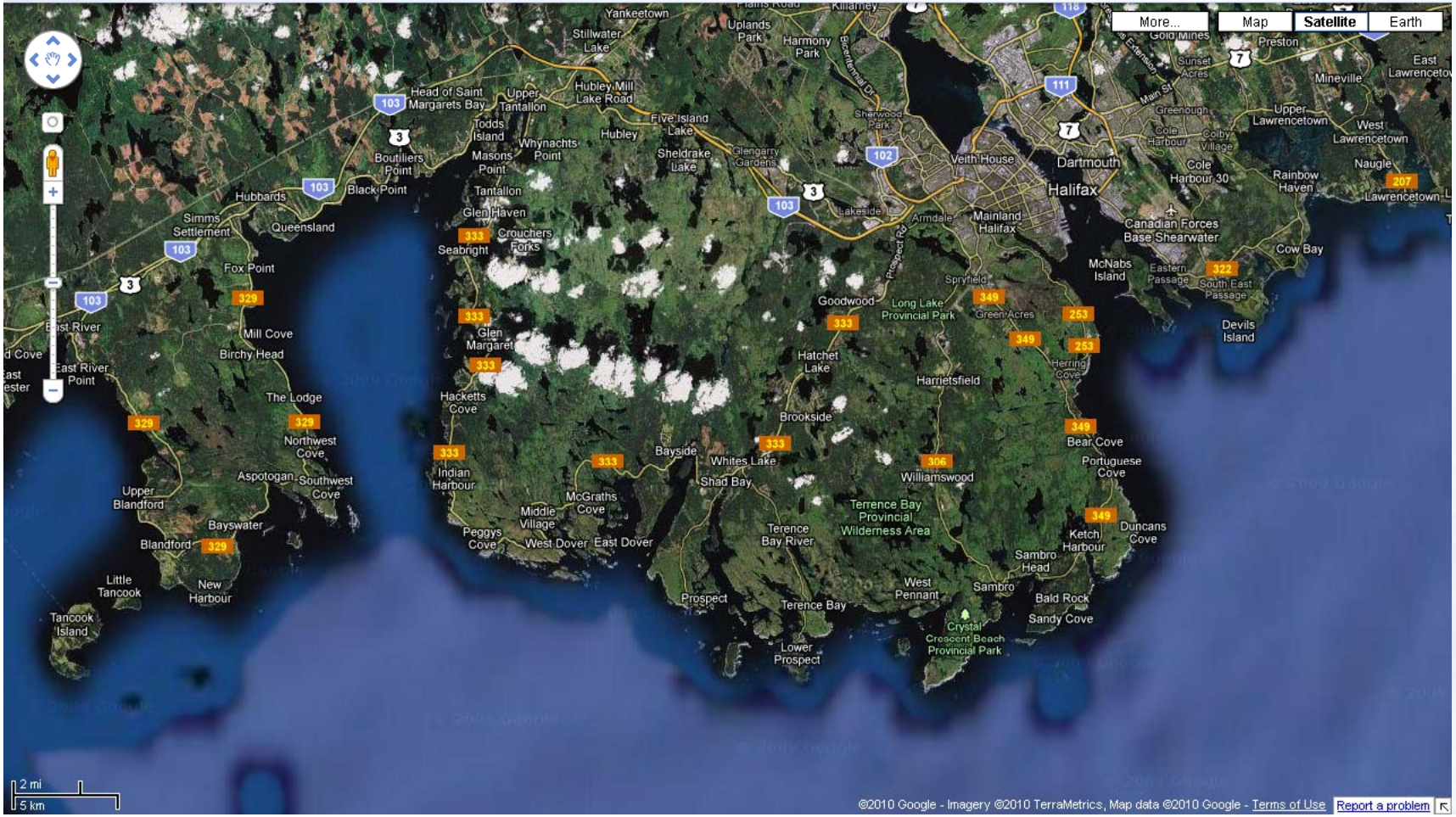
www.noc.ac.uk

Radar Wave Inversions

- Wave patterns clearly visible in the sea clutter of standard marine radar.
- Typically record sequences of this sea clutter over a few minutes to get an animation of waves at coastal sites from a cliff top, building or tower.
- Use wave theory to determine the water depth and currents that caused that wave behaviour – depth determination fundamentally limited to depths of approx half the wavelength of the waves.
- Question posed at MREA2007 - Could this be achieved using data from a moving vessel?

Test sites in Nova Scotia: Halifax & St Margaret's Bay

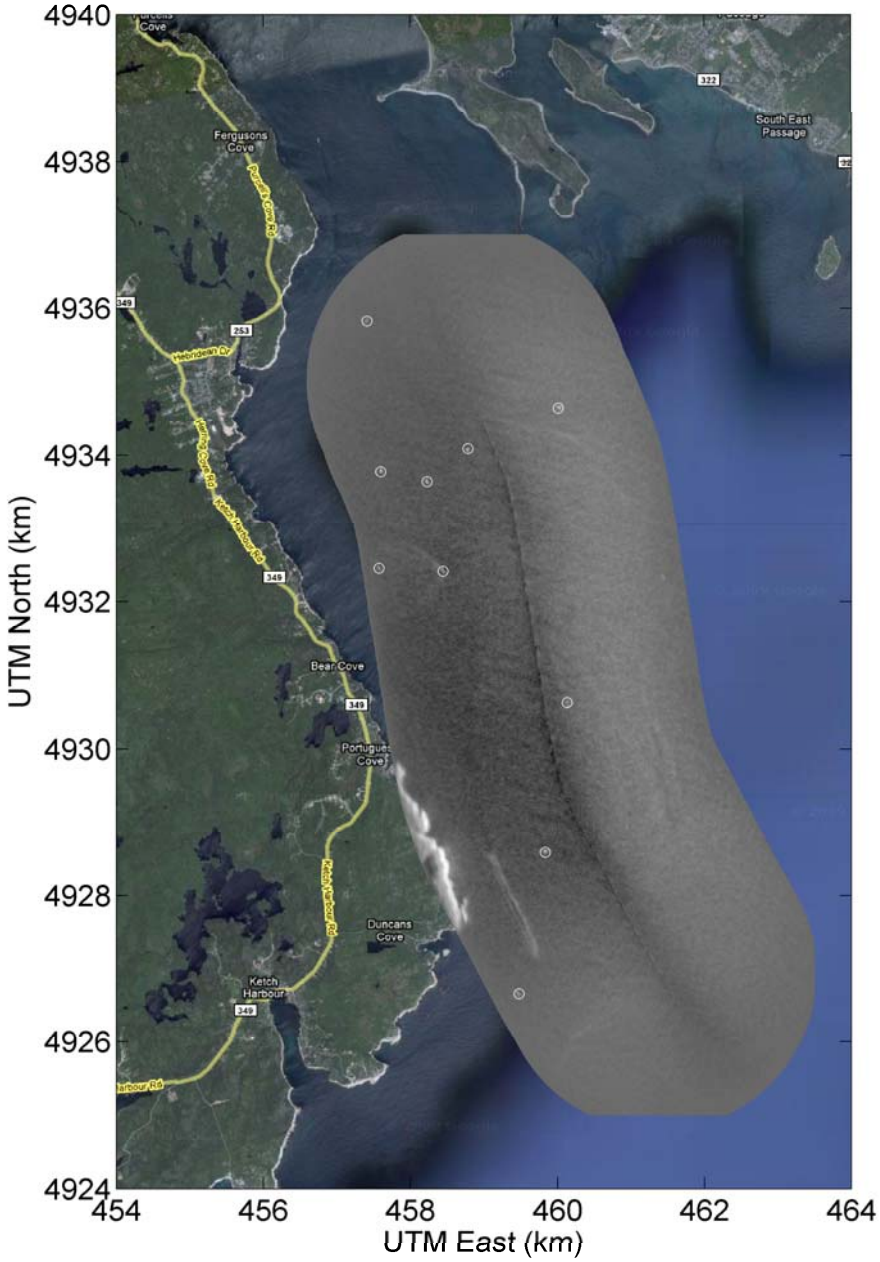


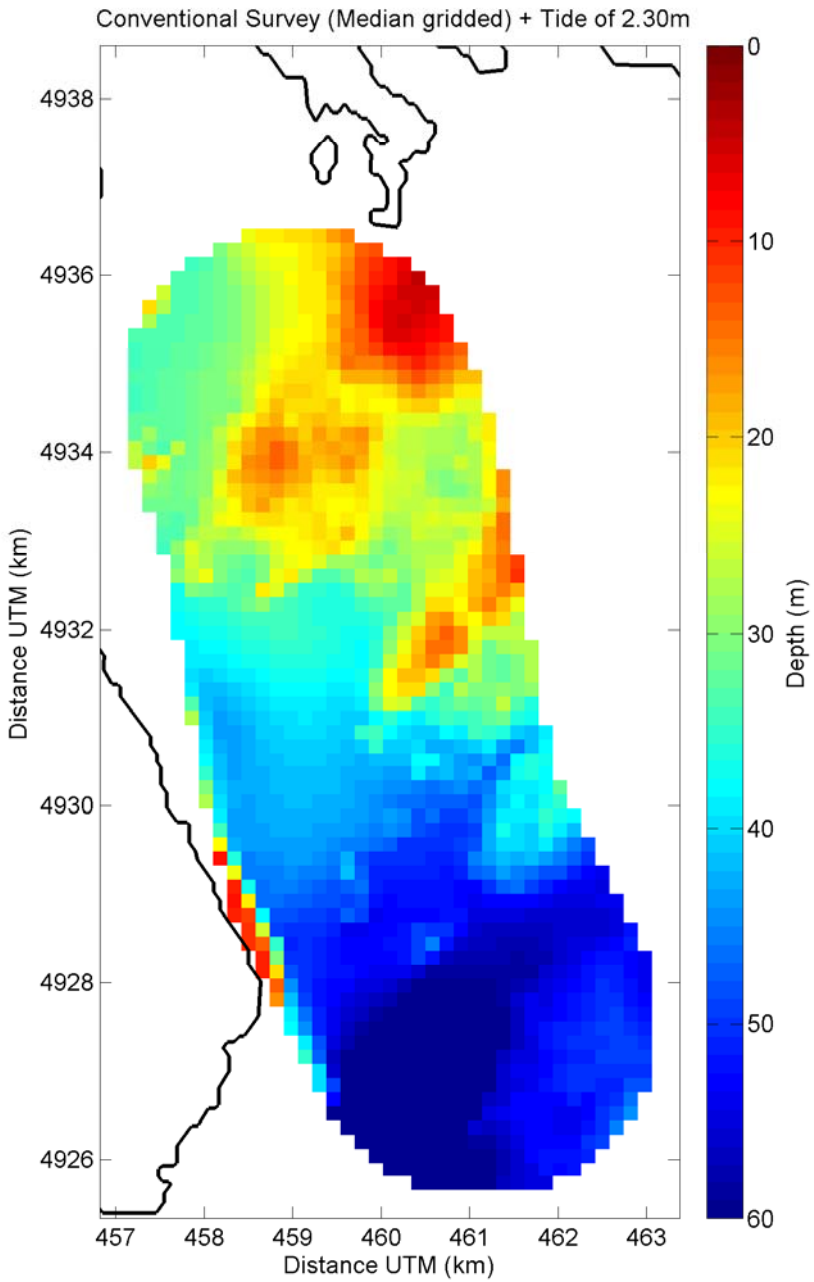


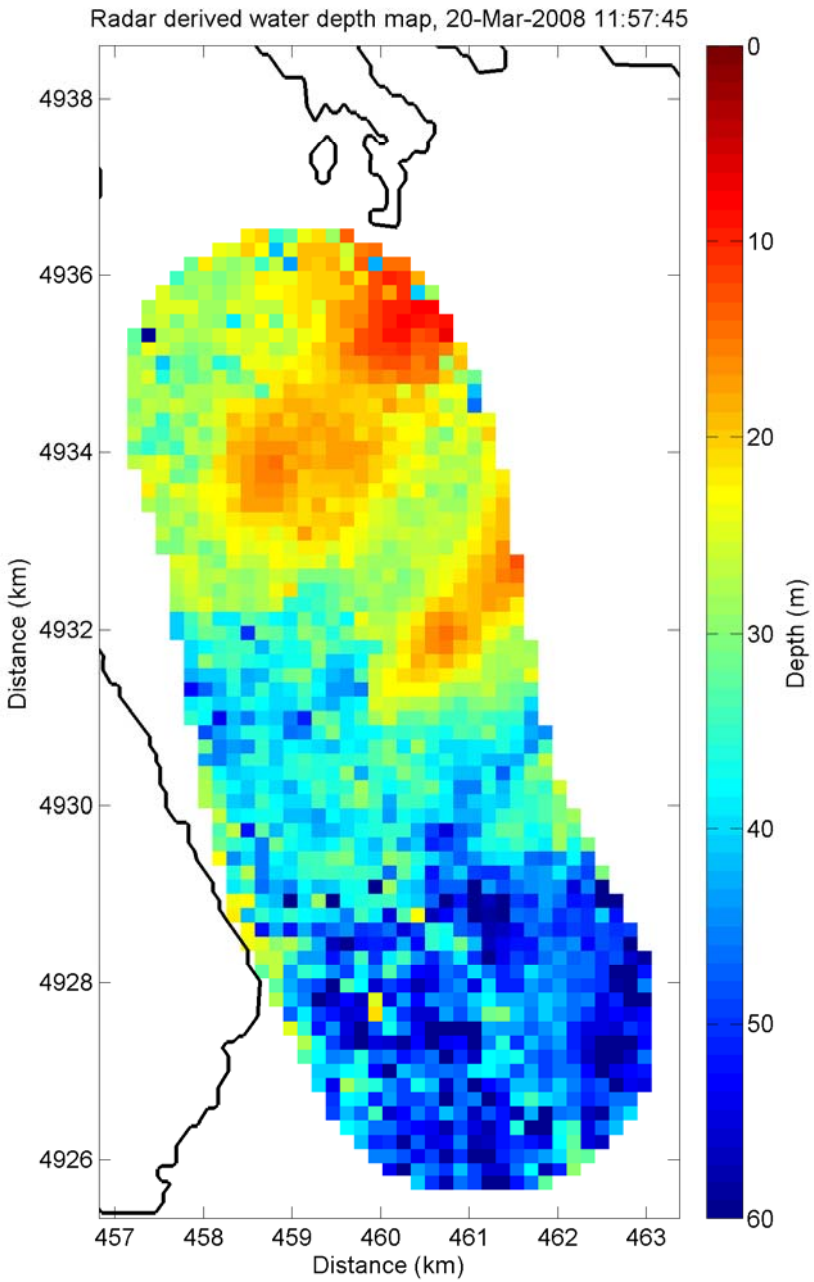
Quest 313
Halifax Approaches
March 20th 2008

- Racal-Decca Bridgemaster 2 X-Band Radar on short pulse
  Wamos II Radar Digitiser
  Single record
  512 images @ 2.26s intervals
  ~17 minutes of data
  Recording Range : 2km
  Ship Speed : 10-14 knots
  Wave Hs : 1.4m (swell)
  DGPS & GYRO every 10secs
  Analysis : 640m square @ 160m intervals (very coarse!)

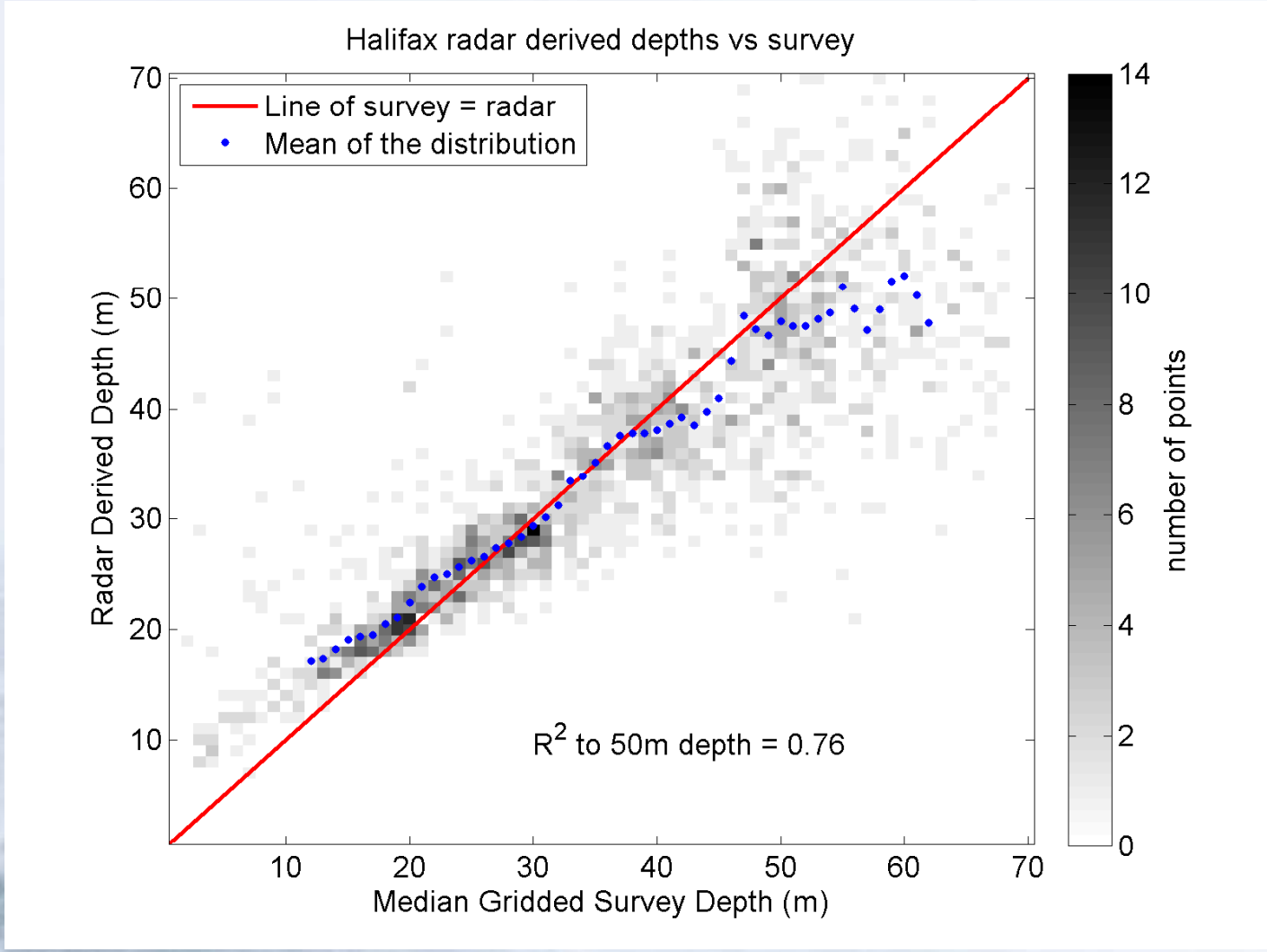
CFAV Quest Approach to Halifax
Radar Timelapse Overlay on Google Earth Imagery 20th March 2008



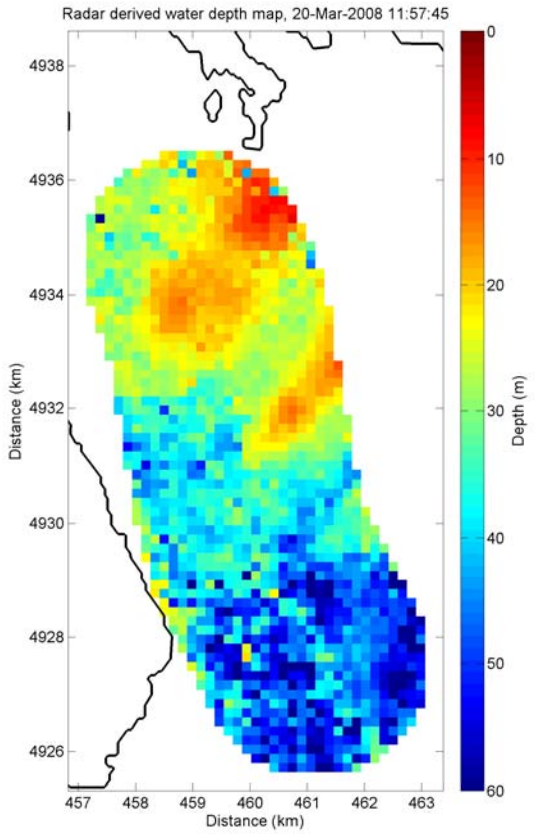

Conventional Survey (Median gridded) + Tide of 2.30m
Distance UTM (km)
Distance UTM (km)
Depth (m)
4938
4936
4934
4932
4930
4928
4926
457
458
459
460
461
462
463
0
10
20
30
40
50
60

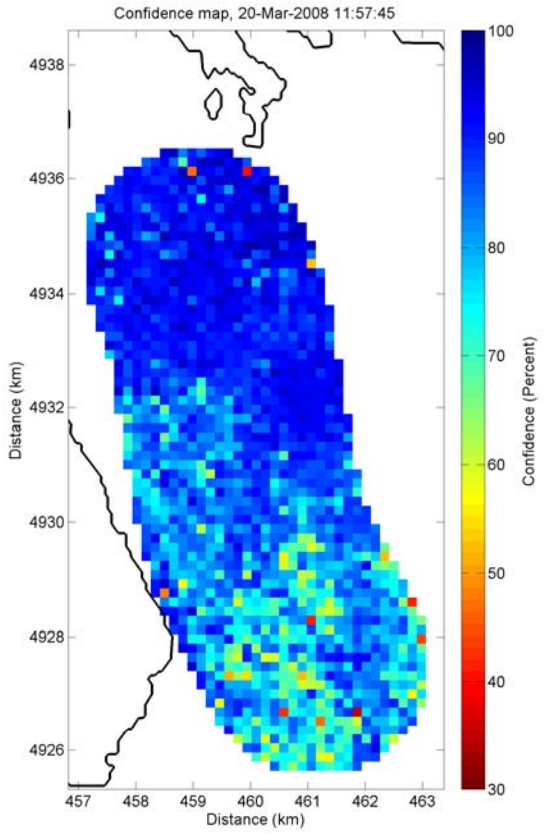

Radar derived water depth map, 20-Mar-2008 11:57:45
Distance (km)
Distance (km)
Depth (m)
4938
4936
4934
4932
4930
4928
4926
457
458
459
460
461
462
463
0
10
20
30
40
50
60

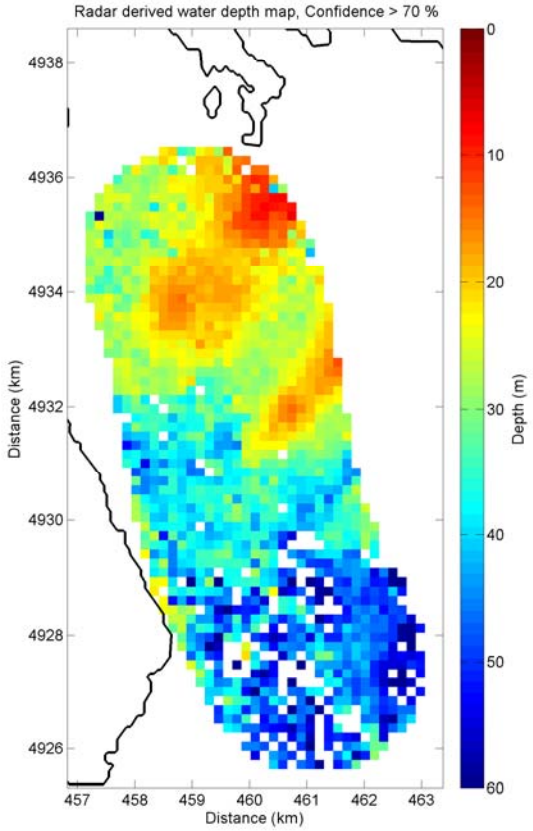
Comparing radar derived depths with Survey

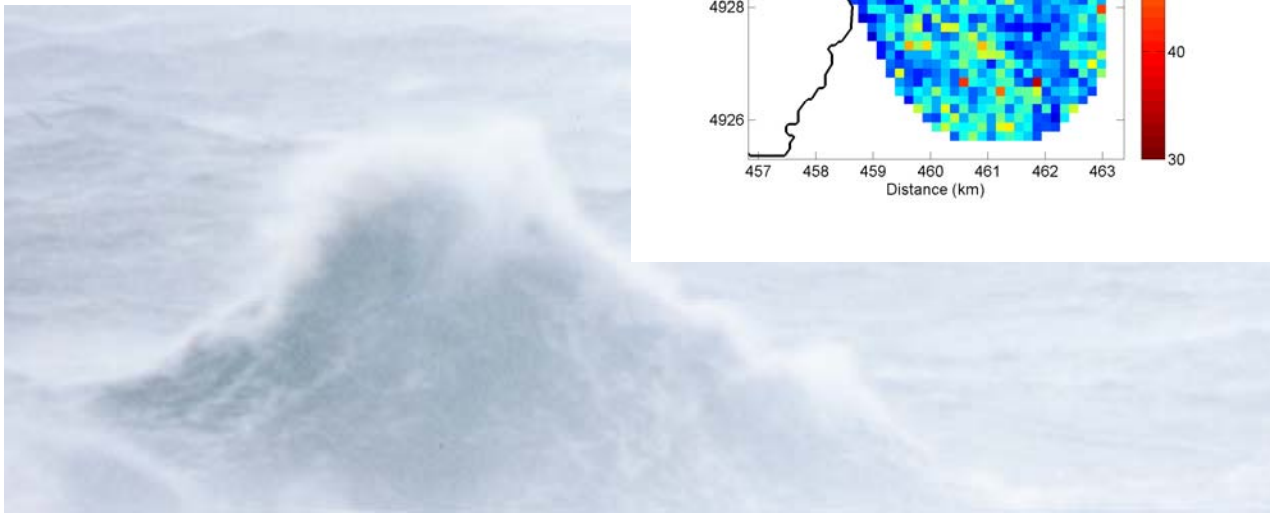


Confidence Filtering (a work in progress)



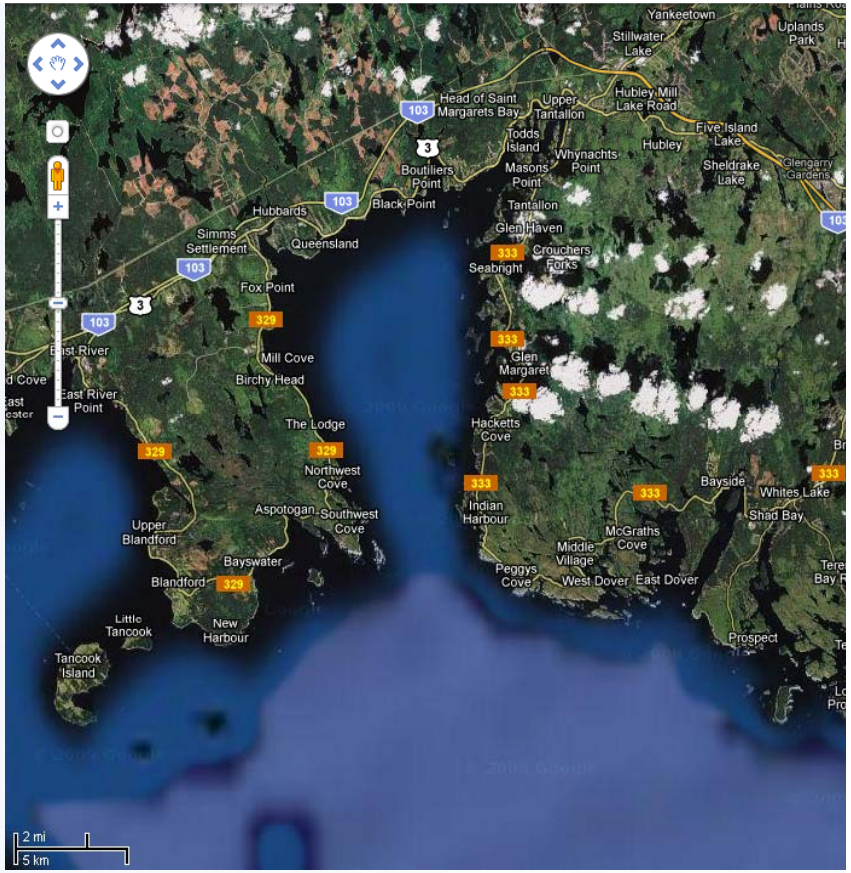


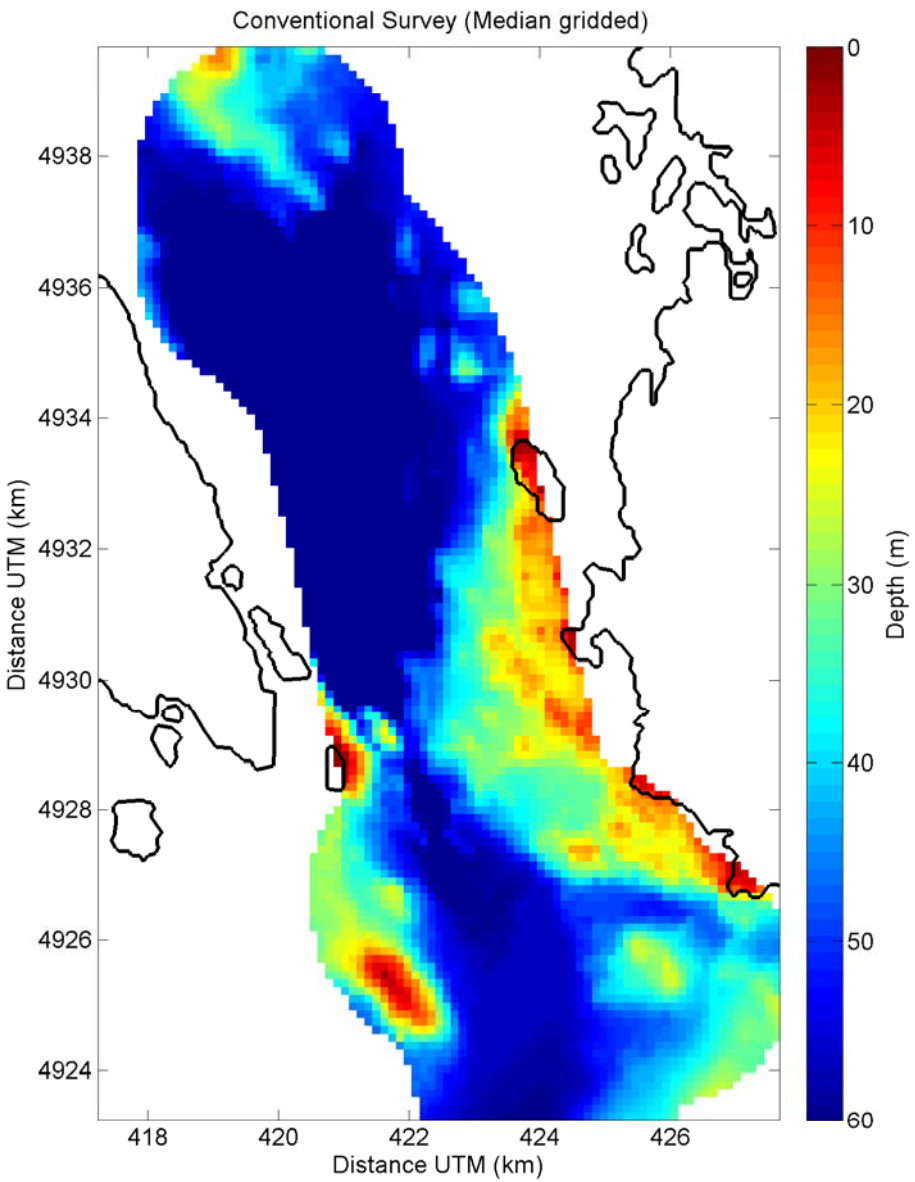


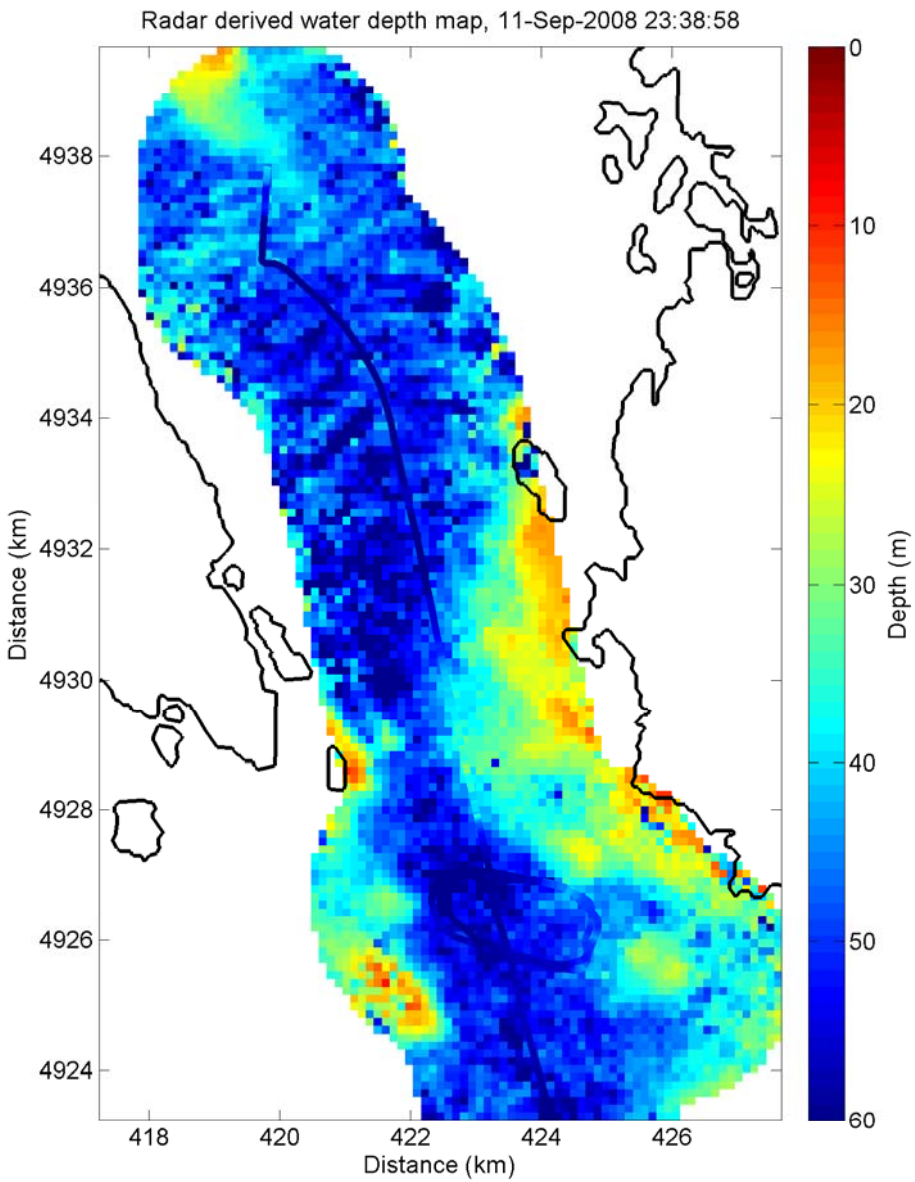


Quest 325
St Margaret's Bay
November 6th 2009

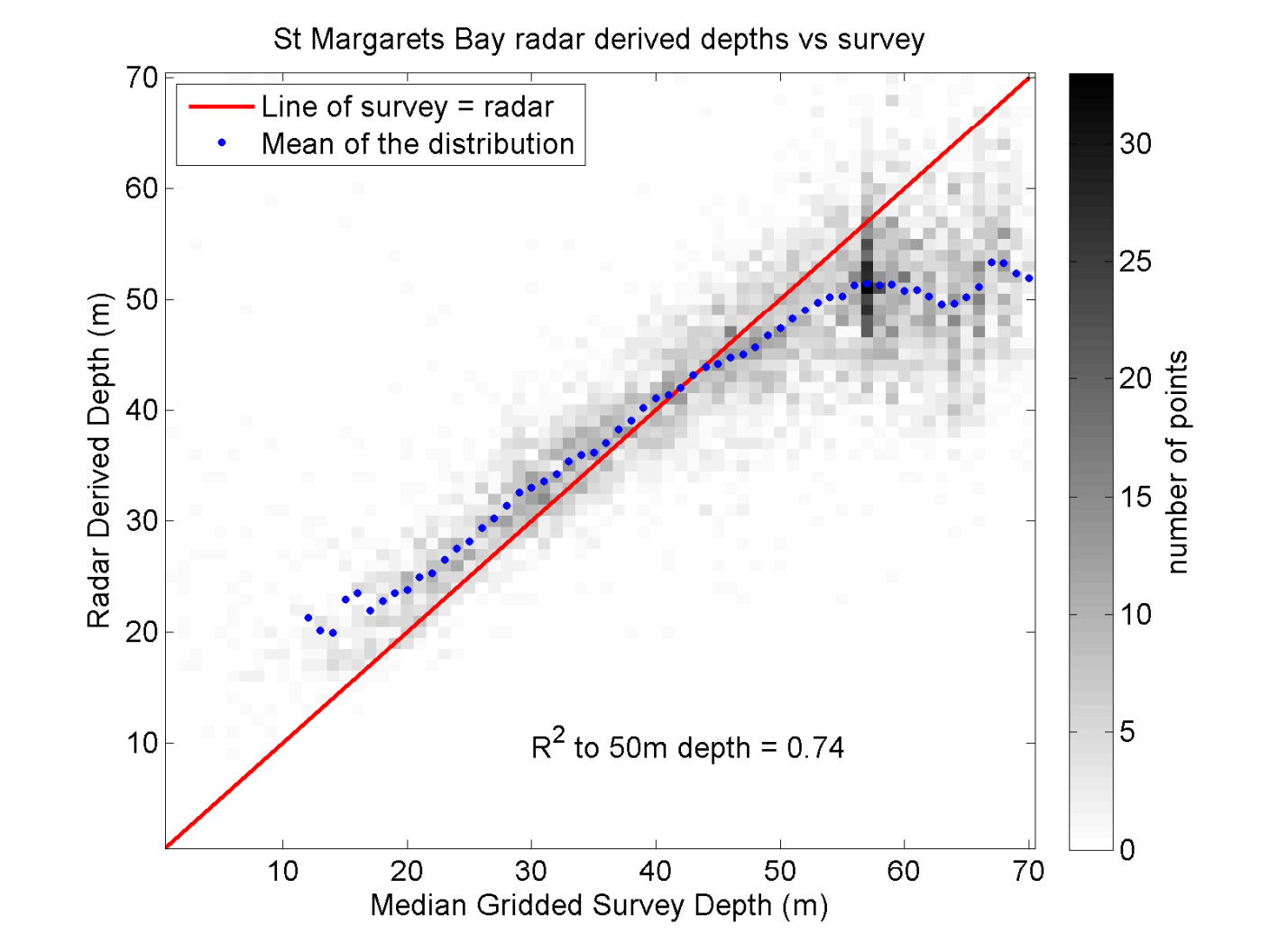
• Wamos software upgraded – each frame timestamped + GYRO
Multiple short records over 2.5 hours
32 images @ 2.26s intervals
~1.5 minutes of data each
Recording Range : 2km
Ship Speed : 1-10 knots
Wave Hs : 2.1m (swell)
DGPS & GYRO every 2secs
Analysis : 480m square @ 120m intervals



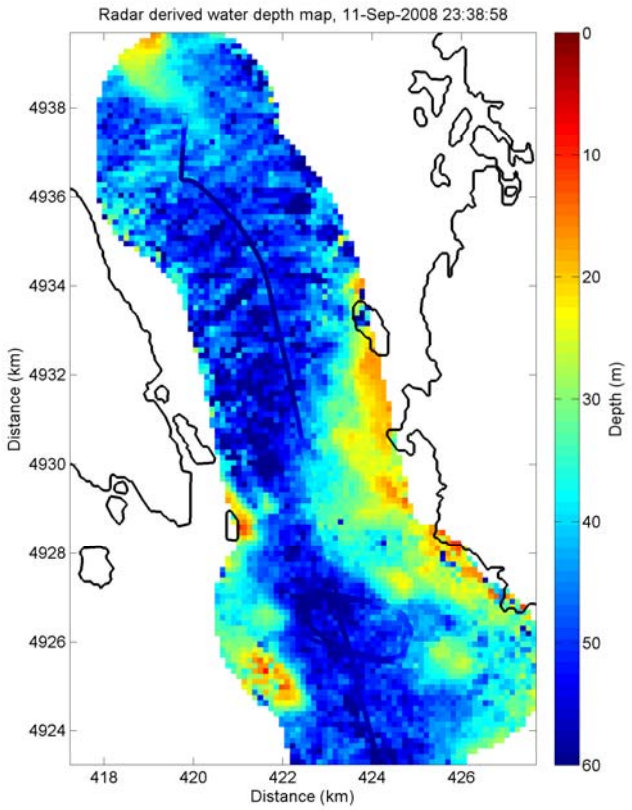

Conventional Survey (Median gridded)
Distance UTM (km)
4938
4936
4934
4932
4930
4928
4926
4924
418
420
422
424
426
Distance UTM (km)
Depth (m)
0
10
20
30
40
50
60

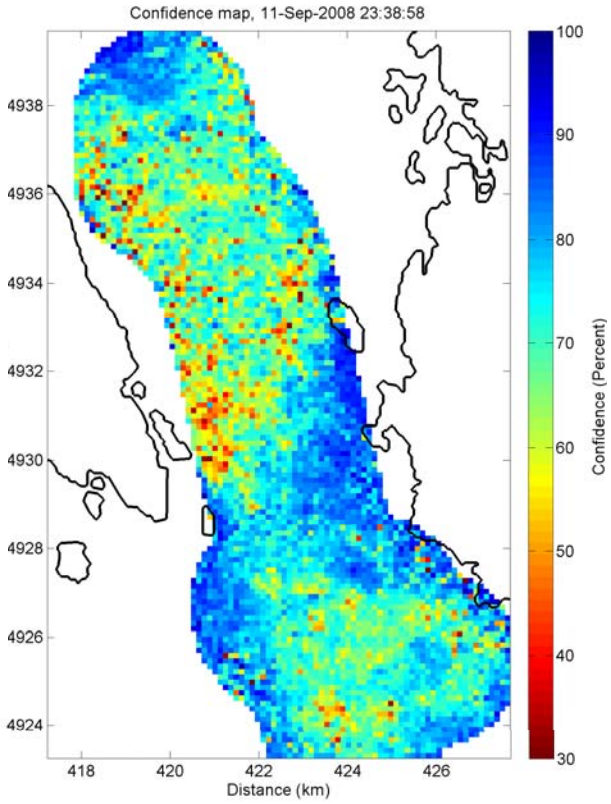

Radar derived water depth map, 11-Sep-2008 23:38:58
Distance (km)
4938
4936
4934
4932
4930
4928
4926
4924
418
420
422
424
426
Distance (km)
Depth (m)
0
10
20
30
40
50
60

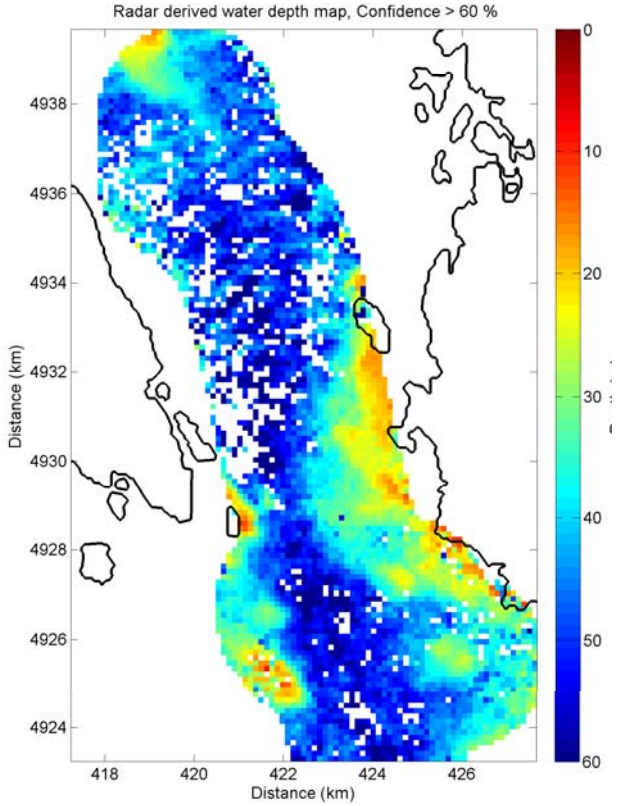
Comparing radar derived depths with Survey



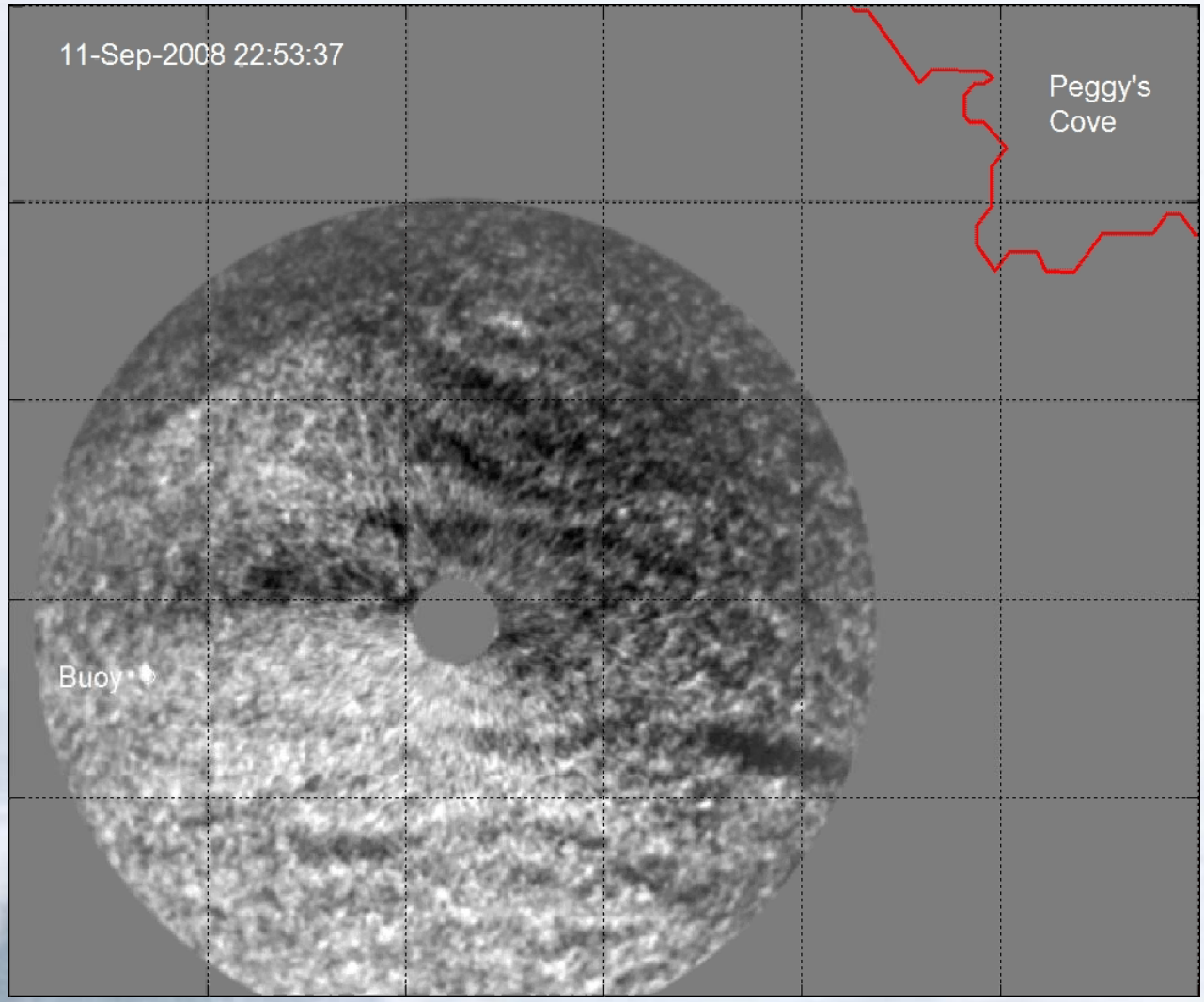
Confidence Filtering (a work in progress)

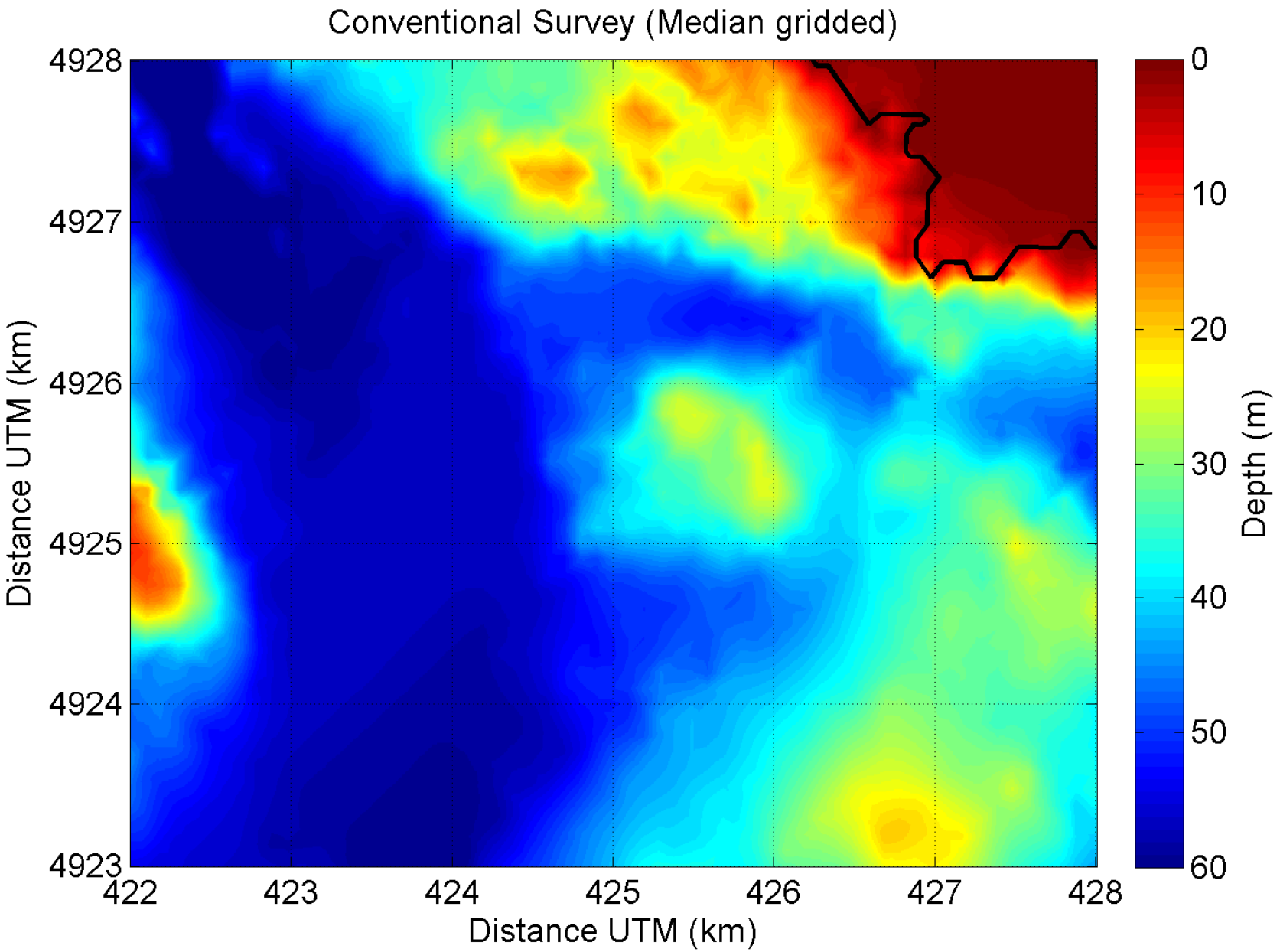






Internal Waves, fronts & the ship's wake




Conventional Survey (Median gridded)
4928
4927
4926
4925
4924
4923
Distance UTM (km)
422
423
424
425
426
427
428
Distance UTM (km)
0
10
20
30
40
50
60
Depth (m)

Summary

Question posed at MREA2007 - Could marine radar remote mapping be achieved using data from a moving vessel?

Answer: Yes.

Provisos:

- Need waves of Hs>1m
- Maximum depth ~ half the wavelength of waves
- Radar operating on short pulse (not always desirable for ship operations)
- Need good georeferencing (GYRO & DGPS preferably every radar frame)
- Accuracy & resolution suitable for ‘quick look’ at uncharted areas, perhaps to guide more detailed surveys.

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