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HICO Data User's Workshop,10 October 2012, Glasgow, Scotland

Processing HICO data in Western Australia

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Overview

- Introduction to RSSRG
- Hyperspectral studies
- Shark Bay, Western Australia
- HICO Processing
- Preliminary HICO Products\
- Summary and Future Work

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The RSSRG

- Remote Sensing and Satellite Research Group – Perth, Western Australia
- Experience with air-borne hyperspectral data
- Developing bathymetry and benthic retrieval shallow water algorithms
- Development of hyperspectral above-water radiometric instruments
- Hyperion Processing
- Data processing workflows for satellite imagery

Shallow Water Algorithm

- BRUCE algorithm – Klonowski et al., 2007, JARS
- Retrieve IOPs, bathymetry and substrate maps
- Three key substrate types

$$r_{rs} = r_{rs}^{dp}\left(1-\exp\left[-\left\{\frac{1}{\cos\theta_w}+\frac{D_u^C}{\cos\theta_v}\right\}\kappa H\right]\right) + \frac{\rho}{\pi}\exp\left[-\left\{\frac{1}{\cos\theta_w}+\frac{D_u^B}{\cos\theta_v}\right\}\kappa H\right]$$

$$D_u^C = 1.03\left(1+2.4u\right)^{0.5} \quad \text{and} \quad D_u^B = 1.04\left(1+5.4u\right)^{0.5}$$

$$u = b_b/\left(a+b_b\right) \quad \text{and} \quad \kappa = a+b_b$$

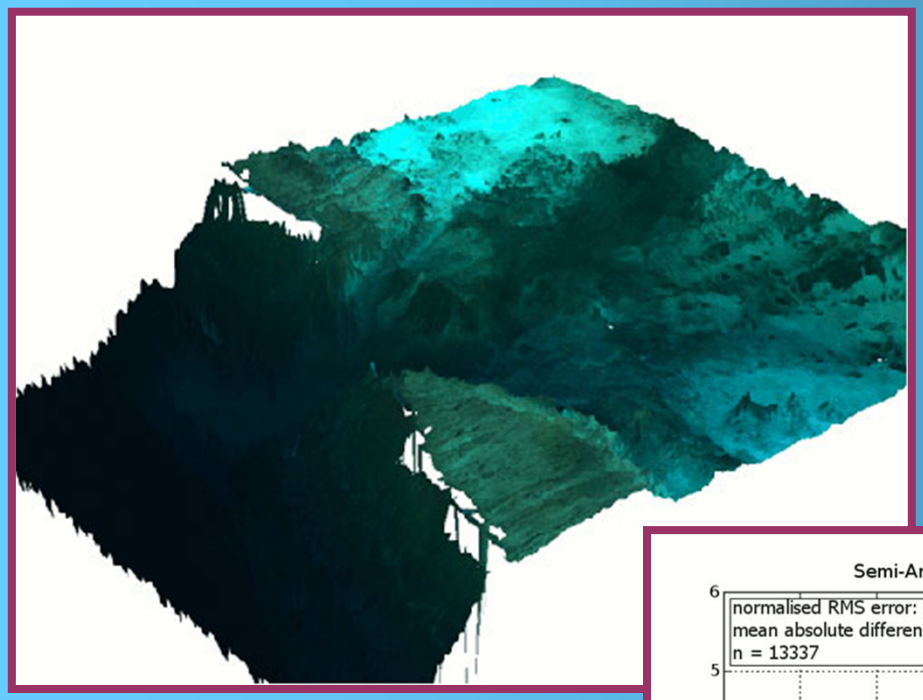
$$r_{rs}^{dp} = g_0 u + g_1 u^2$$

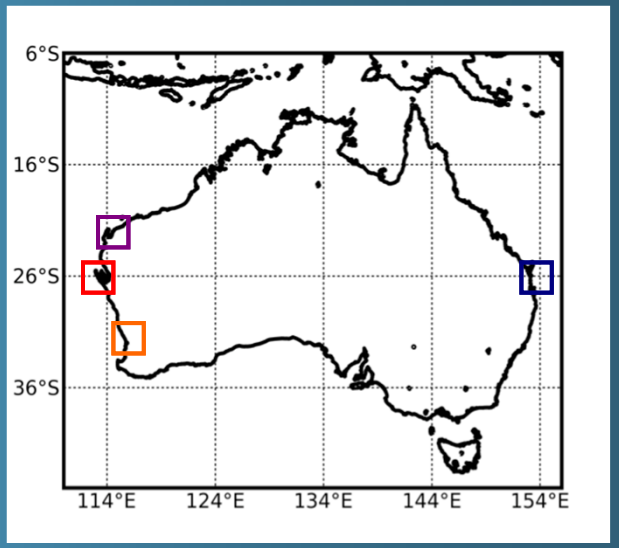
H = geometric depth

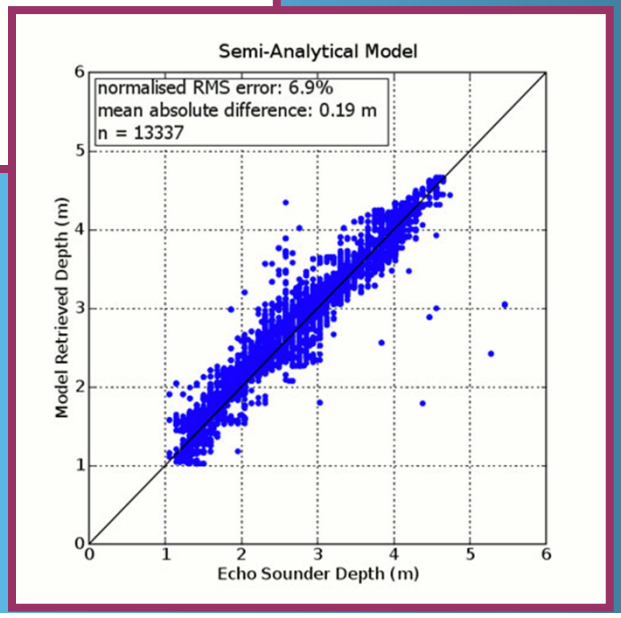
$$\rho = B_1\rho_1^* + B_2\rho_2^* + B_3\rho_3^*$$

Previous Hyperspectral Studies

2006: Ningaloo Reef

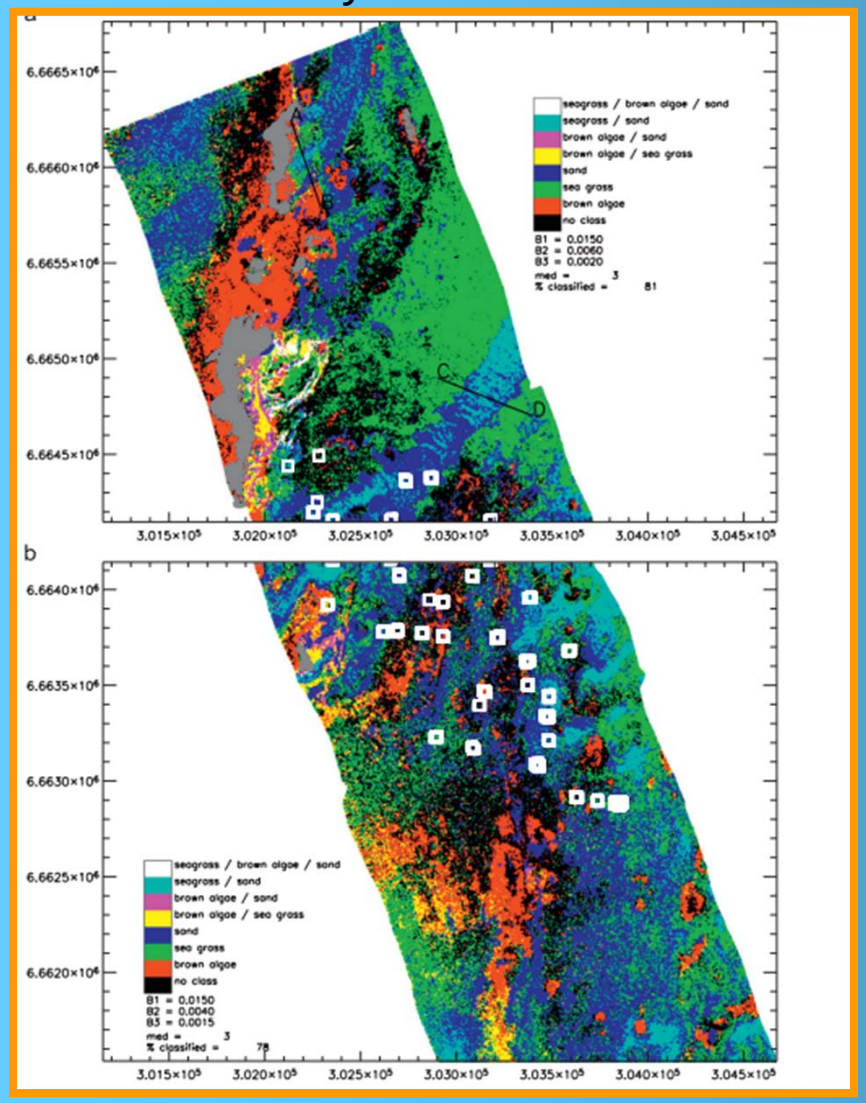


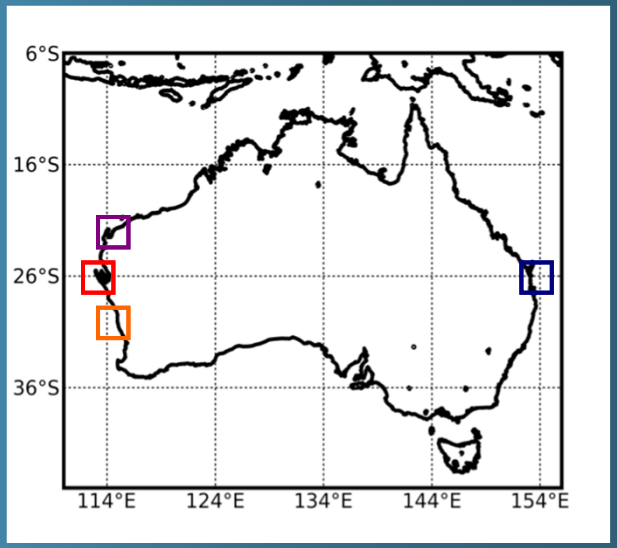




Previous Hyperspectral Studies

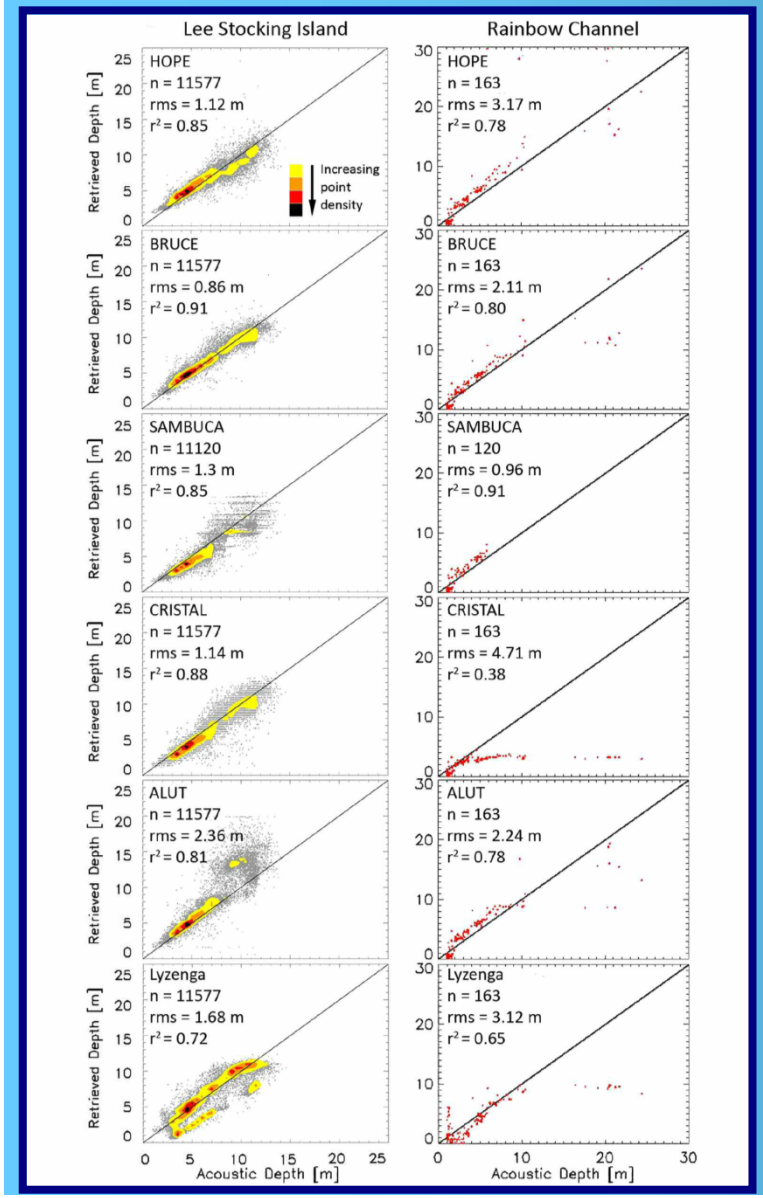
2004: Jurien Bay

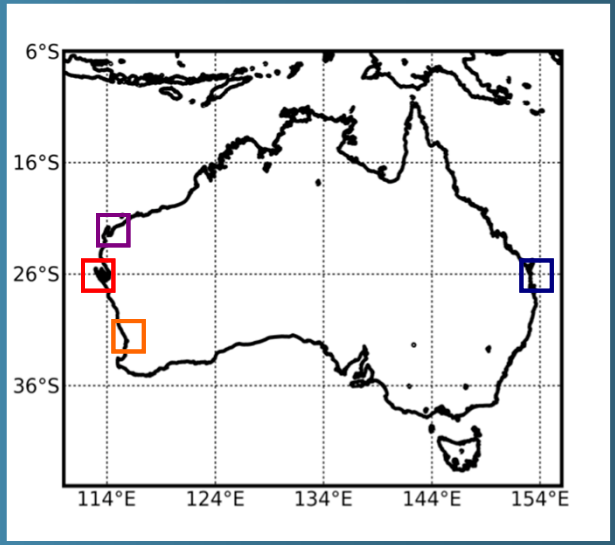




Previous Hyperspectral Studies

2011: L&O Methods Comparison Paper

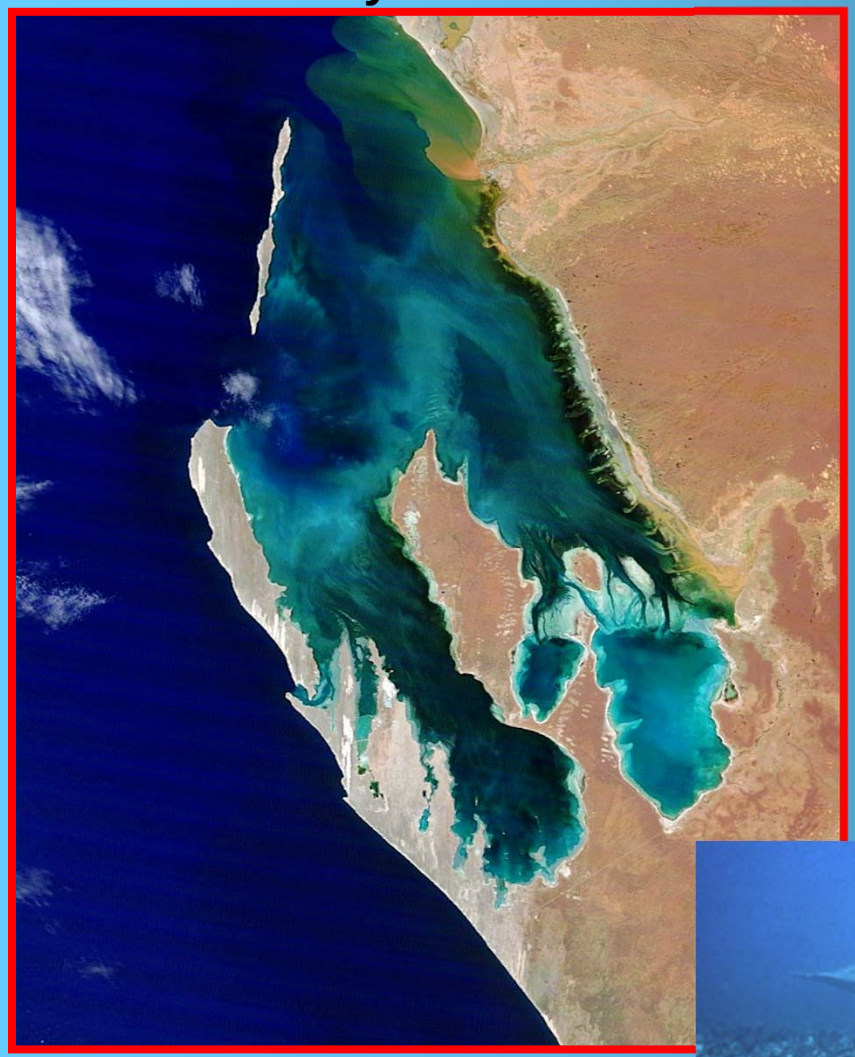


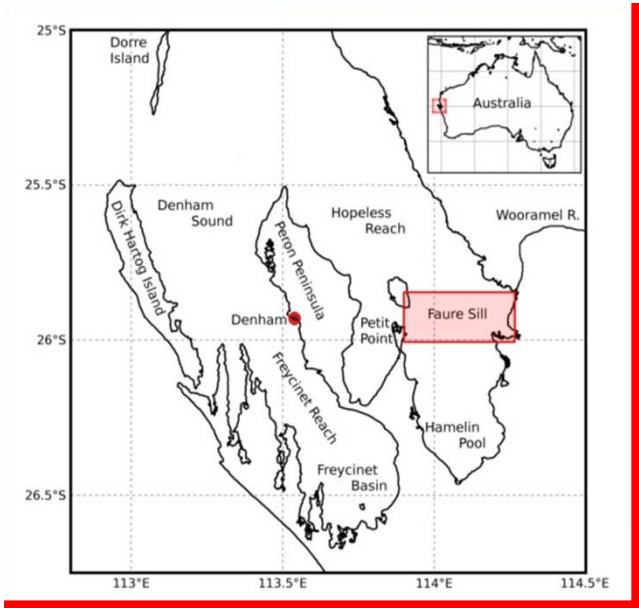


Dekker, Phinn et al., 2012, LOM

Previous Hyperspectral Studies

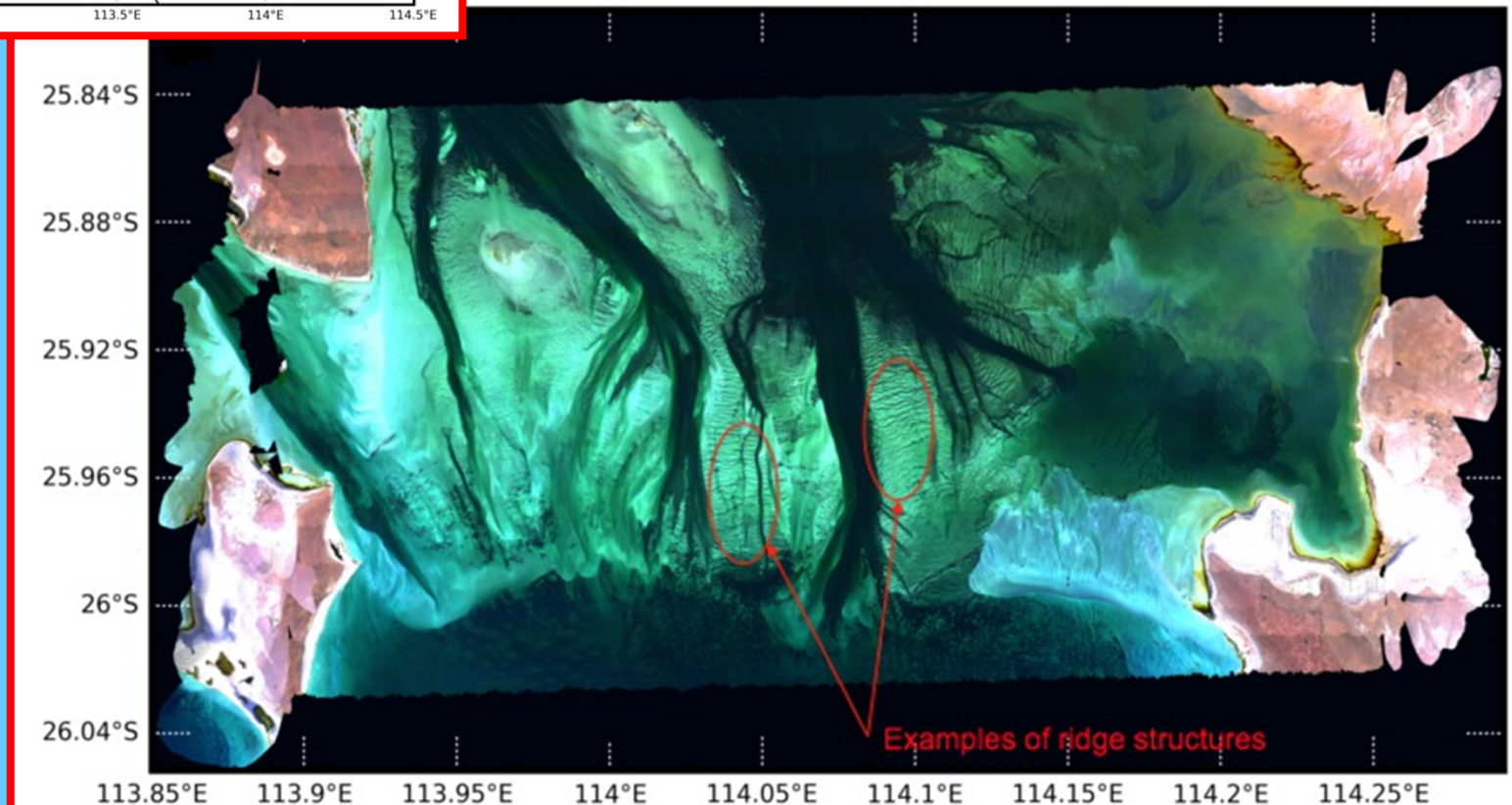
2012: Shark Bay



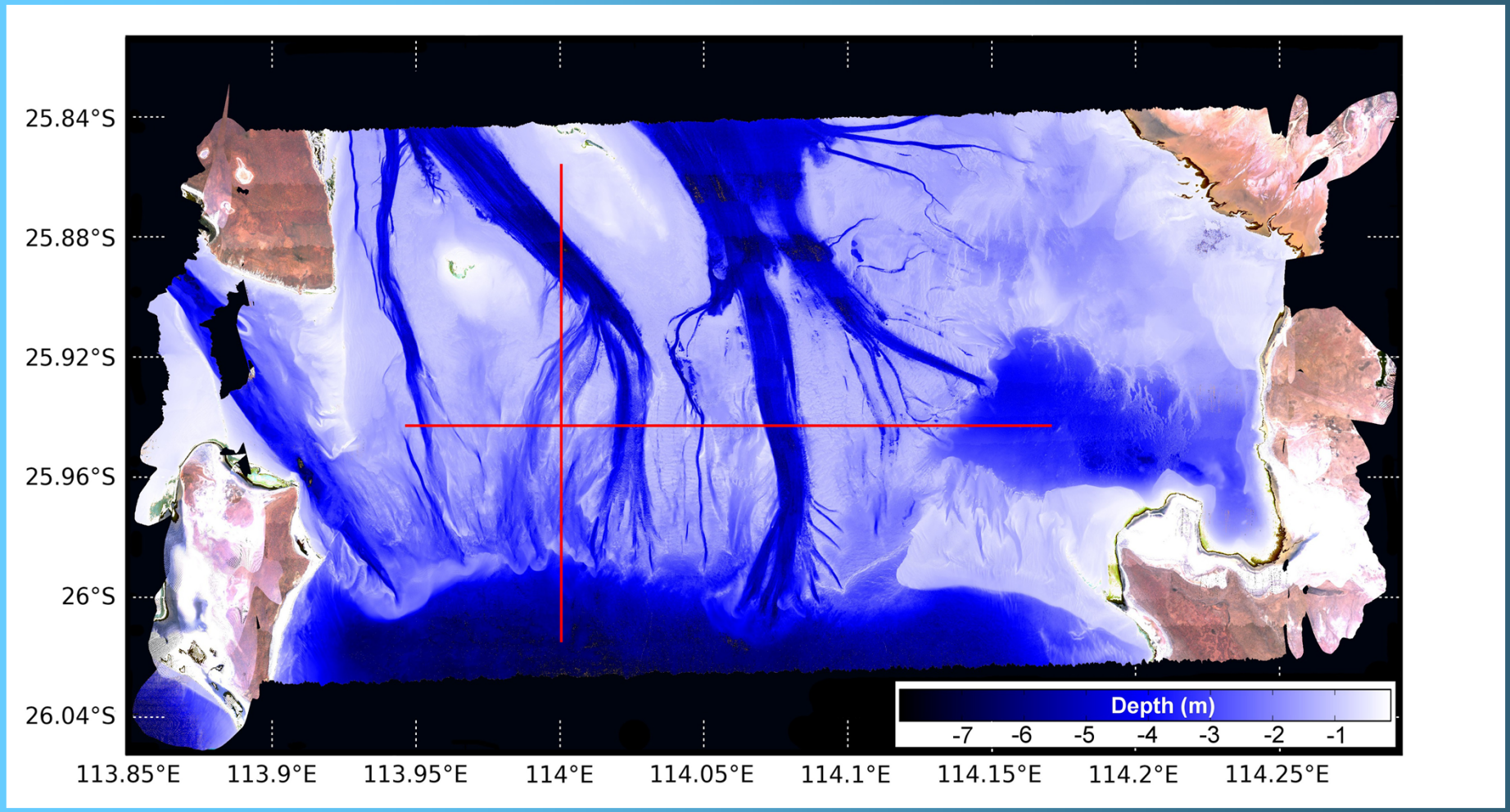

Dorre Island
Australia
Denham Sound
Hopeless Reach
Wooramel R.
Dirk Hartog Island
Peron Peninsula
Denham
Petit Point
Faure Sill
Freycinet Reach
Hamelin Pool
Freycinet Basin
25°S
25.5°S
26°S
26.5°S
113°E
113.5°E
114°E
114.5°E

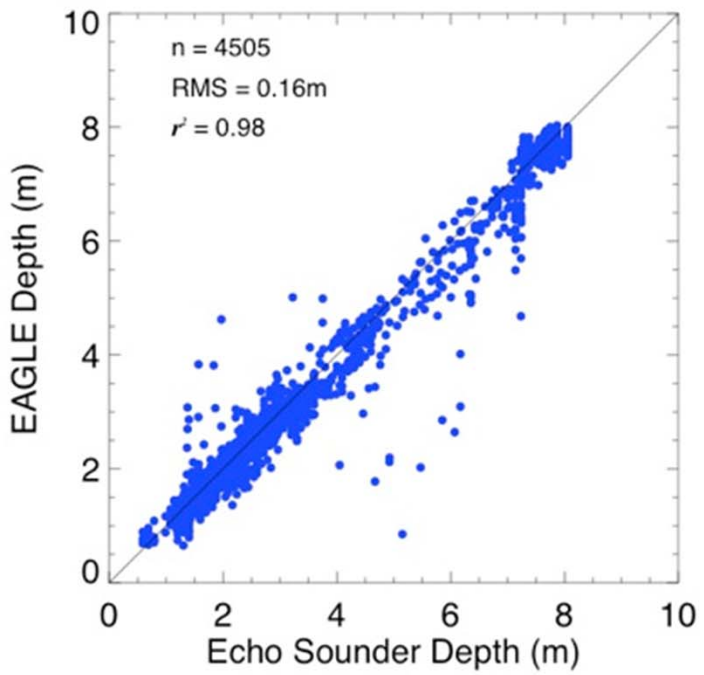

FLINDERS UNIVERSITY
ENVIRONMENTAL RESEARCH
RESTRICTED

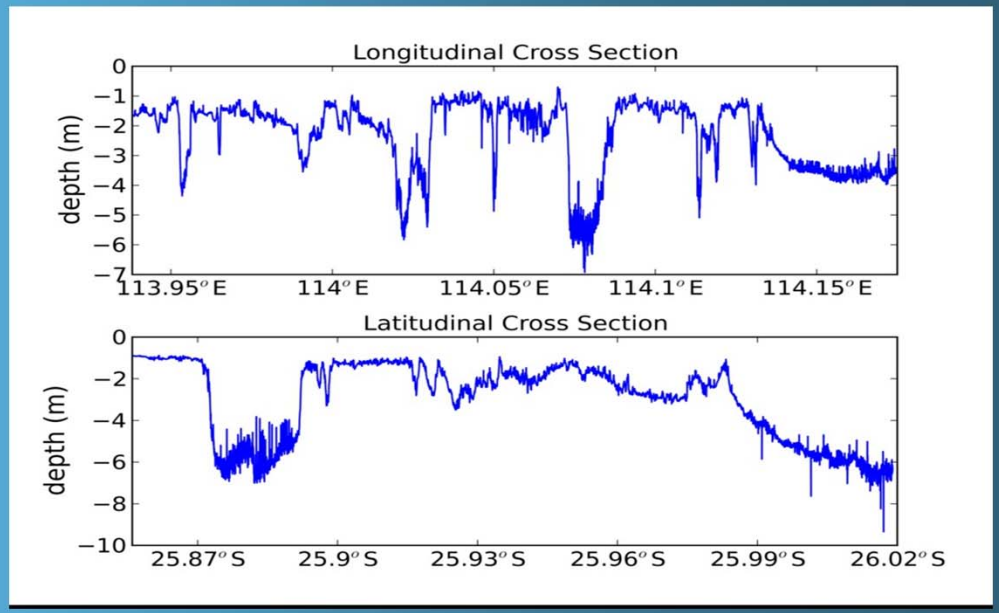

Faure Island
Pelican Island
Denham

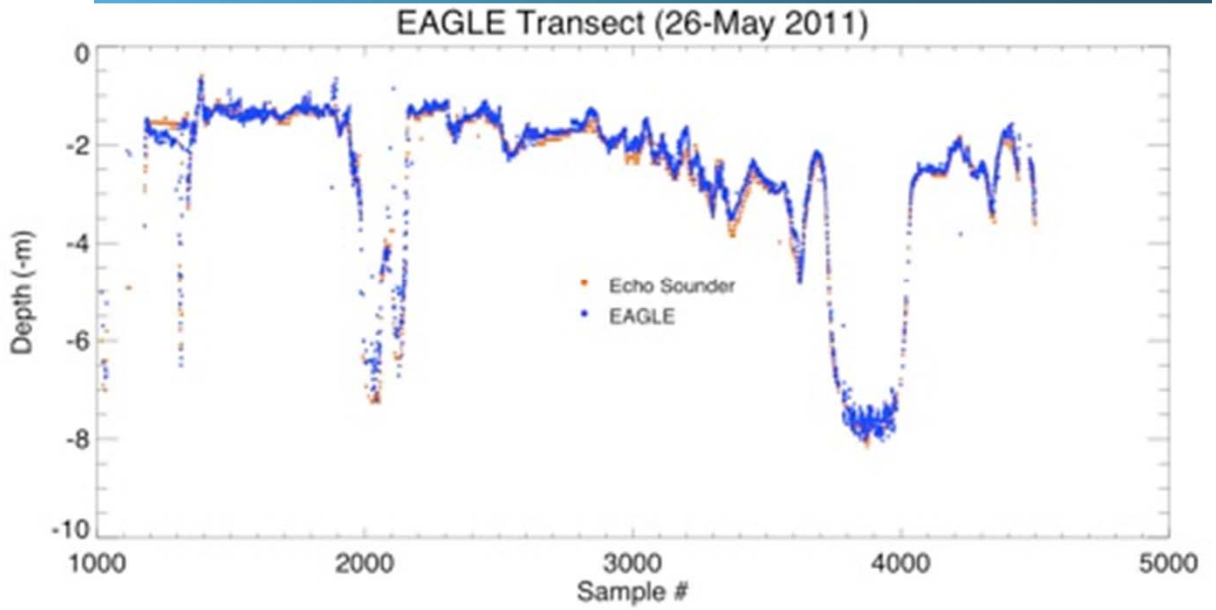

25.84°S
25.88°S
25.92°S
25.96°S
26°S
26.04°S
113.85°E
113.9°E
113.95°E
114°E
114.05°E
114.1°E
114.15°E
114.2°E
114.25°E
Examples of ridge structures

Bathymetry
Shark Bay

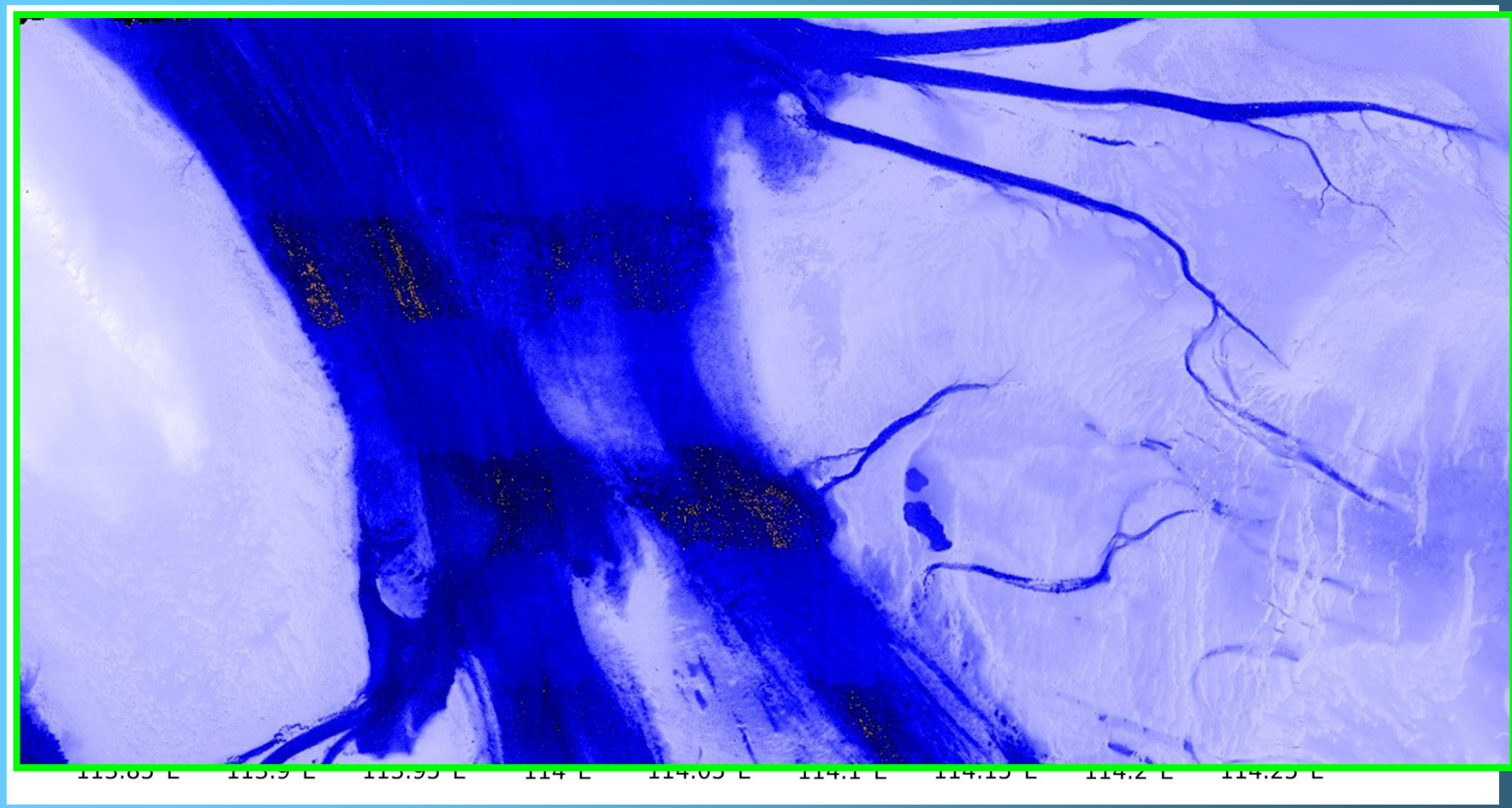


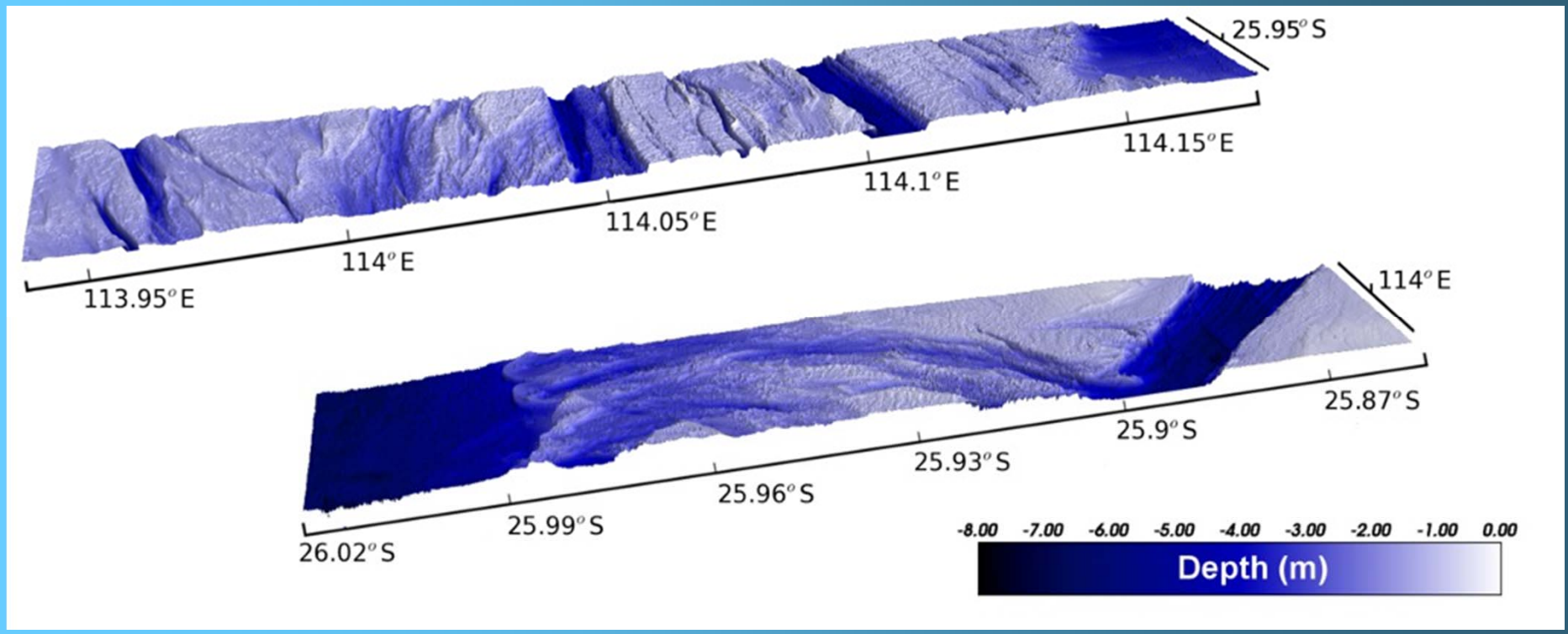

n = 4505
RMS = 0.16m
r² = 0.98
EAGLE Depth (m)
Echo Sounder Depth (m)
0
2
4
6
8
10

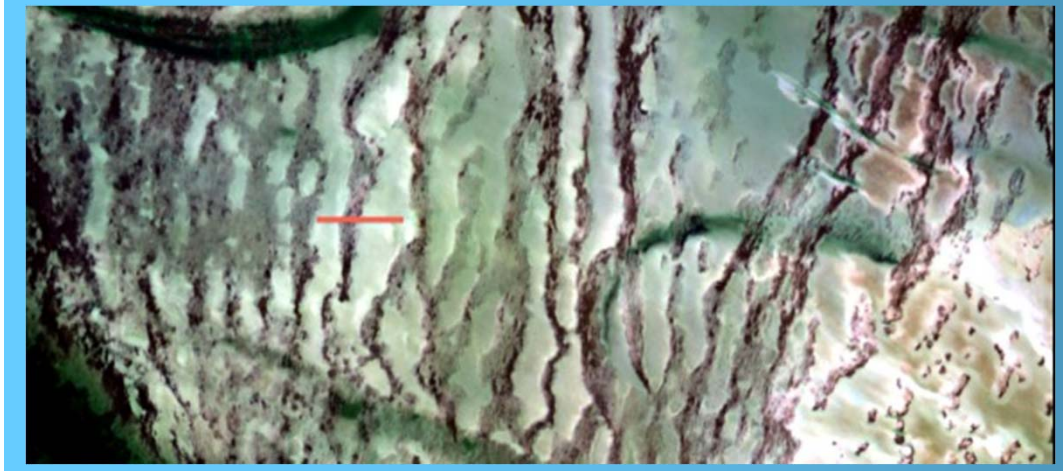

Longitudinal Cross Section
depth (m)
113.95° E
114° E
114.05° E
114.1° E
114.15° E
Latitudinal Cross Section
depth (m)
25.87° S
25.9° S
25.93° S
25.96° S
25.99° S
26.02° S

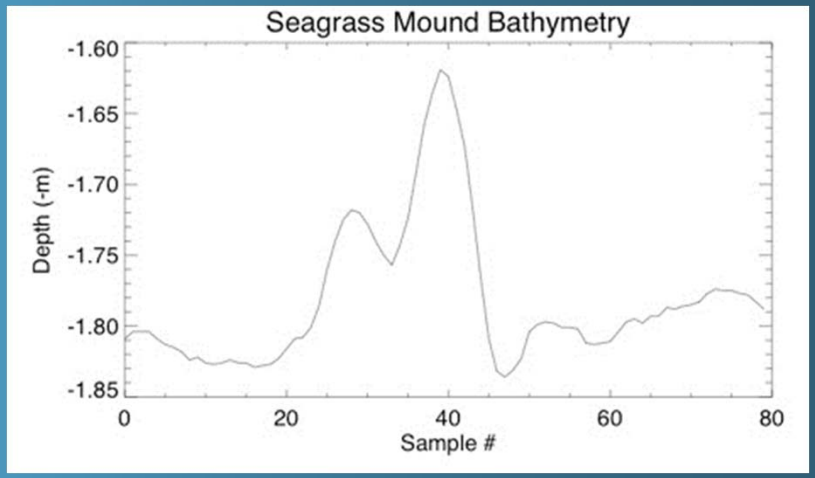

EAGLE Transect (26-May 2011)
Depth (-m)
Sample #
Echo Sounder
EAGLE
1000
2000
3000
4000
5000

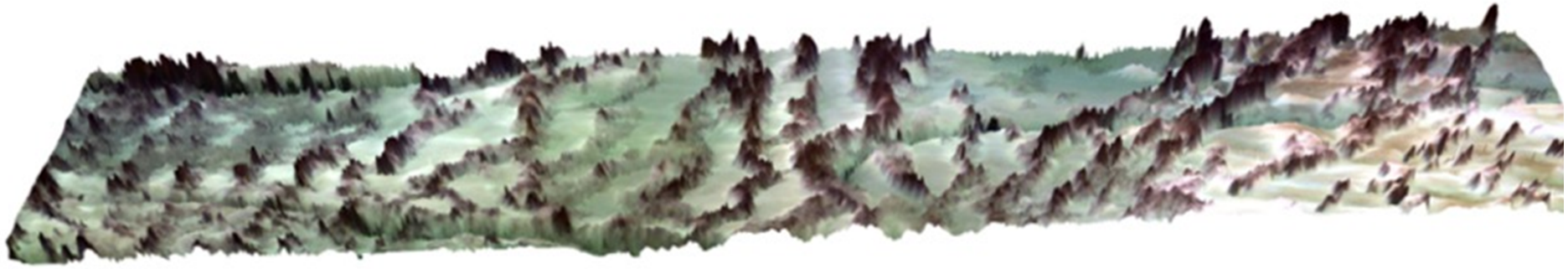
Sunglint Quality Concerns



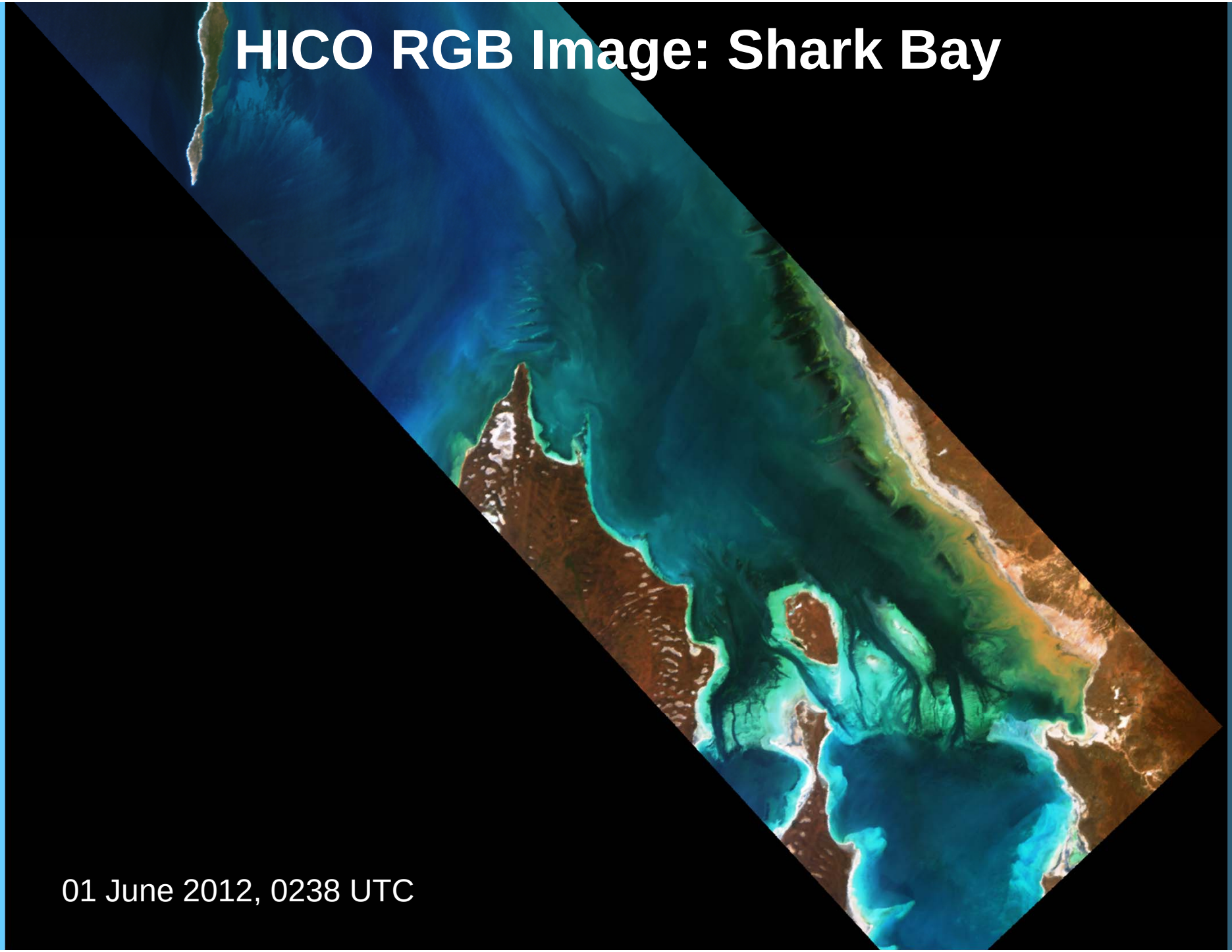

25.95° S
114.15° E
114.1° E
114.05° E
114° E
113.95° E
114° E
25.87° S
25.9° S
25.93° S
25.96° S
25.99° S
26.02° S
-8.00 -7.00 -6.00 -5.00 -4.00 -3.00 -2.00 -1.00 0.00
Depth (m)




Seagrass Mound Bathymetry
-1.60
-1.65
-1.70
-1.75
-1.80
-1.85
Depth (-m)
0
20
40
60
80
Sample #

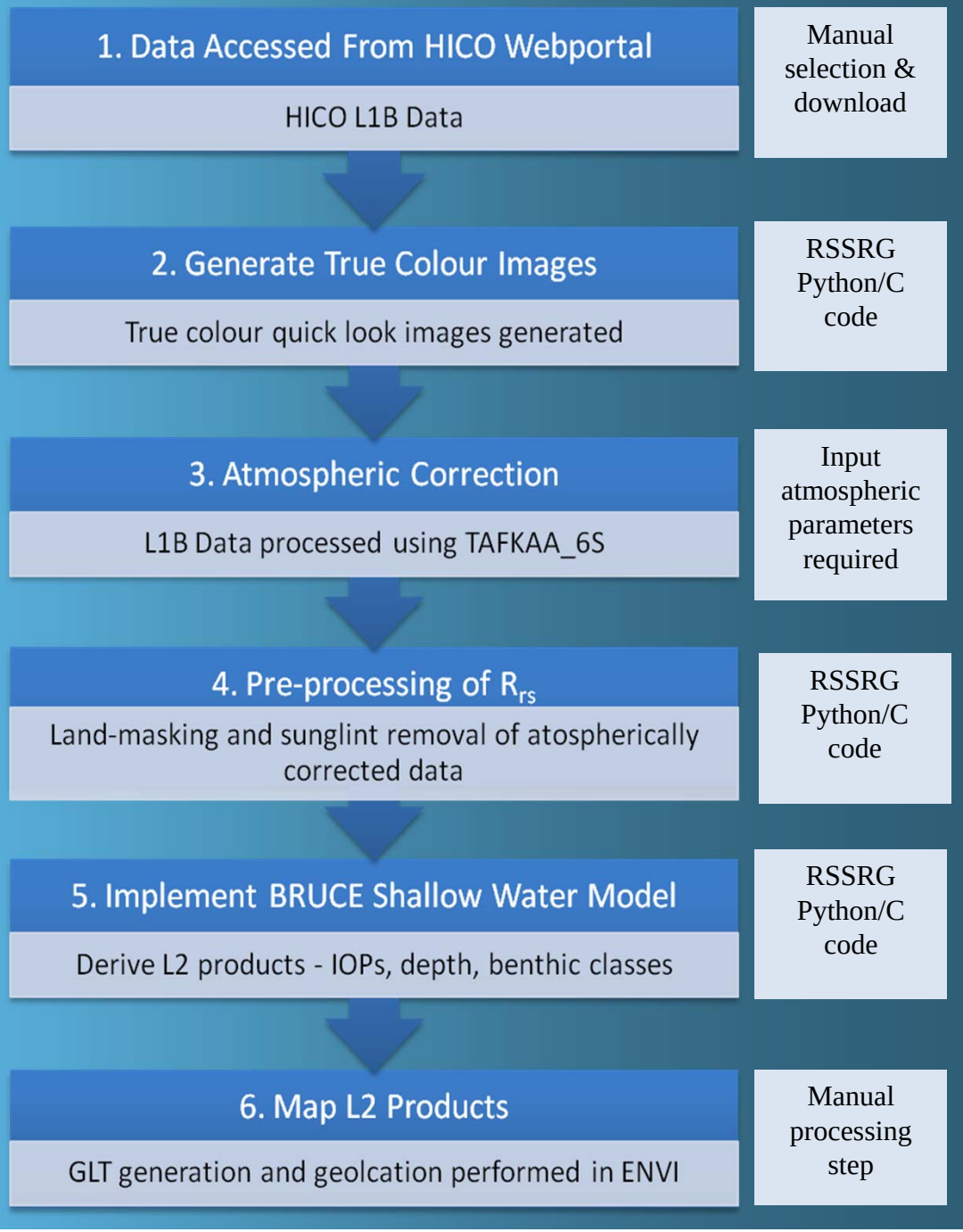


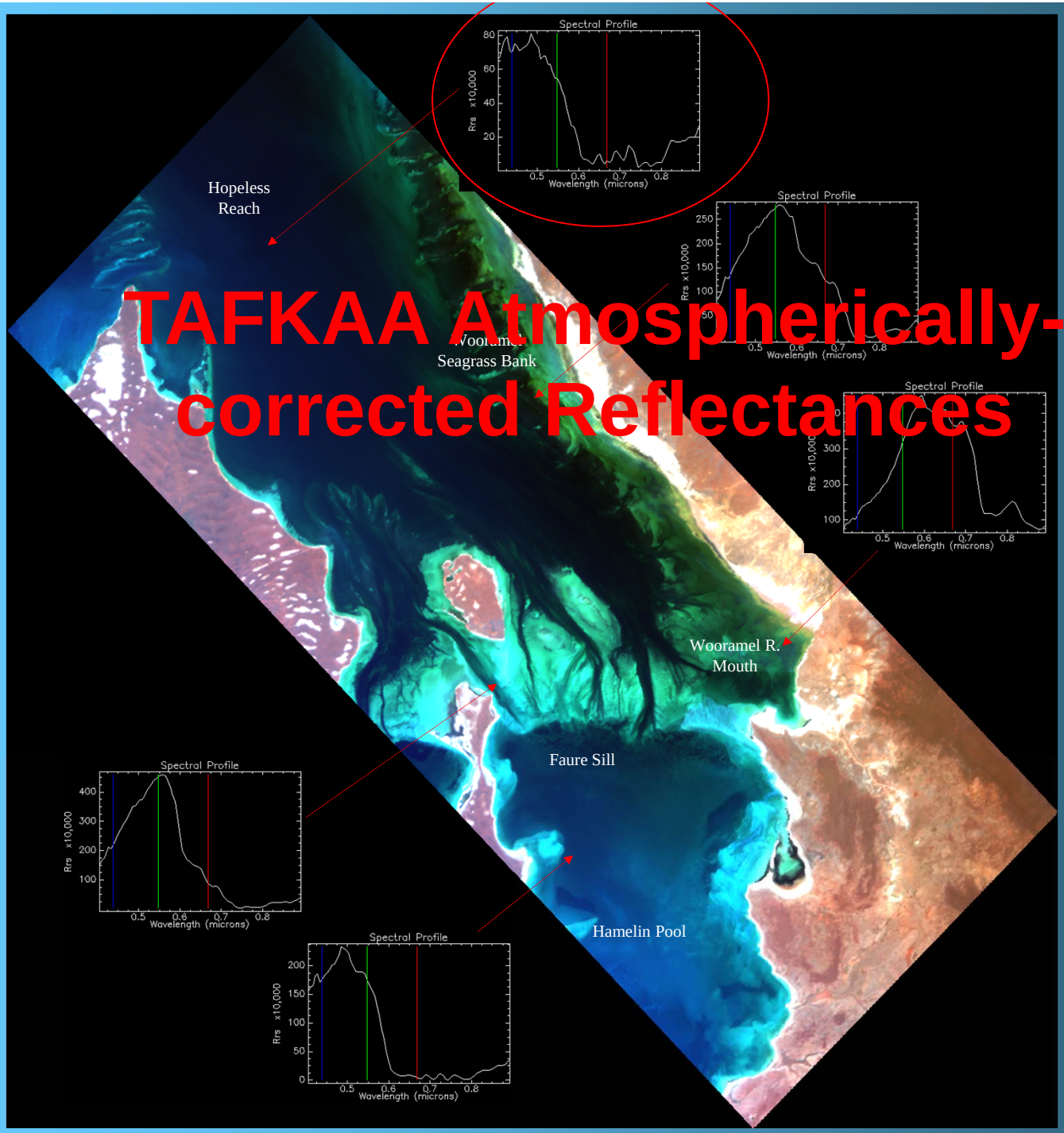
HICO RGB Image: Shark Bay



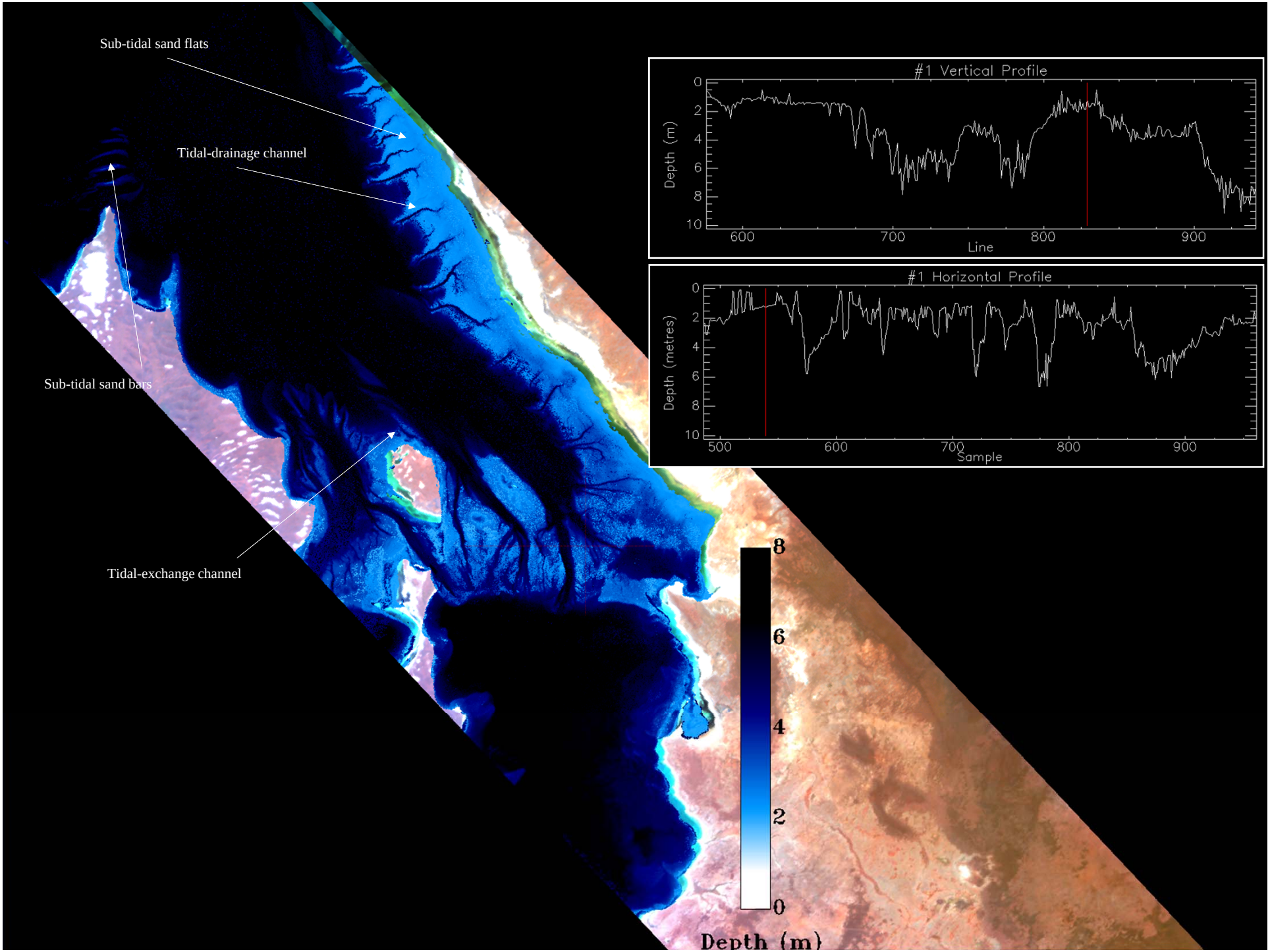
01 June 2012, 0238 UTC

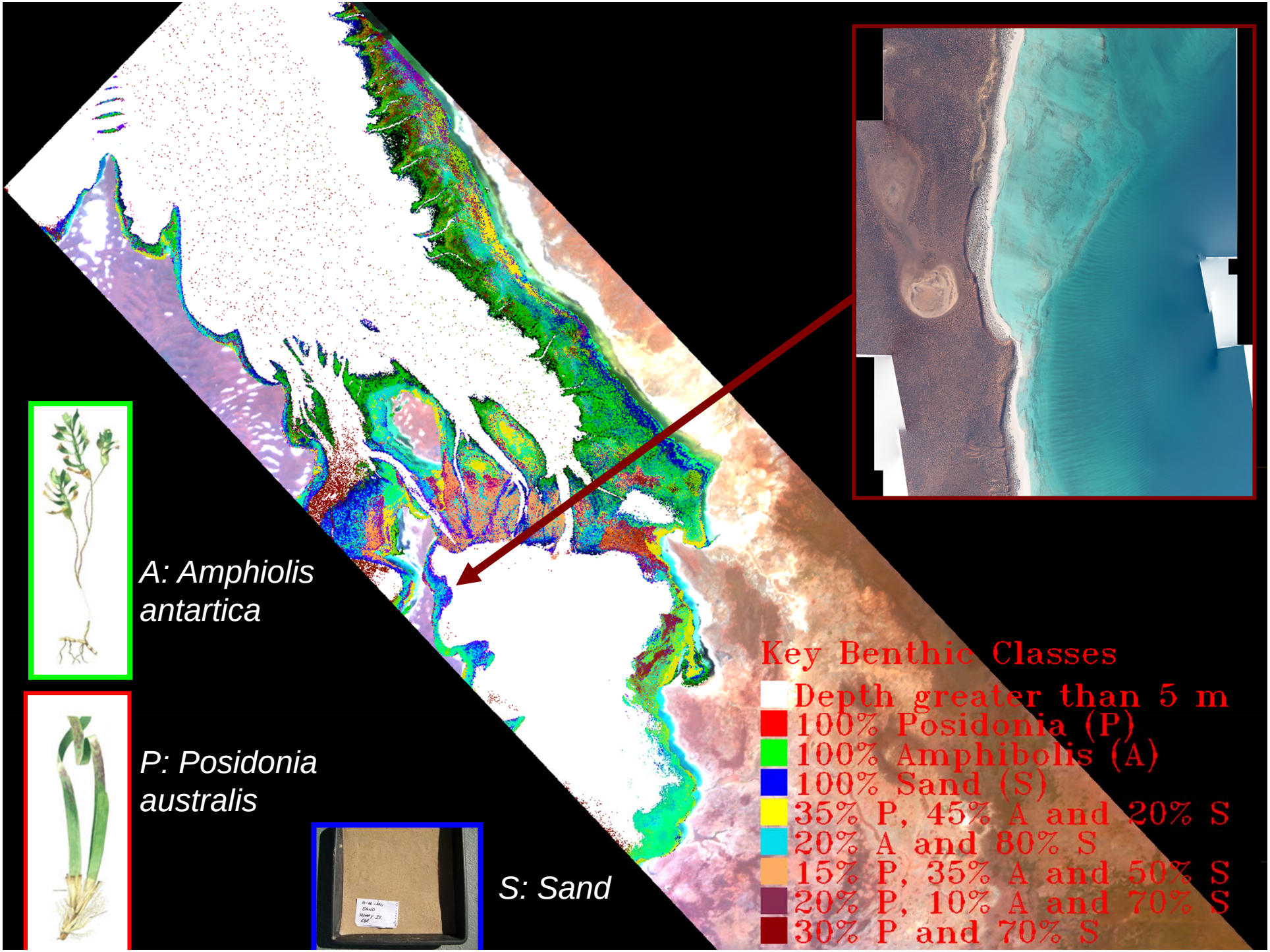
HICO Processing Workflow





TAFKAA Atmospherically-corrected Reflectances


Sub-tidal sand flats
Tidal-drainage channel
Sub-tidal sand bars
Tidal-exchange channel
#1 Vertical Profile
Depth (m)
Line
#1 Horizontal Profile
Depth (metres)
Sample
8
6
4
2
0
Depth (m)


A: Amphiolis antartica
P: Posidonia australis
S: Sand
Key Benthic Classes
Depth greater than 5 m
100% Posidonia (P)
100% Amphibolis (A)
100% Sand (S)
35% P, 45% A and 20% S
20% A and 80% S
15% P, 35% A and 50% S
20% P, 10% A and 70% S
30% P and 70% S

Summary

- HICO data easy to access ☺
- Good communication regarding HICO overpasses – new schedule webpage ☺
- Preliminary results are promising ☺
- Lead time short – field validation in remote areas 😐
- Issues with atmospheric correction ☹
- Ancillary data access for atmospheric correction 😐

Further Work

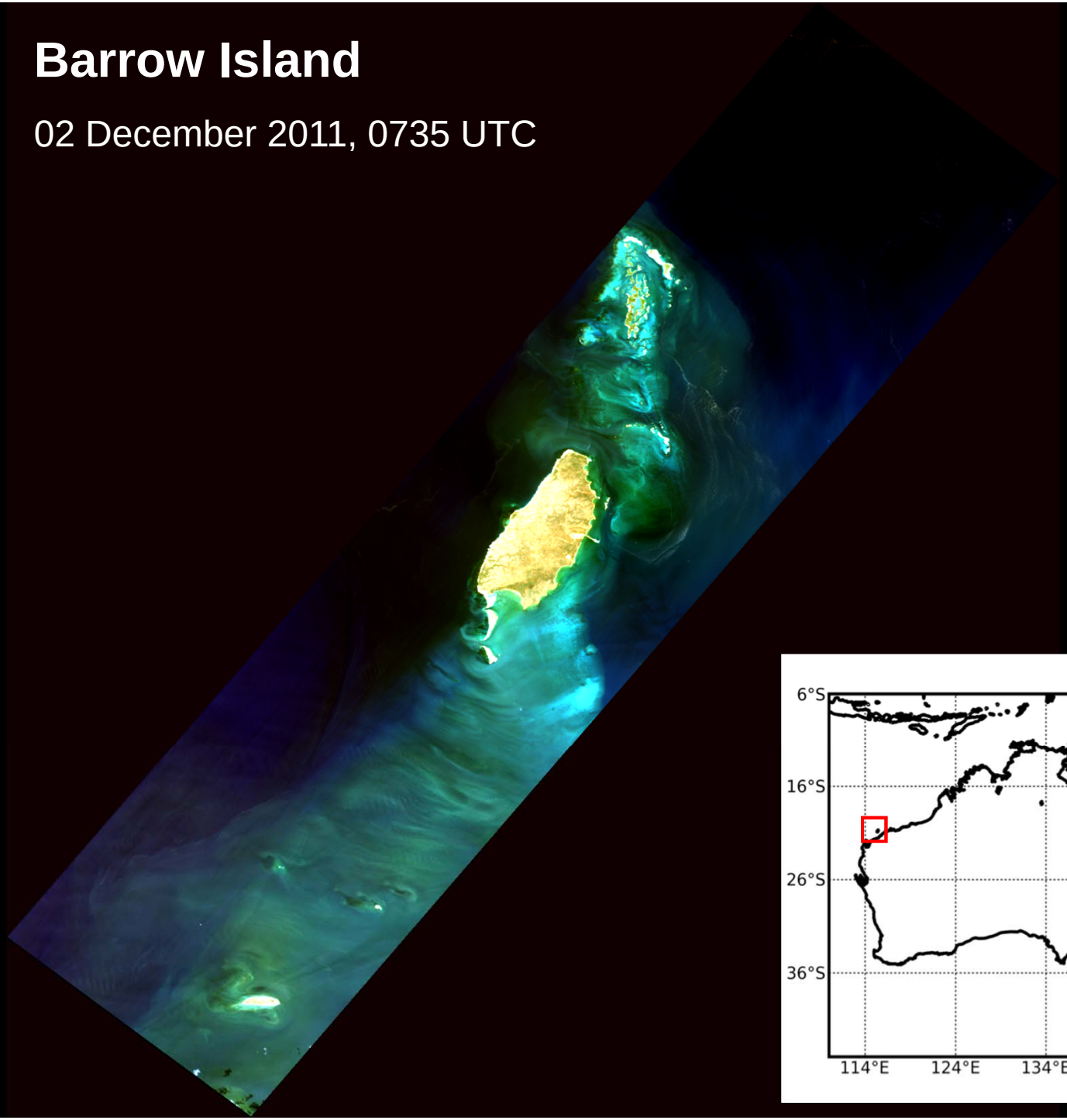
- Improving/implementing a new sun glint correction scheme
- Implement an effective cloud masking routine
- Ongoing attempts at validation of HICO-derived products
- Investigate alternative approaches for atmospheric correction
- Investigate an open source approach to geo-location
- Continue to liaise with potential data product end-users regarding their needs.

Additional HICO Scenes

- Barrow Island
- Montgomery Reef
- Swan River Estuary (Perth Metropolitan)

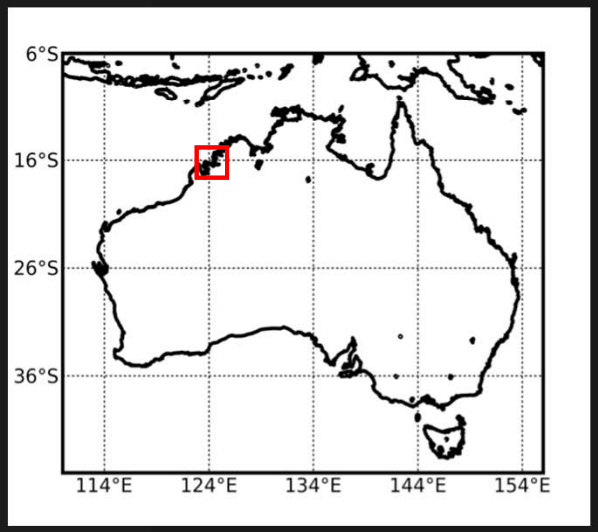
Barrow Island

02 December 2011, 0735 UTC



Montgomery Reef

03 December 2011, 0145 UTC



Swan River (Perth)

07 January 2012, 0115 UTC

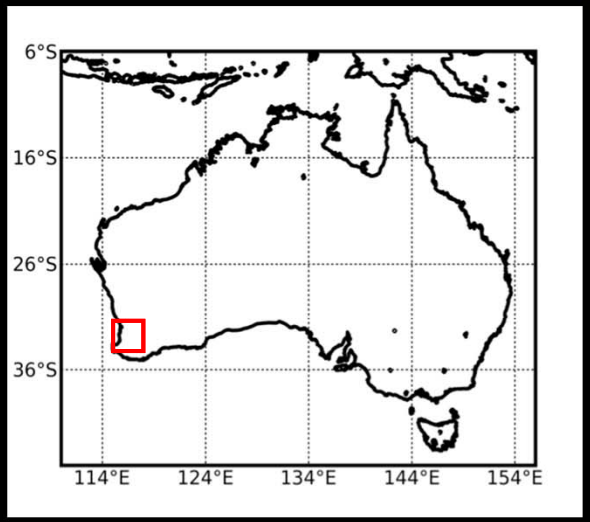


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Image processed by the Remote Sensing and Satellite Research Group, Curtin University
HICO Data provided by the Naval Research Laboratory