Monitoring Coastal Saline Lake Environments using CHRIS Data

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The Saline Lake Environment

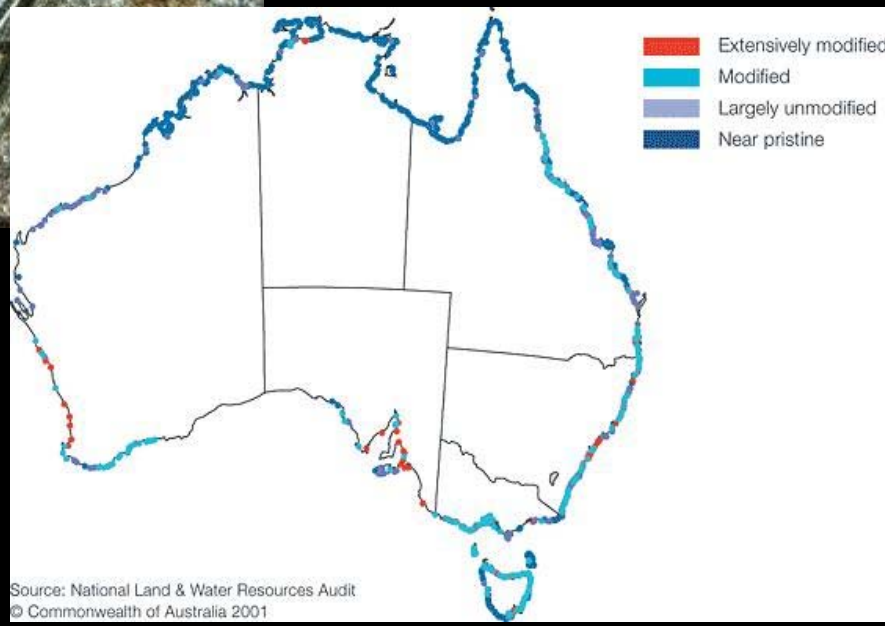
- Ecological: habitat for unique plants and animals.
- Social: recreational activities (boating, fishing, and swimming).
- Economic: tourism, fisheries, and aquaculture.

The Saline Lake Environment

- Among the world's most productive ecosystems.
- Highly variable in physical, chemical, and biological properties.
- Productivity depends on temperature, light, and nutrient levels.
- Human activities such as agriculture, forestry, and urban development can all affect water quality.
- Increased sediment and nutrient levels can have detrimental effects.

The Saline Lake Environment

- An excess of nutrients can lead to eutrophication.
- Phytoplankton blooms continuously, congesting the estuaries with unconsumed and decaying plant material.
- The abundance of phytoplankton can be estimated by measuring the concentration of chlorophyll suspended in water.



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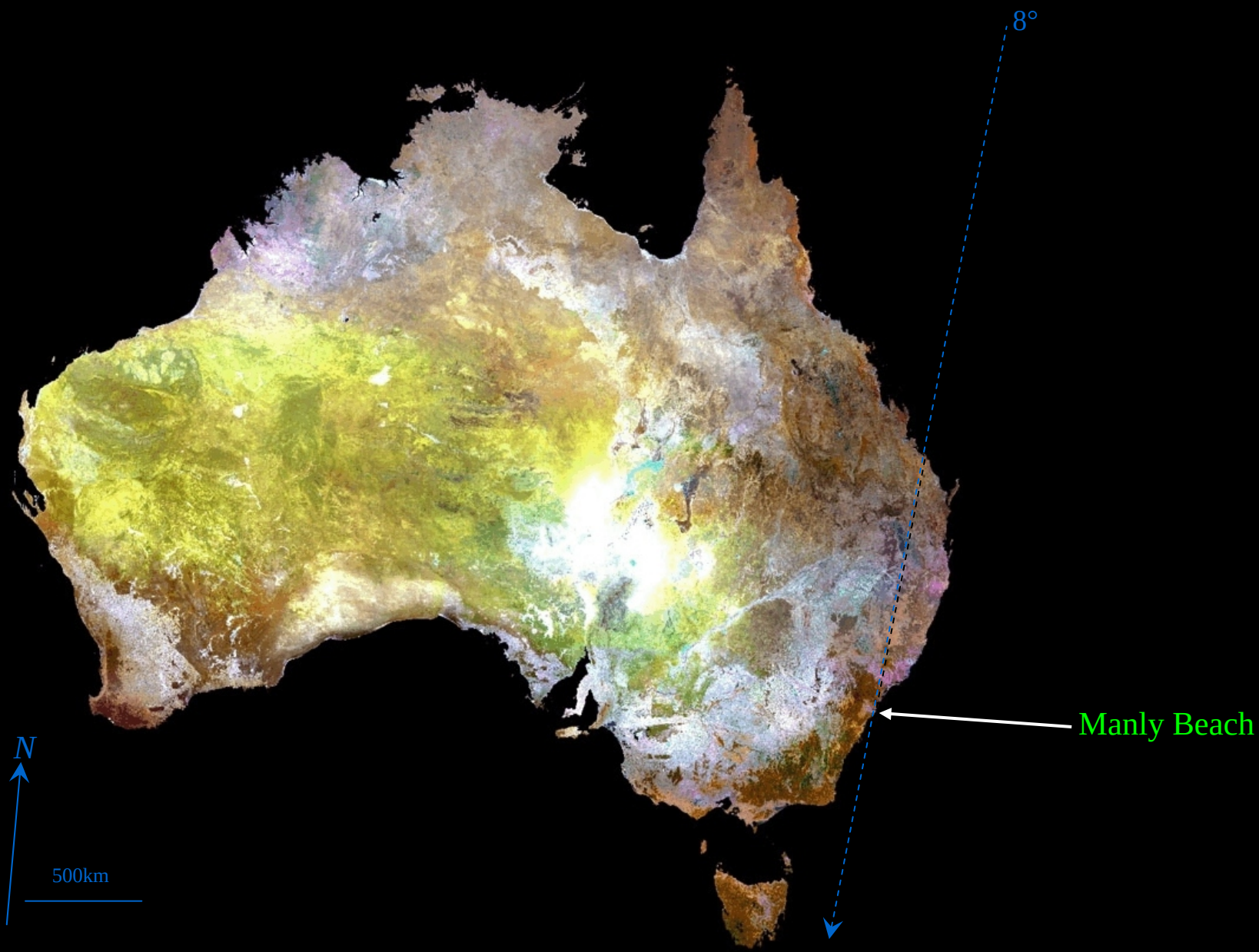
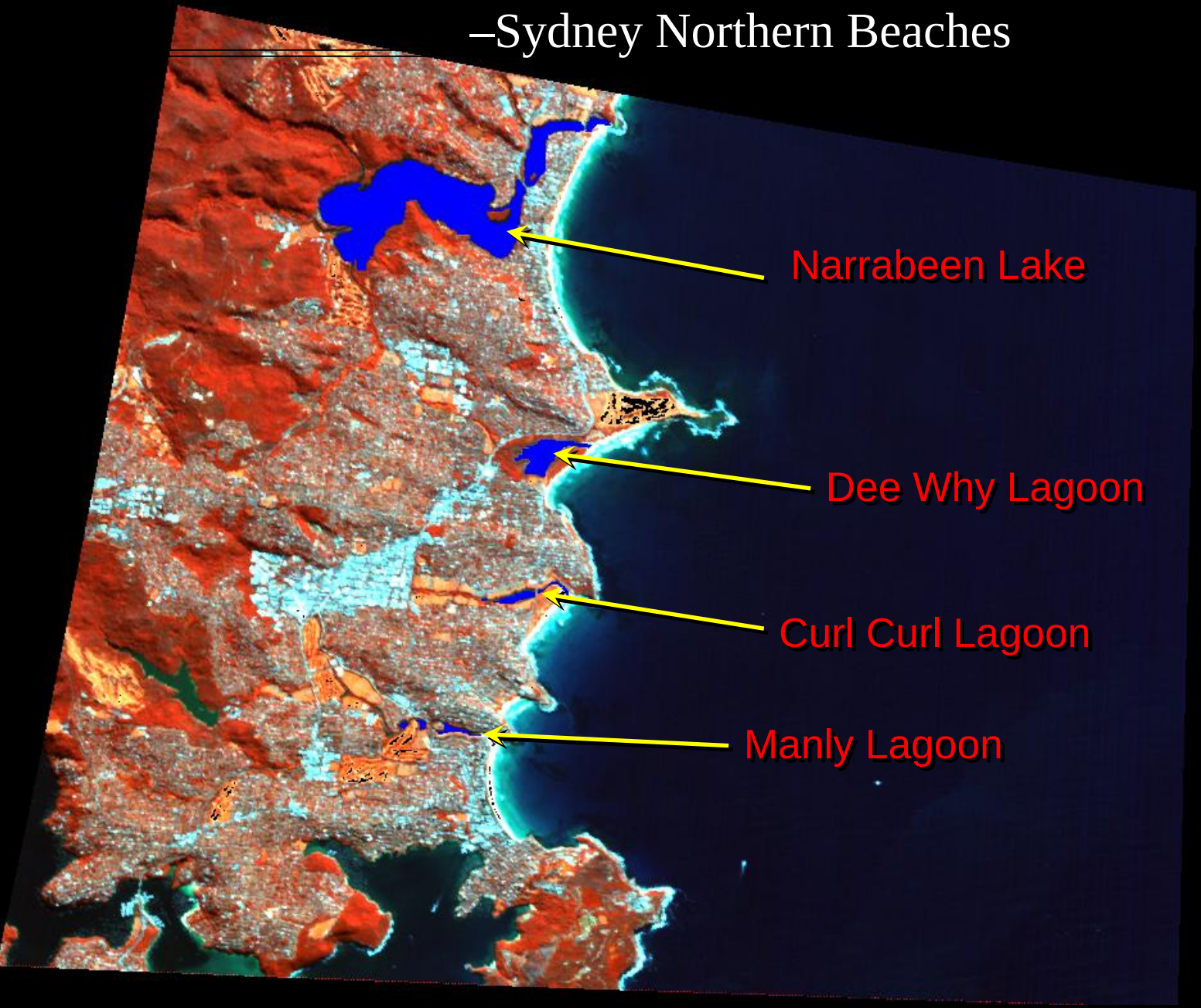
Australian CHRIS Study Site



Saline Lakes

–Sydney Northern Beaches



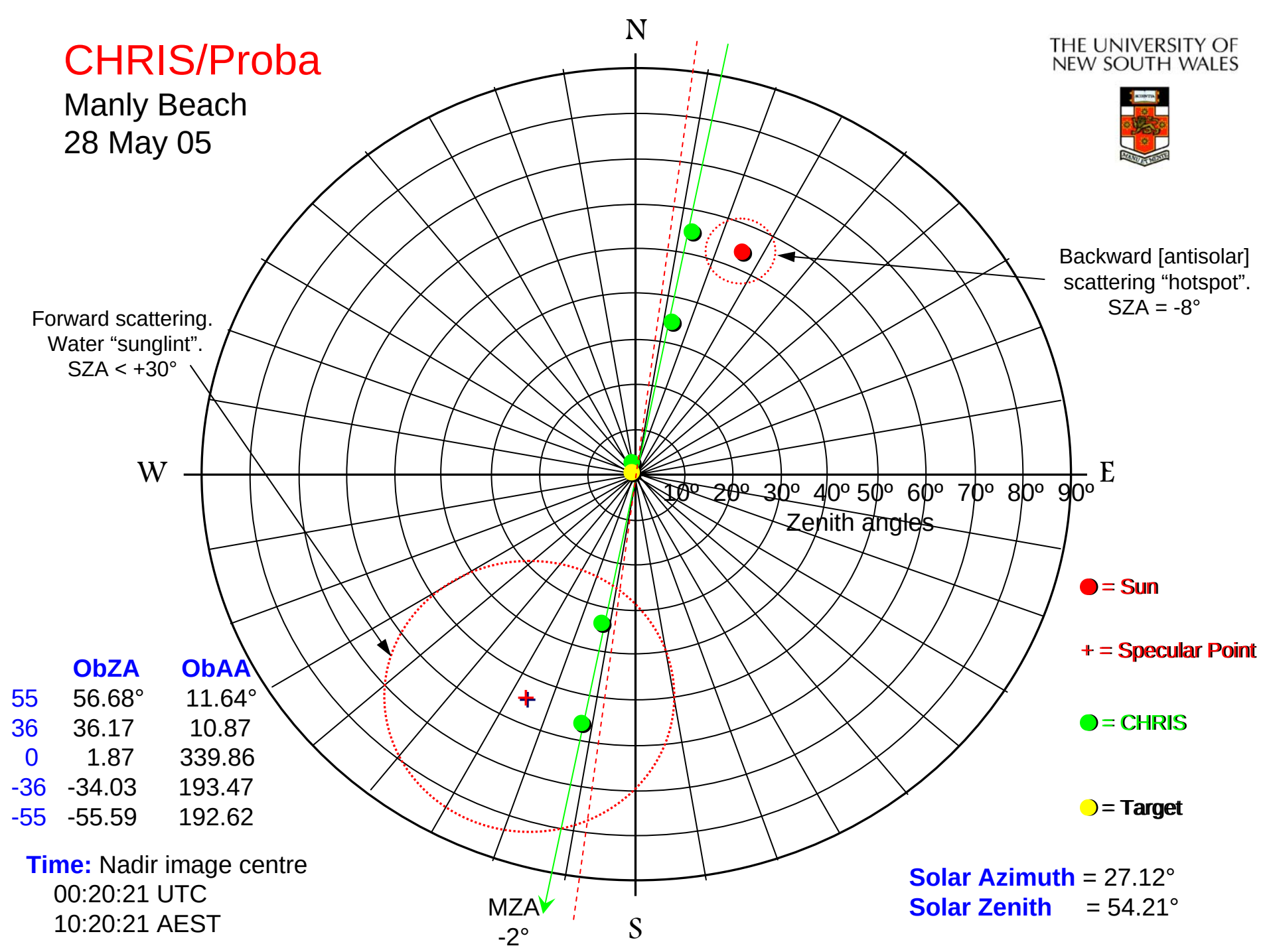
Data Description

- CHRIS dataset (Mode 2) of Sydney's Northern Beaches.
- For this study, three angles were examined: -36, 0, +36.
- Collected on 28 May 2005 at 10:20 a.m. SIRA destriped.
- Tidal information (*partial influence only*): low tide @ 6:11 a.m., high tide @ 12:13 p.m.

CHRIS/Proba

Manly Beach
28 May 05

THE UNIVERSITY OF NEW SOUTH WALES



	ObZA	ObAA
55	56.68°	11.64°
36	36.17	10.87
0	1.87	339.86
-36	-34.03	193.47
-55	-55.59	192.62

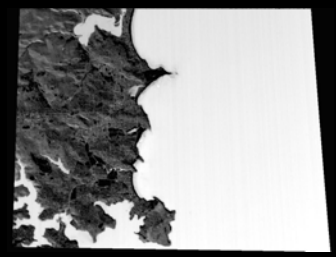
Time: Nadir image centre
00:20:21 UTC
10:20:21 AEST

Solar Azimuth = 27.12°
Solar Zenith = 54.21°

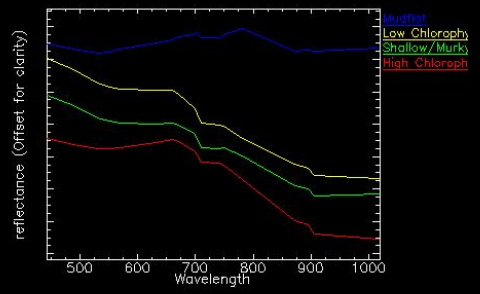
Methods

Geo-referencing

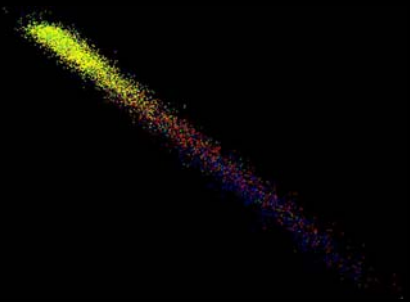
MNF Transformation

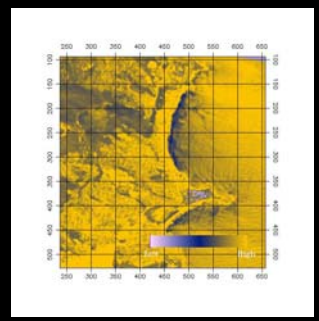


n-Dimensional Visualization and Endmember Identification



Formation of Spectral Library





OCRES program

Results…

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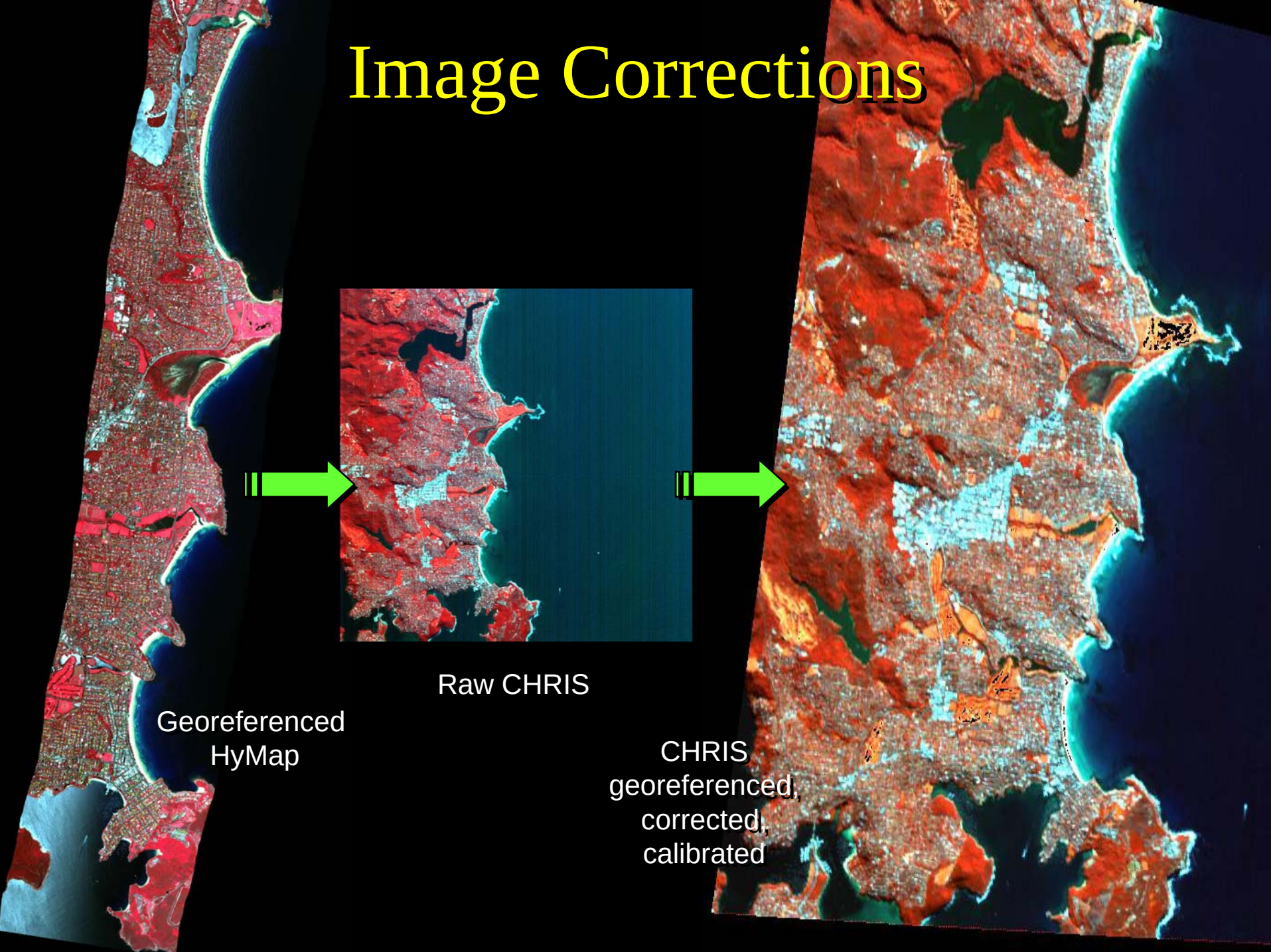
Image Corrections



Raw CHRIS

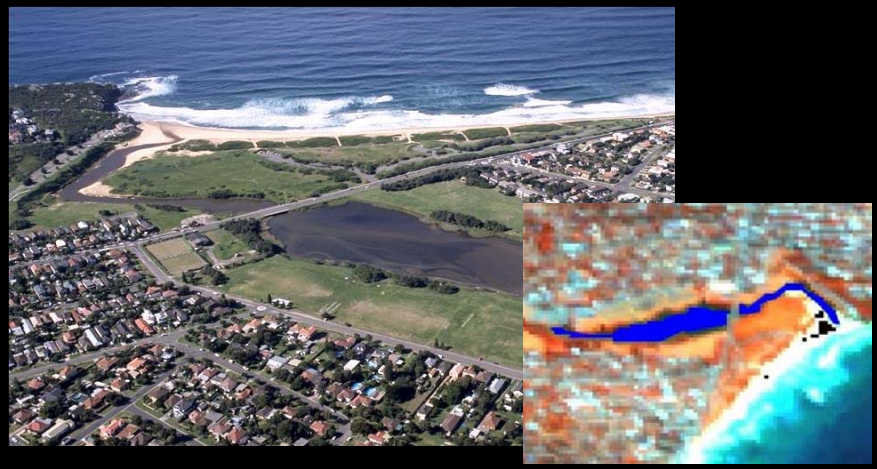
Georeferenced
HyMap

CHRIS
georeferenced,
corrected,
calibrated

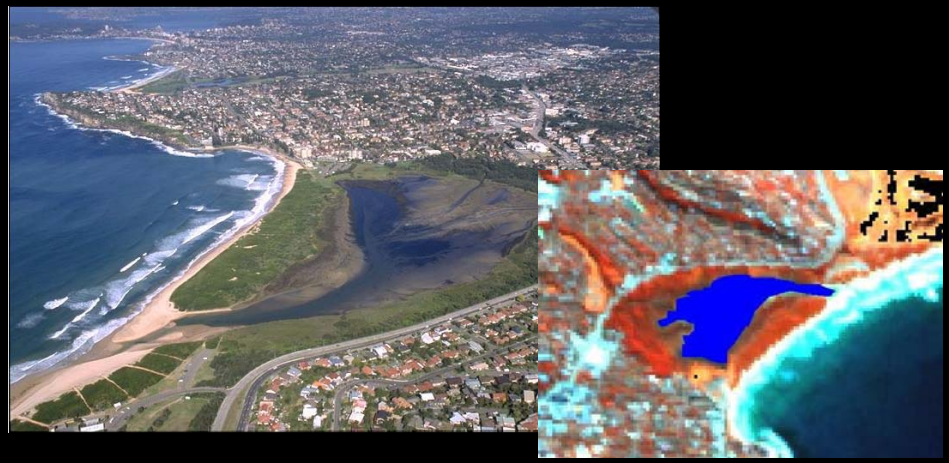
Study Site

Regions of Interest

Narrabeen Lake



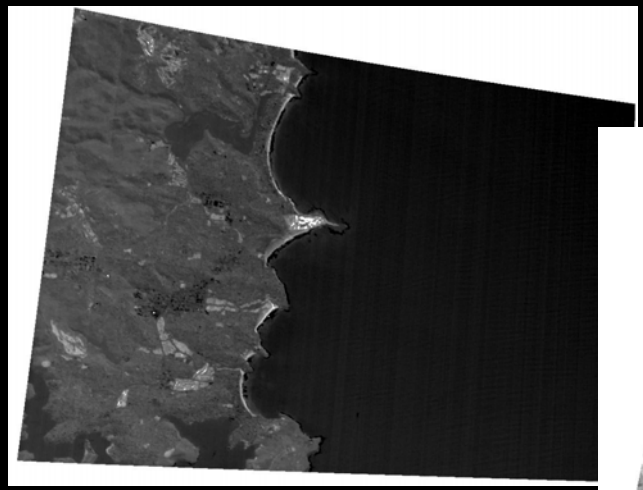
Curl Curl Lagoon



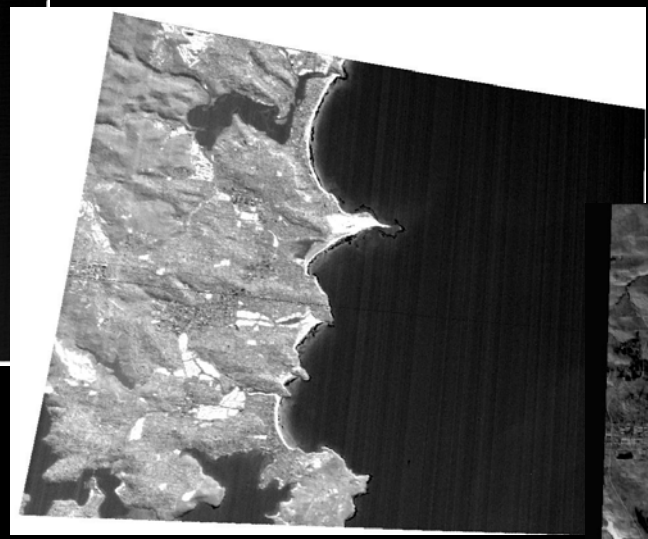
Dee Why Lagoon

Manly Lagoon

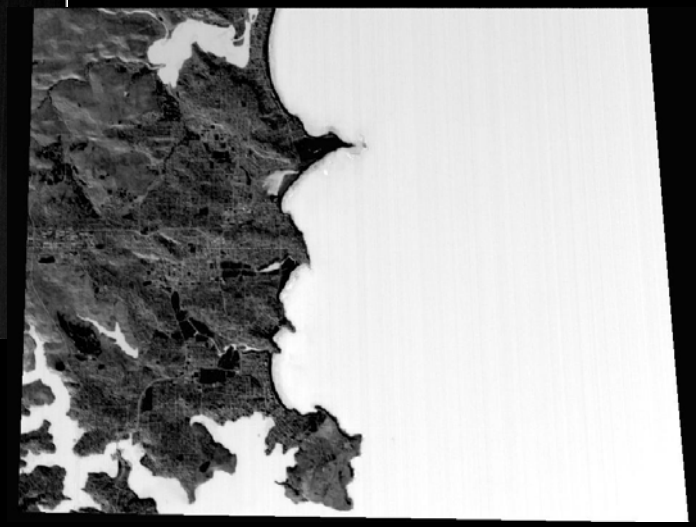
MNF Transformation



-36 Band 1



Nadir Band 1



+36 Band 1

- Use animation tool to identify useful bands. MNF Bands 1-5

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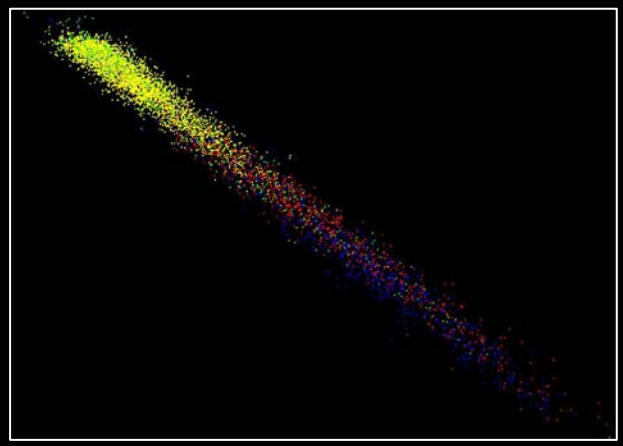
n-Dimensional Visualization



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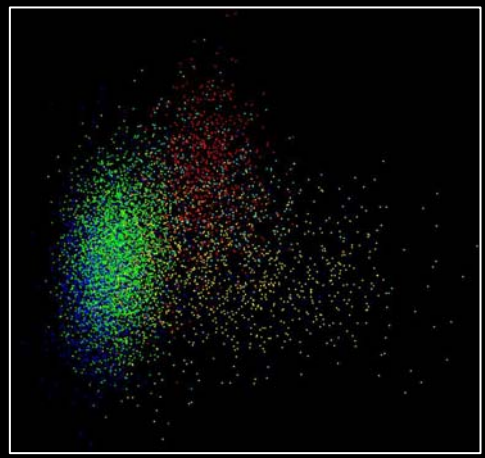

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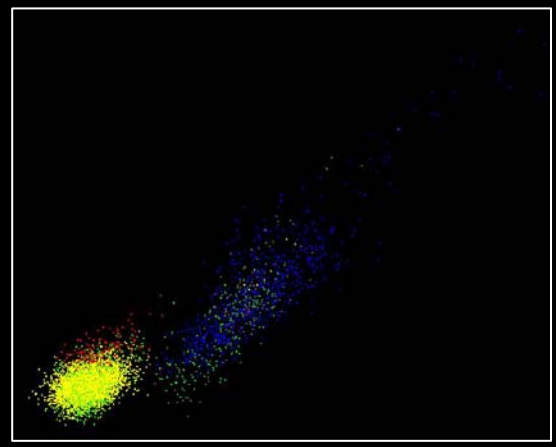


+36

- Bands 1-5 were used for each visualization
- Process of trial and error used to separate identify endmembers

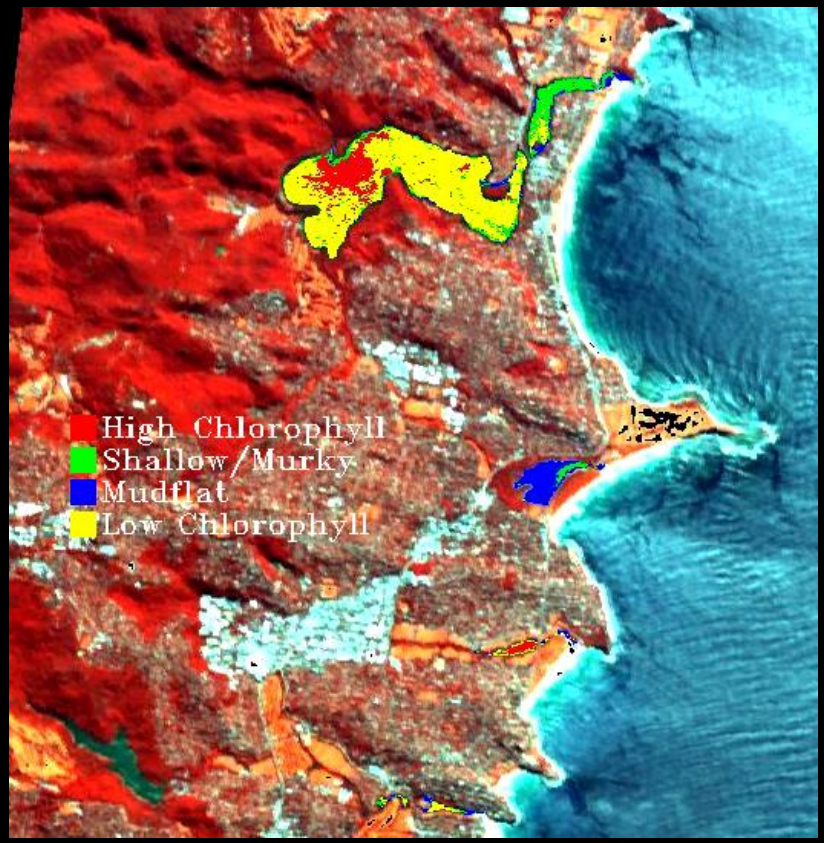
n-Dimensional Visualization

Nadir map of endmembers

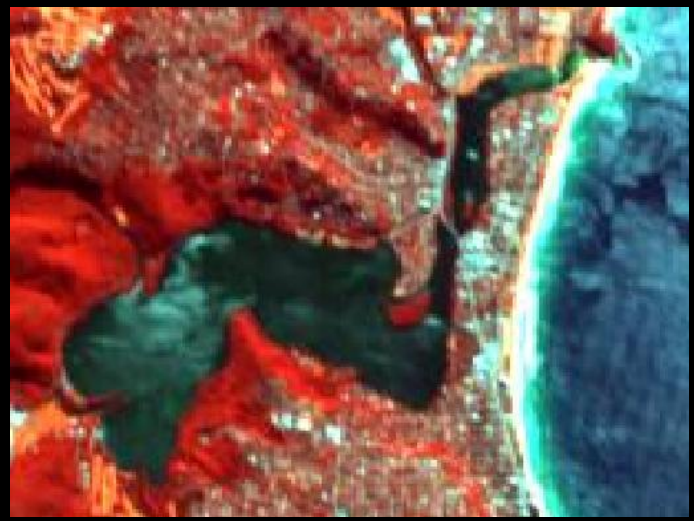
n-Dimensional Visualization

+36 map of endmembers

n-Dimensional Visualization



-36 map of endmembers



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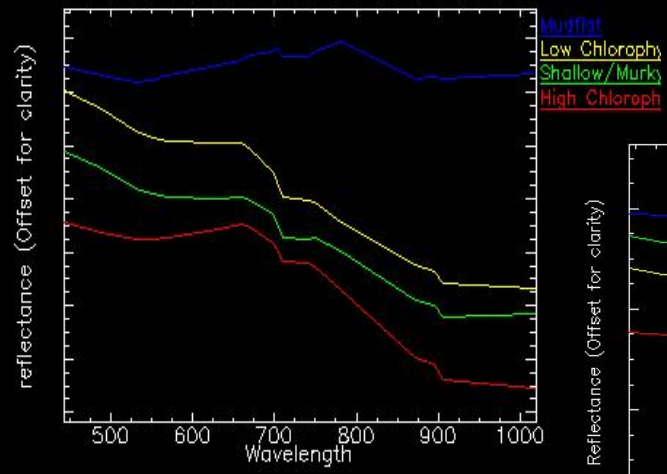
Spectral Libraries



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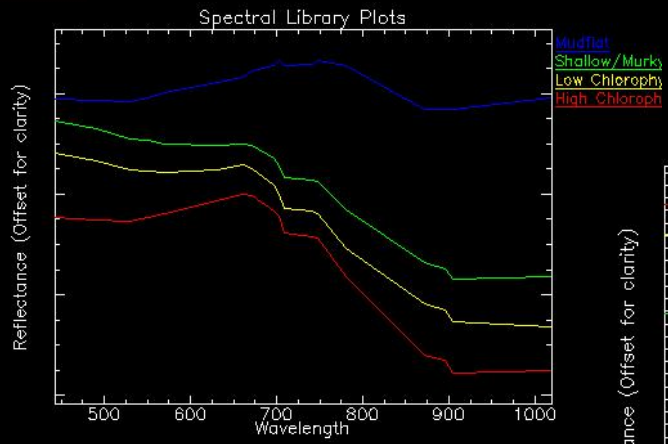

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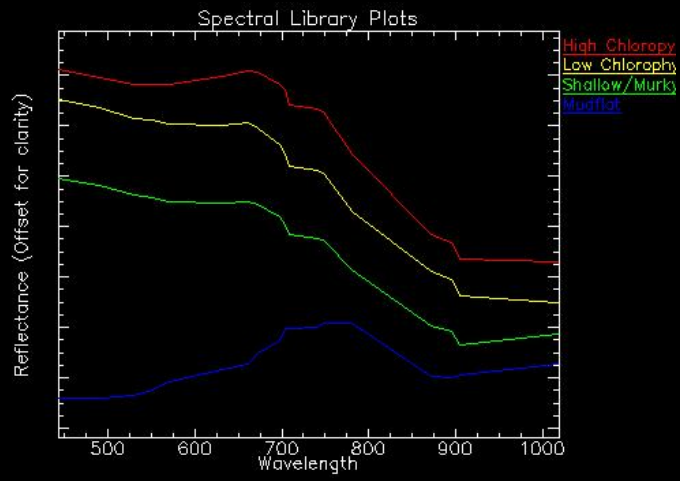

+36

- Differences in libraries due to bidirectional reflectance: sunglint reflectance from rough water surfaces

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OCRES Software

- ENVI Add-ON. Developed in IDL/ENVI Environment.
- Computes Important Ocean parameters:
  - Chlorophyll-a
  - Coloured Dissolved Organic Material (CDOM)
  - Sea Surface Temperature (SST)
- Sensor Specific Algorithms.
- Trial with CHRIS data to examine potential for application/modification to off-nadir observations.

Algorithms

PROPERTY	ALGORITHM
CHLOROPHYLL	OC2, OC3M, OC4 GONS
SEA SURFACE TEMPERATURE	MODIS AQUA NLSST MODIS TERRA NLSST
COLOURED DISSOLVED ORGANIC MATERIAL	CARDER CDM

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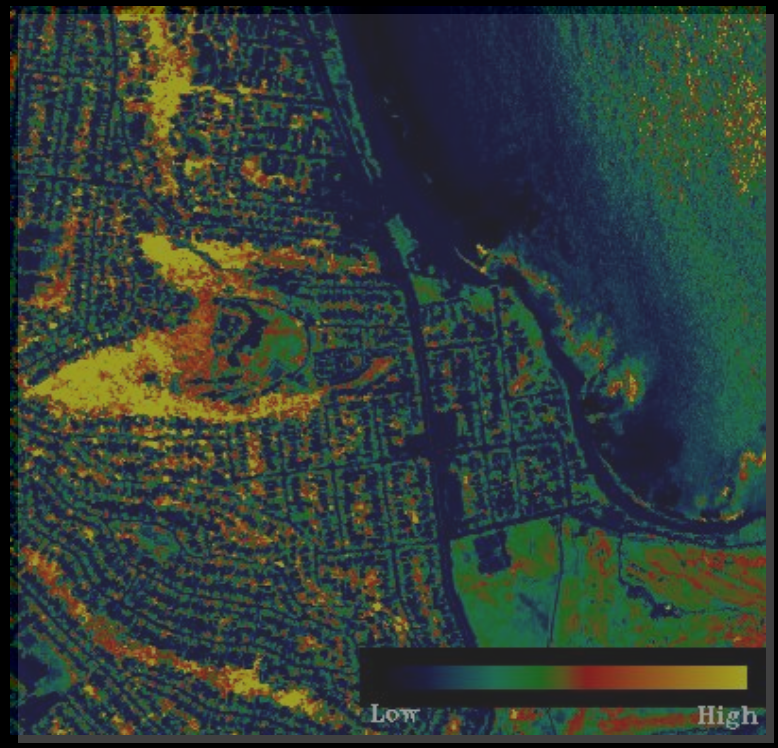
Applications -Chlorophyll



OCRES RESULT OF CHLOROPHYLL ALGORITHM

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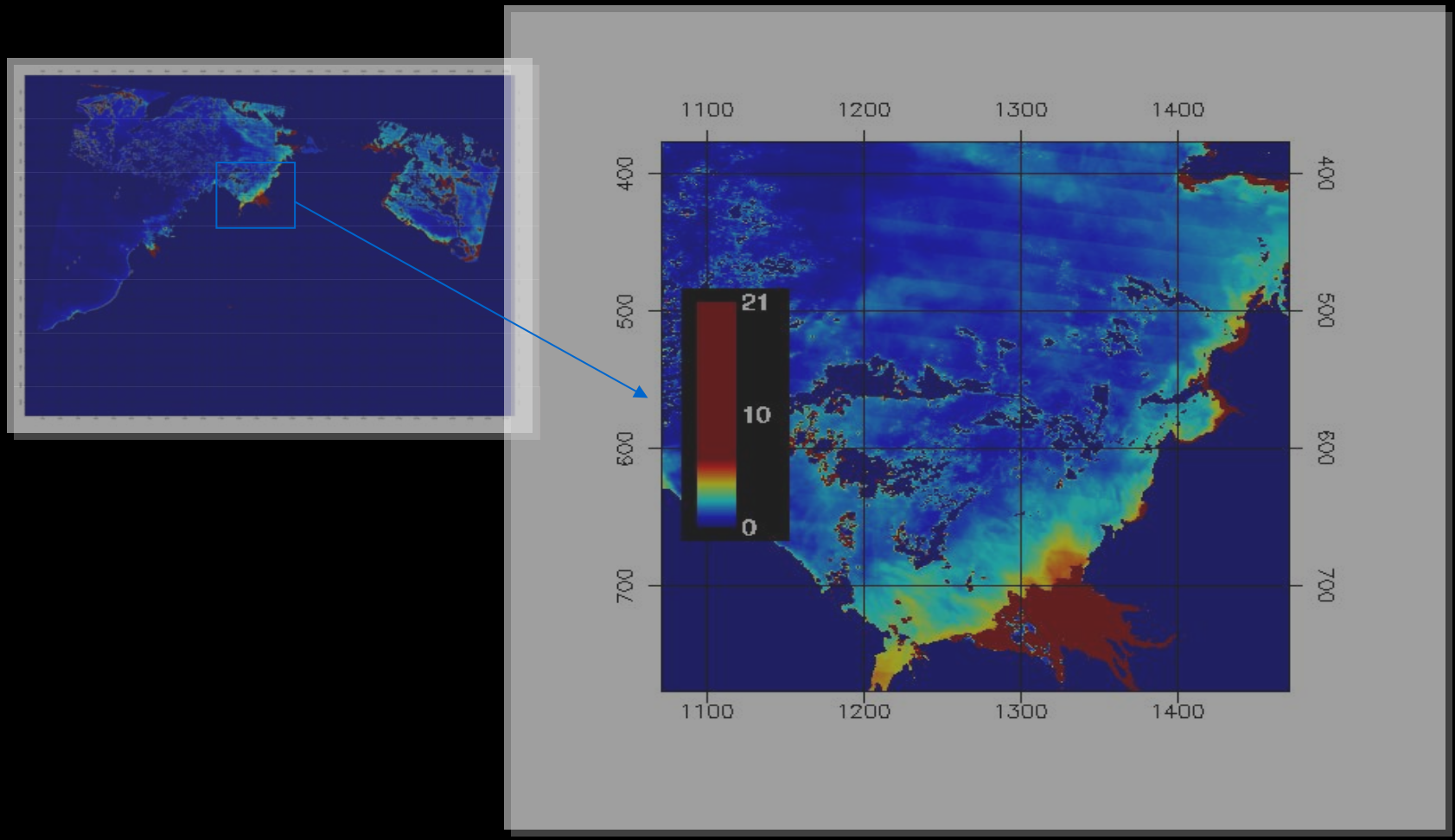
Applications -Chlorophyll



OCRES OC3M ALGORITHM RESULT

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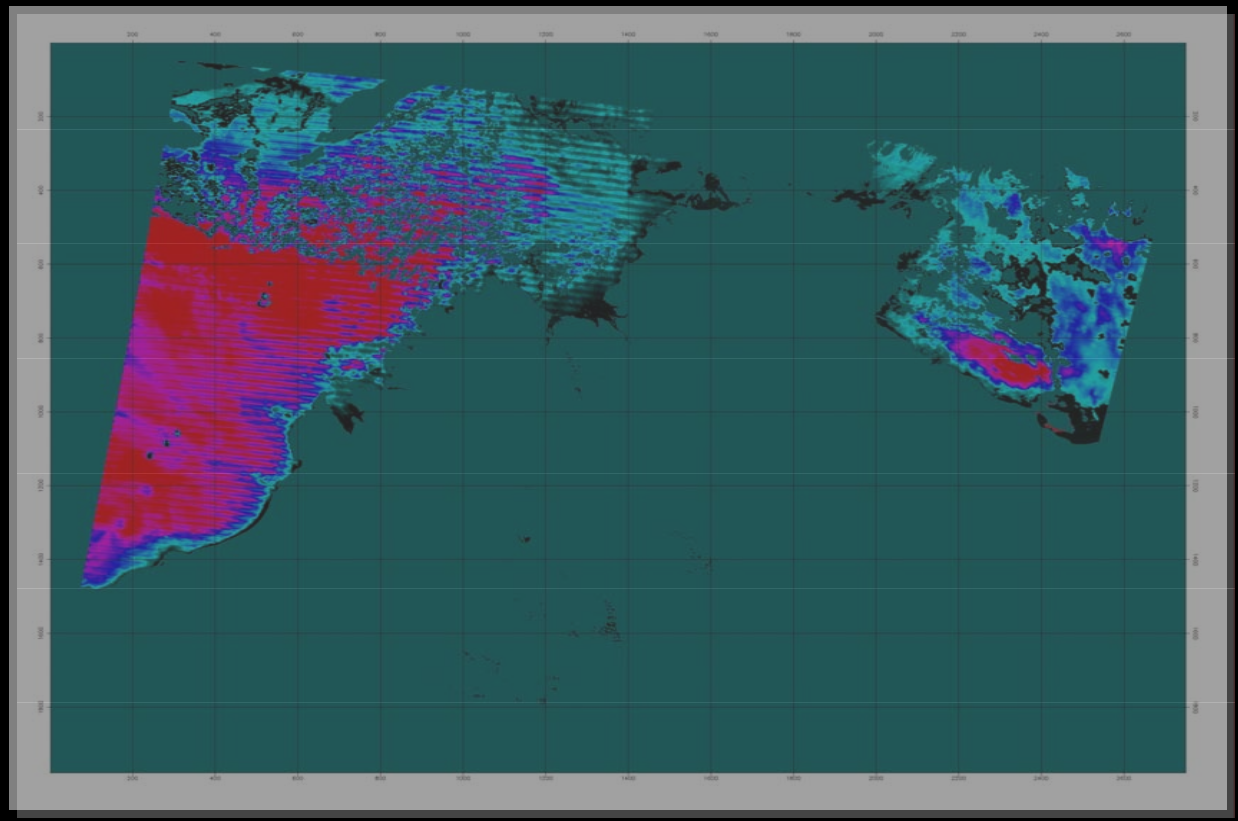
Applications -CDOM



OCRES CARDER CDM ALGORITHM RESULT

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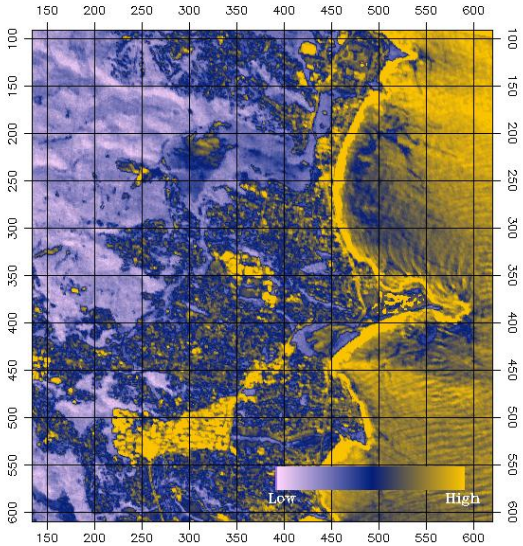
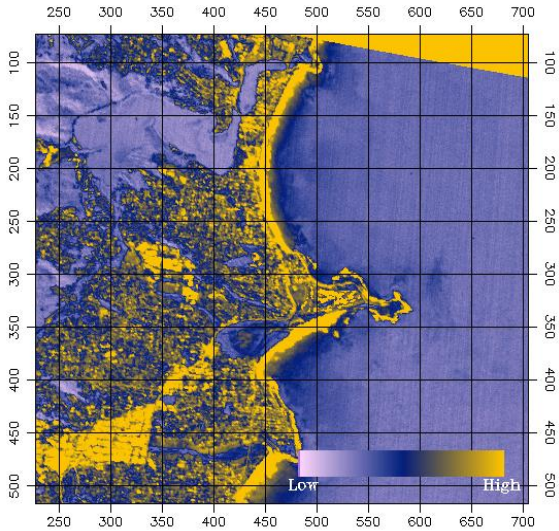
OCRES Software

CDOM/Turbidity

…early off-nadir trials



-36



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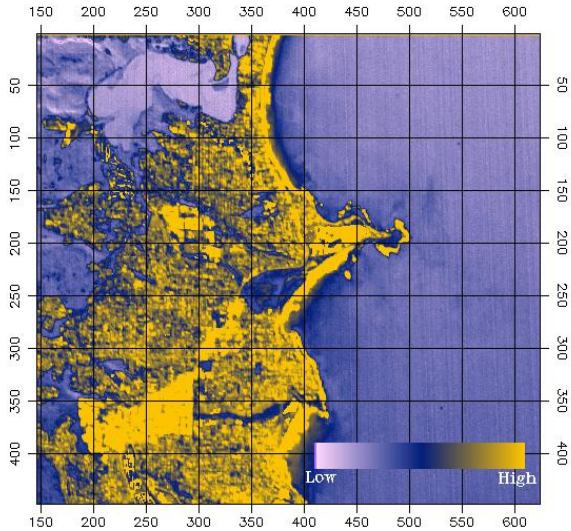

+36

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Conclusions

- Results vary using different angles as would be expected.
- Comparing results from the ‘hourglass’ processing to the OCRES results provides an excellent quality check.
- For meaningful results, the site should be analysed at different points in time (e.g. seasonally) and if possible at different tidal levels.
- Prior knowledge of the area is necessary to get the most out of the analysis.
- Tidal information is necessary to accurately classify the endmembers.

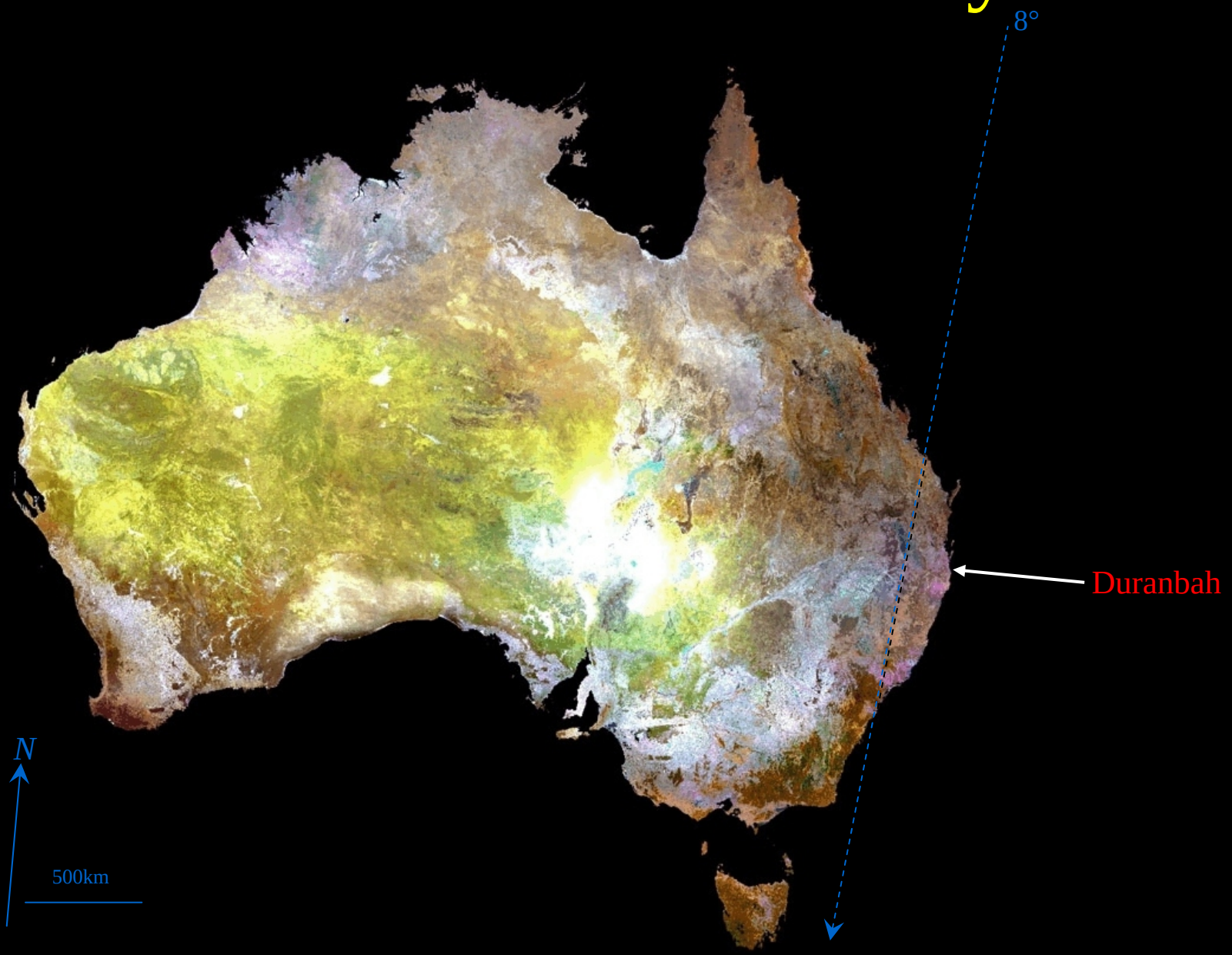
Monitoring Tweed River Water Quality with CHRIS Data

Zhuochun Gao
&
Ray Merton

Introduction

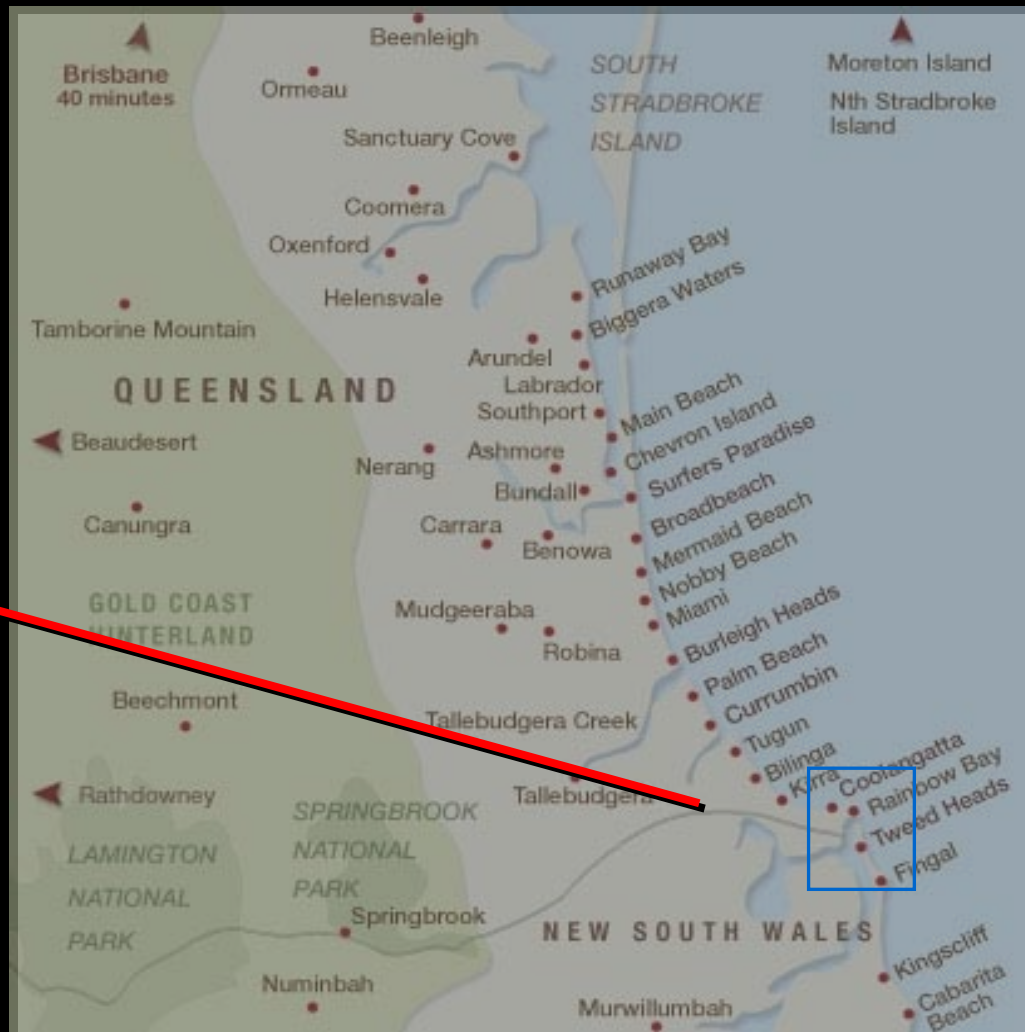
- Estruarine environments are sensitive environments and important ecologically and economically.
- CHRIS Mode 2 data is suitable to estuarine monitoring.
- The objective of this project is to produce water quality maps via OCRES ENVI software.

Australian CHRIS Study Site

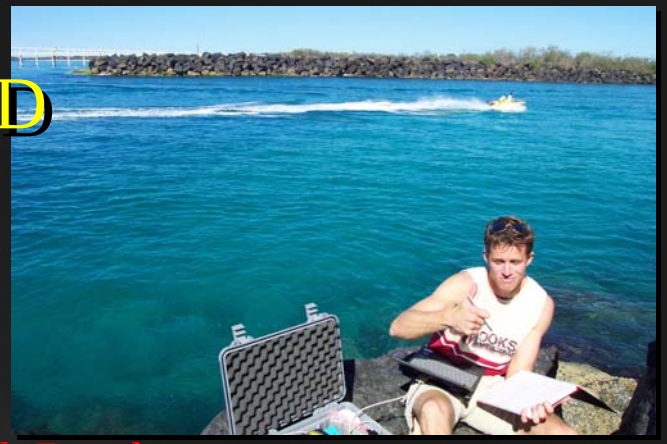


Research Area

- Duranbah on south coast of Queensland (Coolangatta).
- Two datasets dates:
  25 July 2005 & 20 Aug 2005



Duranbah QLD



Duranbah Beach

Greenmount Beach

QLD

NSW

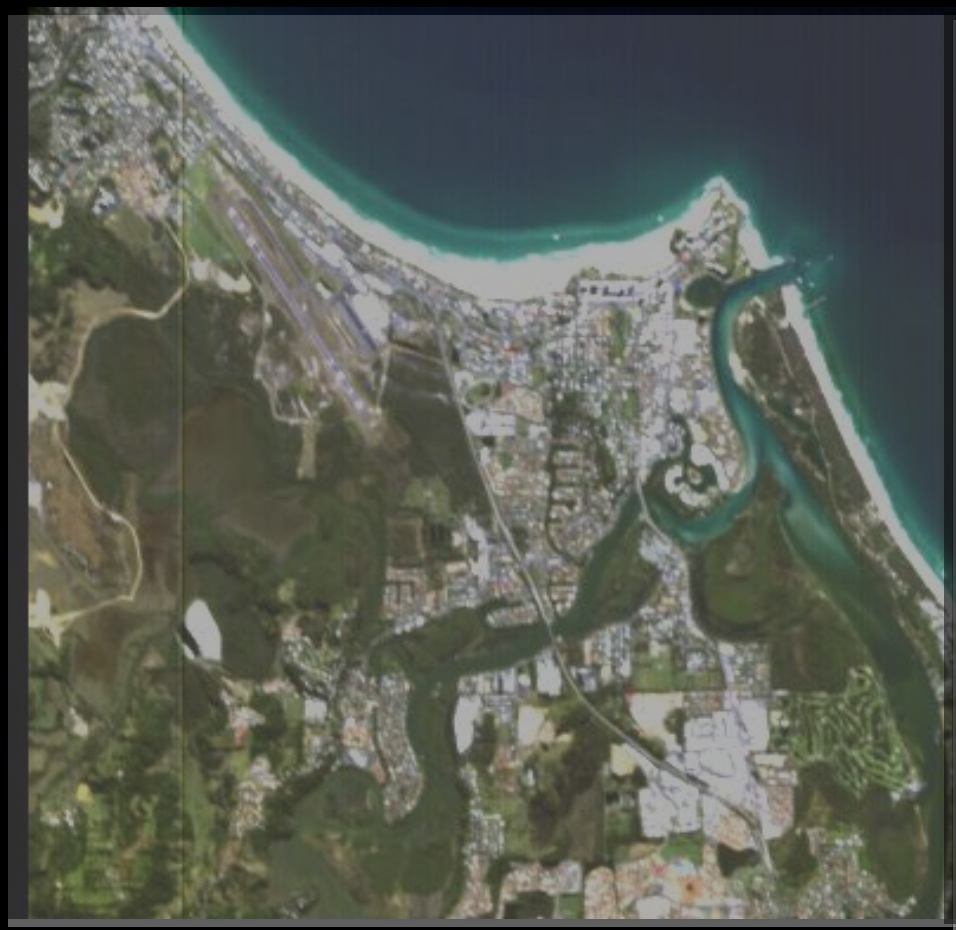
Bed-form Movement

Tweed River

Proba -High Resolution Camera (HRC)
8m GSD

15 Sept 2005

CHRIS Acquisitions (2)



25 July 2005 CHRIS image

20 August 2005 Chris image

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CHRIS/Proba

Duranbah Beach
DB_20050725

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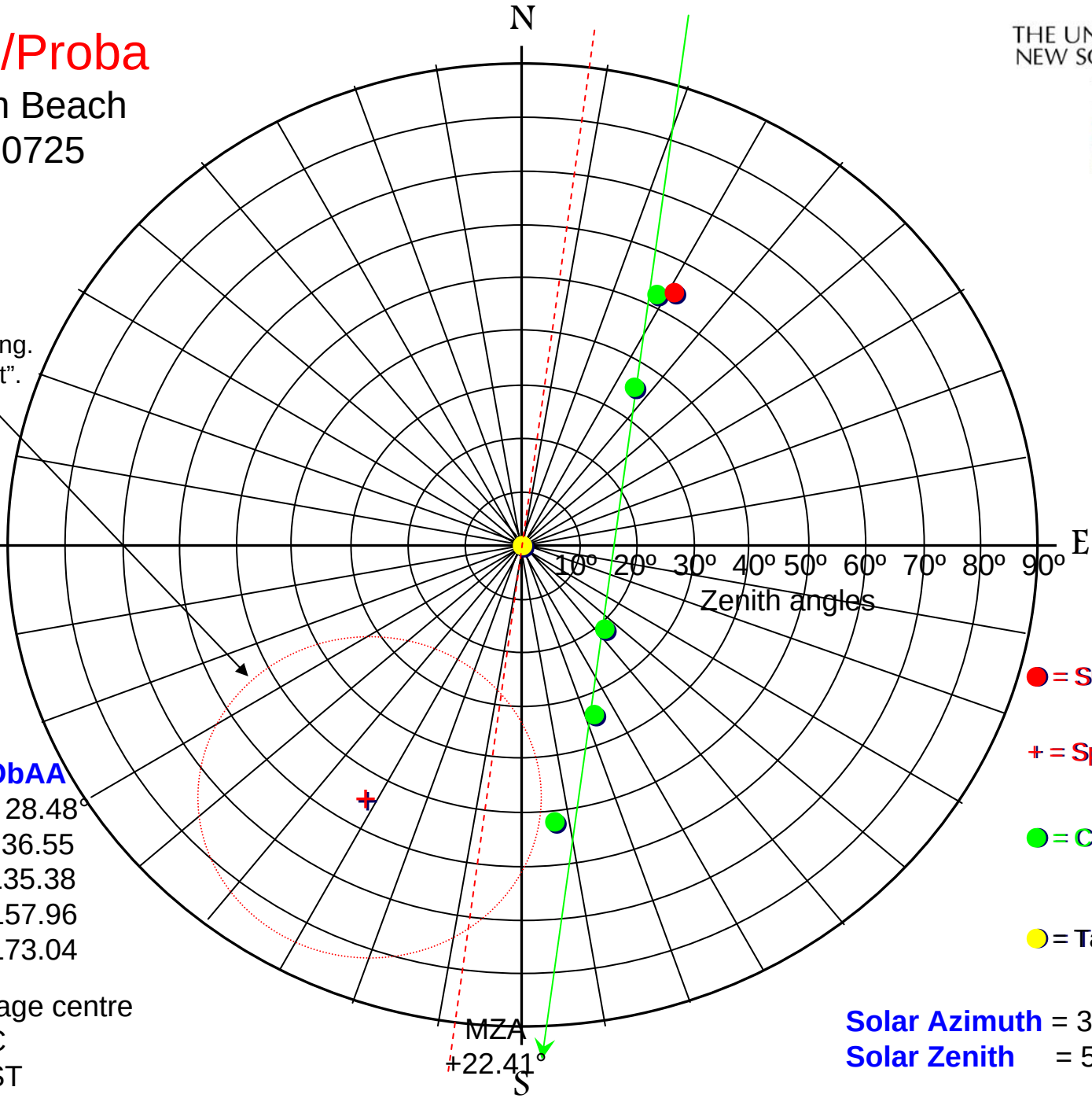

Forward scattering.
Water "sunglint".
SZA < +30°

	ObZA	ObAA
55	53.05°	28.48°
36	36.55	36.55
0	-22.41	135.38
-36	-34.53	157.96
-55	-51.43	173.04

Time: Nadir image centre
00:04:19UTC
10:04:19AEST

= Sun

+ = Specular Point

= CHRIS

= Target

Solar Azimuth = 31.55°
Solar Zenith = 54.22°

CHRIS/Proba

Duranbah Beach
DB_20050820

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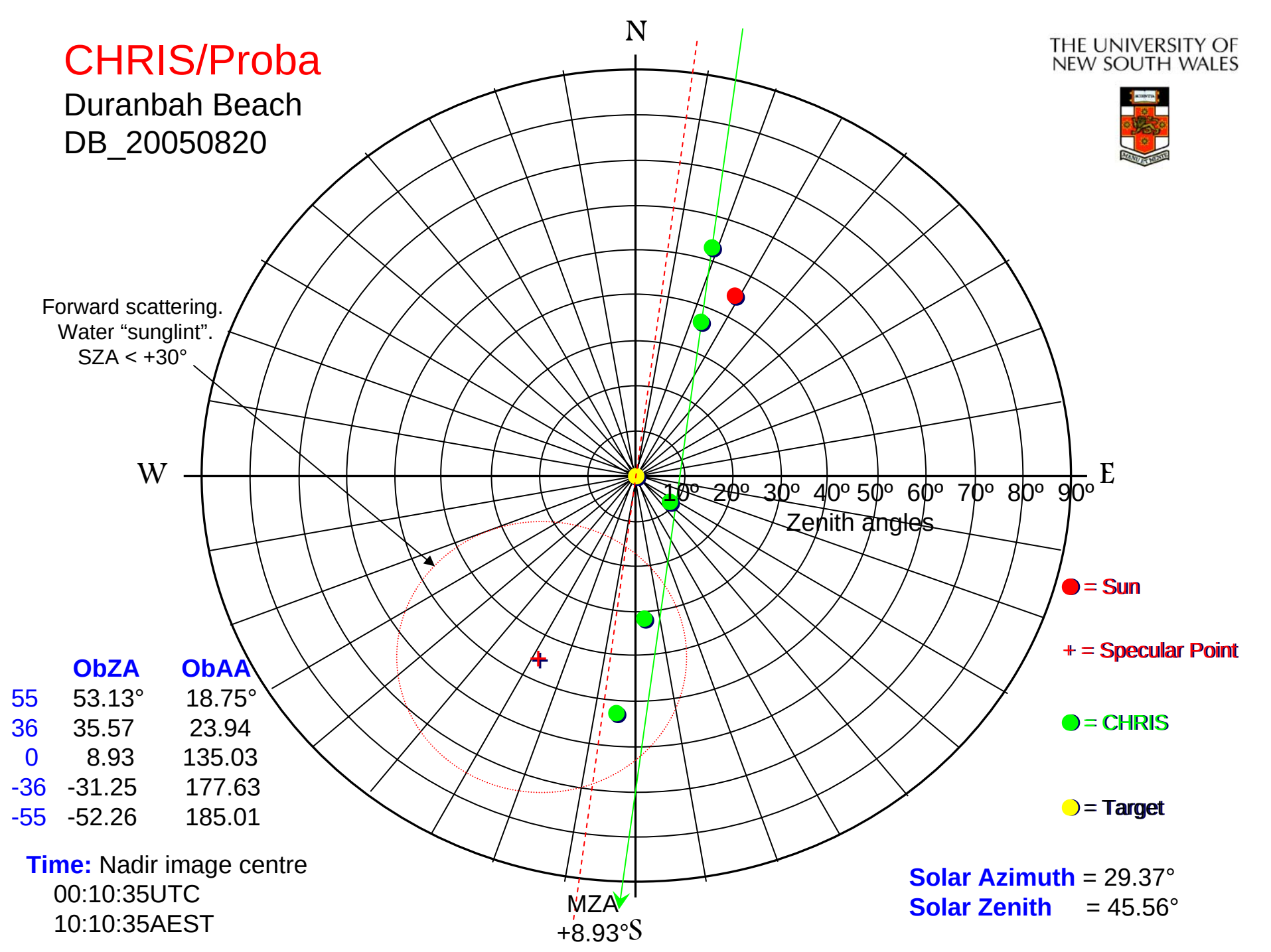


	ObZA	ObAA
55	53.13°	18.75°
36	35.57	23.94
0	8.93	135.03
-36	-31.25	177.63
-55	-52.26	185.01

Time: Nadir image centre
00:10:35UTC
10:10:35AEST

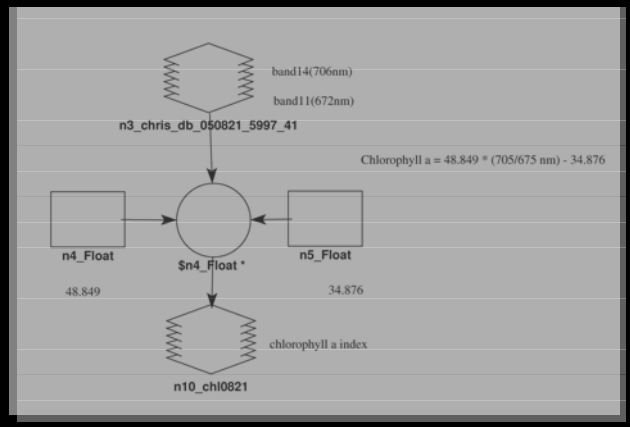
Solar Azimuth = 29.37°
Solar Zenith = 45.56°

Water Quality Indicators

- Chlorophyll-a concentration
- Turbidity
- Total phosphorus concentration (link to algae productivity)

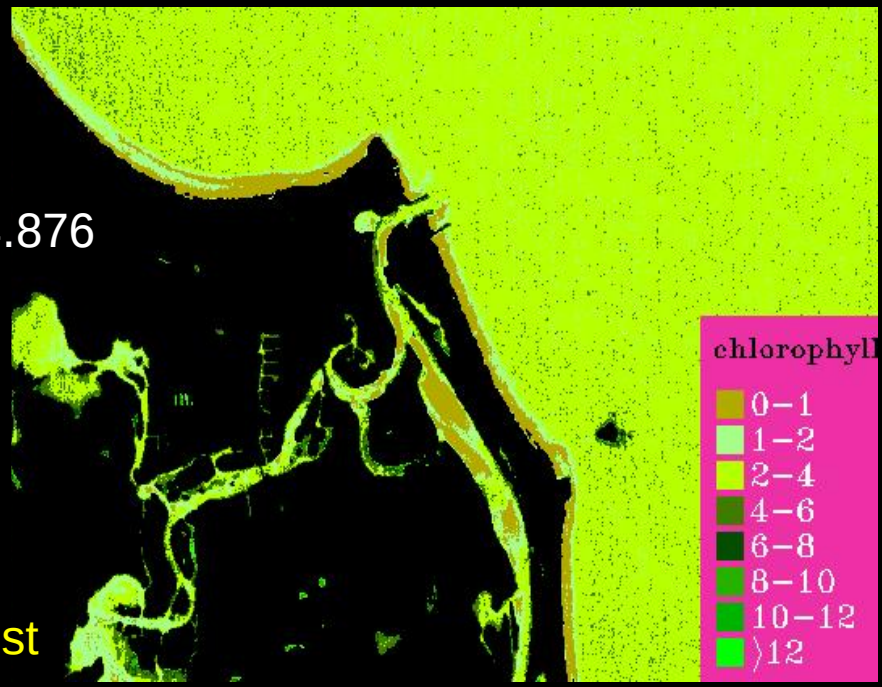
…via OCRES ENVI program

Chlorophyll-a



25 July

- Chlorophyll *a* = 48.849 * (705/675 nm) - 34.876



20 August

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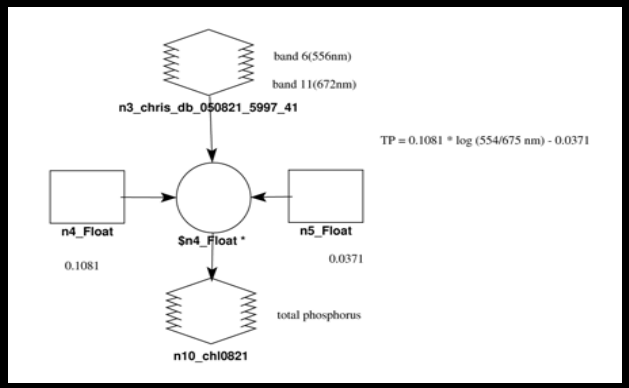
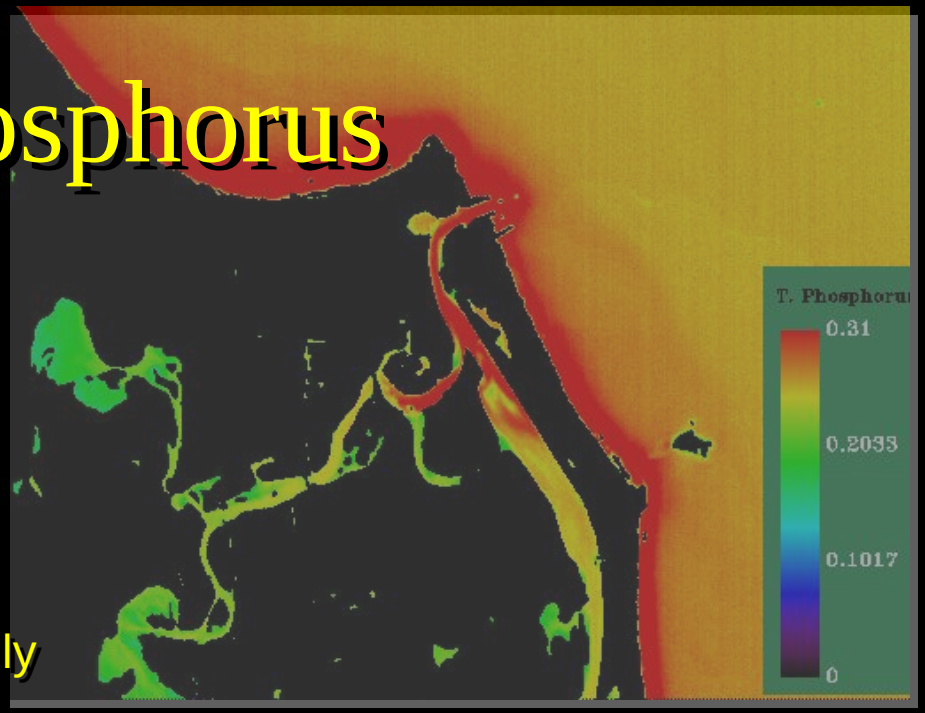
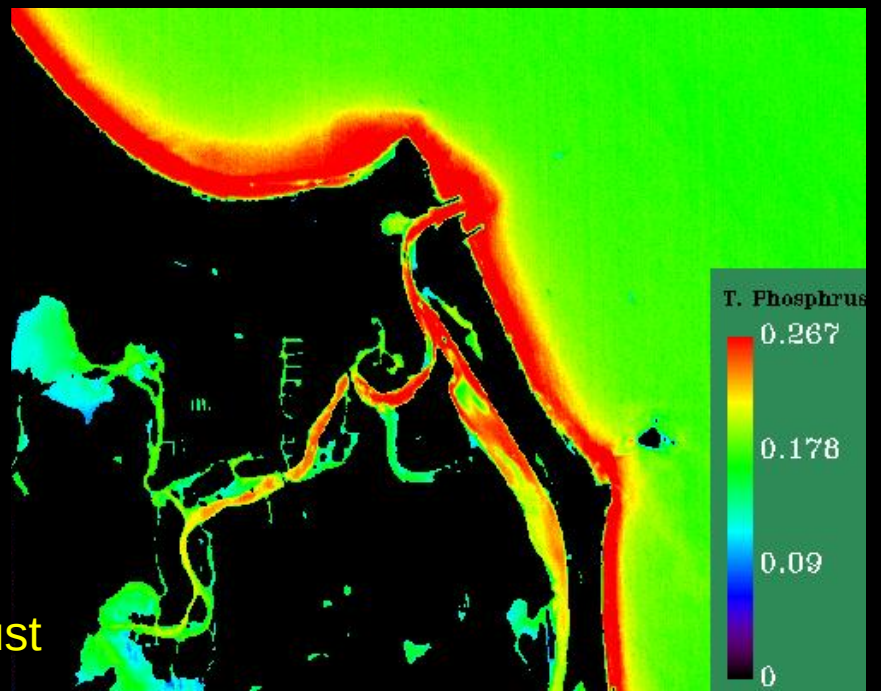
Total Phosphorus





25 July

- TP = 0.1081 * log (554/675 nm) - 0.0371



20 August

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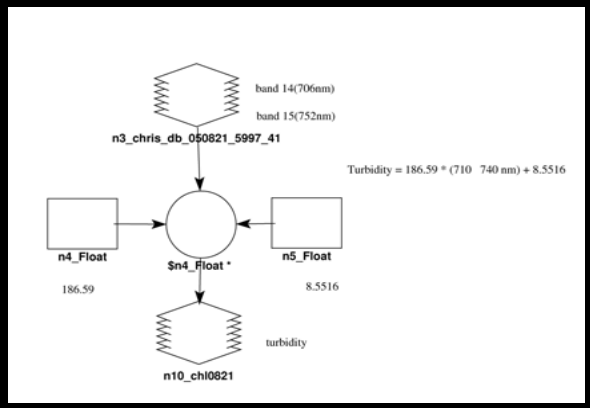
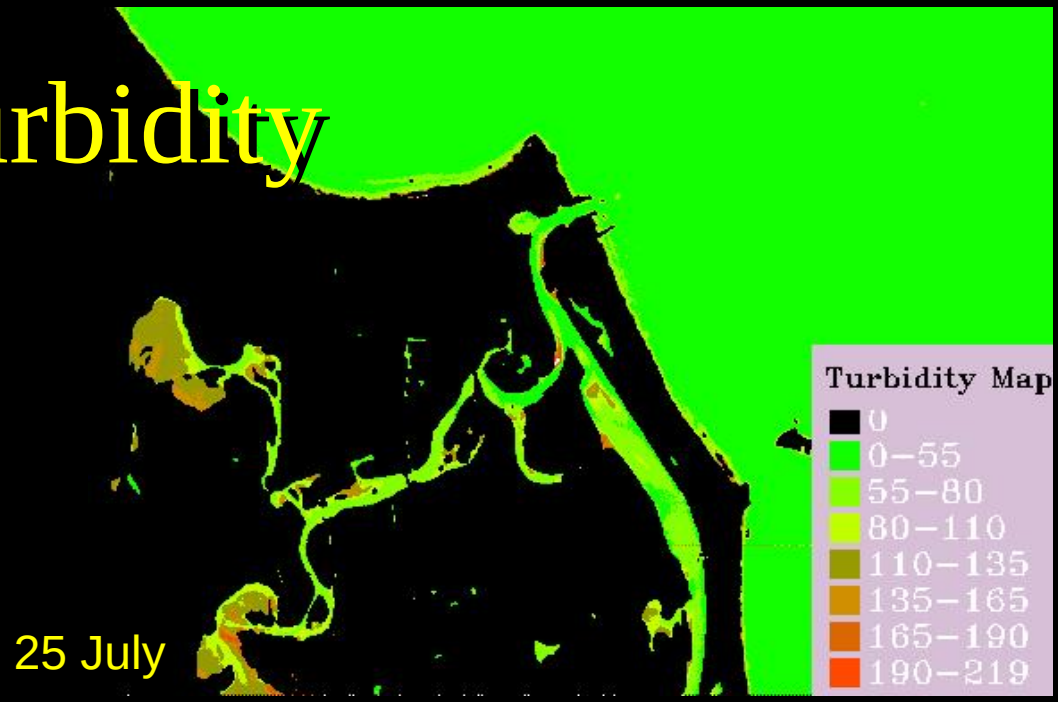
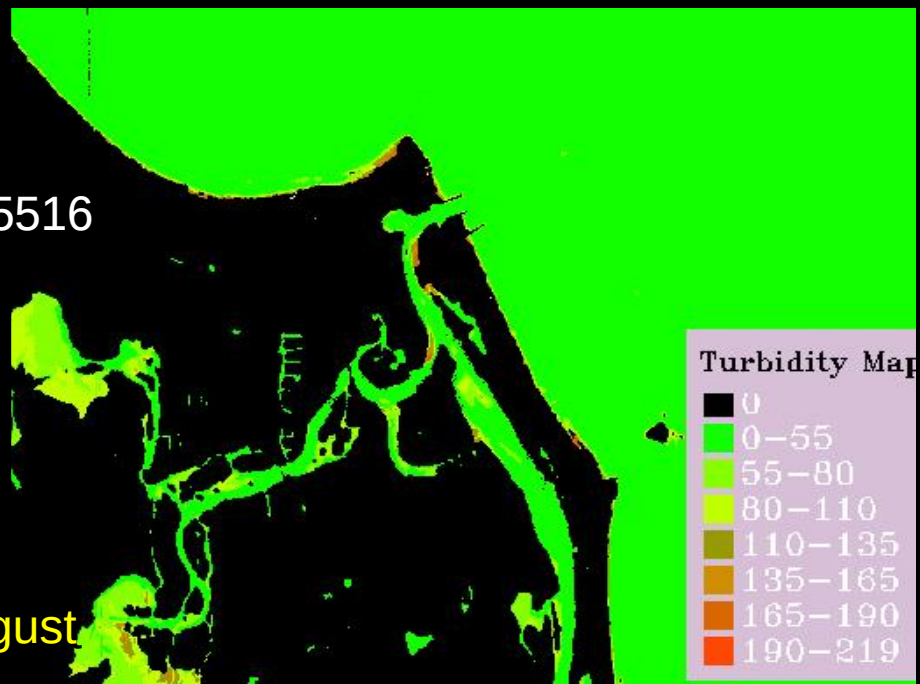
Turbidity





25 July

- Turbidity = 186.59 * (710 – 740 nm) + 8.5516



20 August

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