Detection of Surface and Underwater Features using Synthetic Aperture Radar

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Introduction

Synthetic Aperture Radar (SAR) is a mature remote sensing technology which can form high-resolution images of the earth's surface. The textural detail apparent in Earth Observation (EO) SAR imagery of the ocean surface is a manifestation of a range of physical phenomena including local weather effects, underlying prevailing ocean swells, ocean currents as well as localised changes in the sea-bed topography.

A key enabler for the measurement of ocean surface textural detail is the availability of repeat large area (many 10's of km if not 100's km) coverage of SAR imagery from Earth Observation satellites.
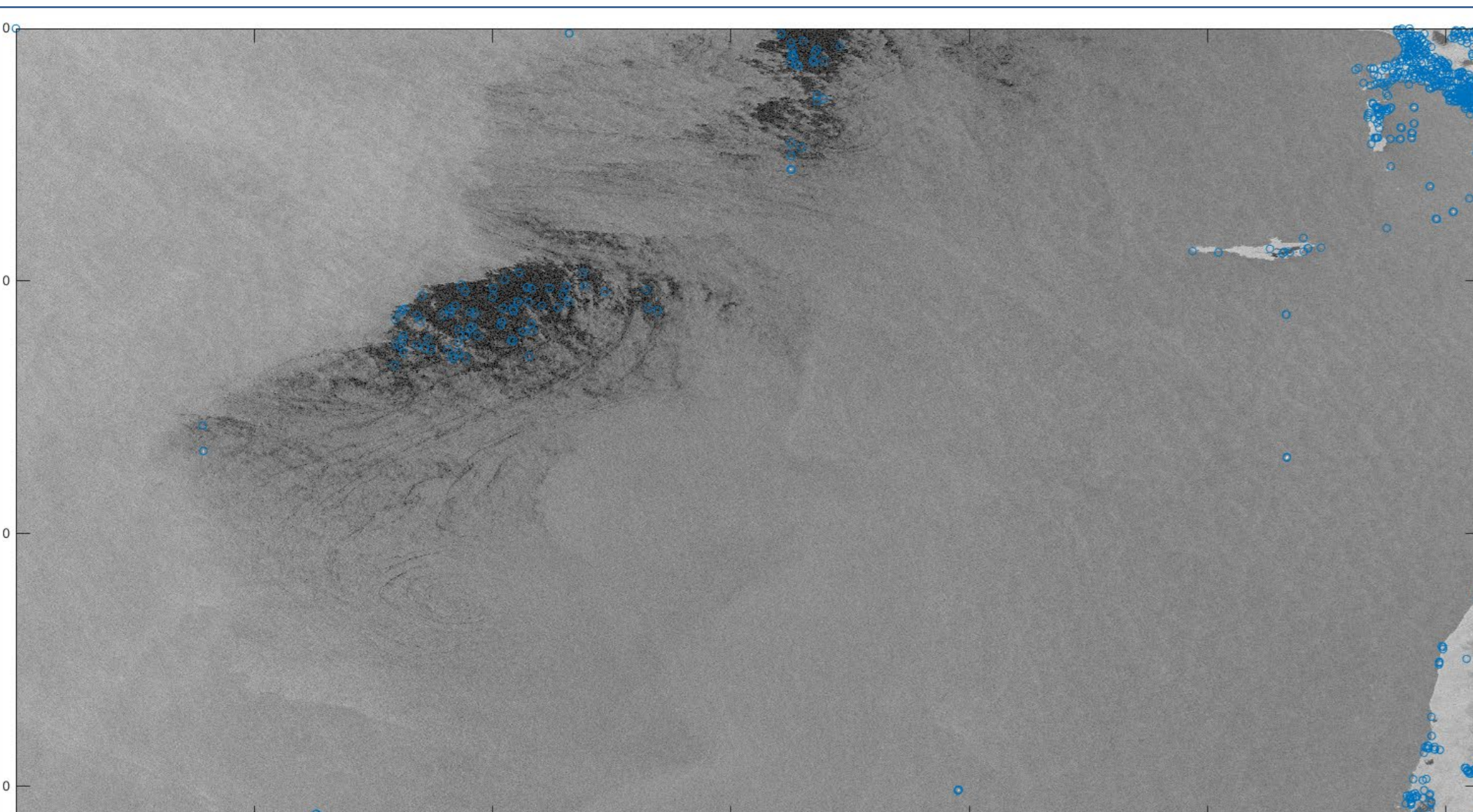
Aims

The focus of the PhD will be on developing an understanding of the information content of multi-dimensional (e.g. spatial, temporal, polarisation) EO SAR ocean data-sets.

Methods

• Identify characterising metrics and features which correlate with geophysical properties

• Exploit weather data to detect and characterize physical phenomena
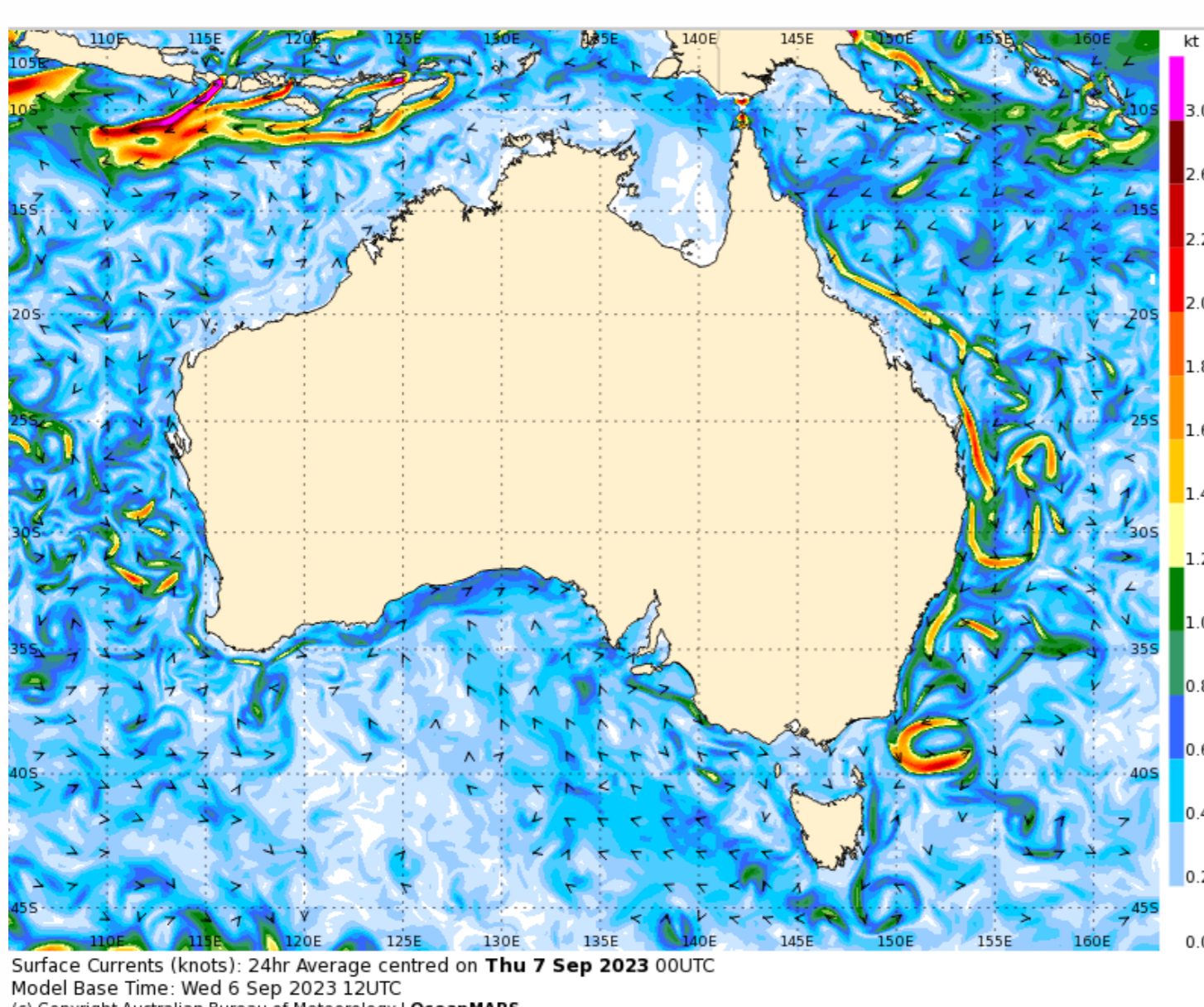
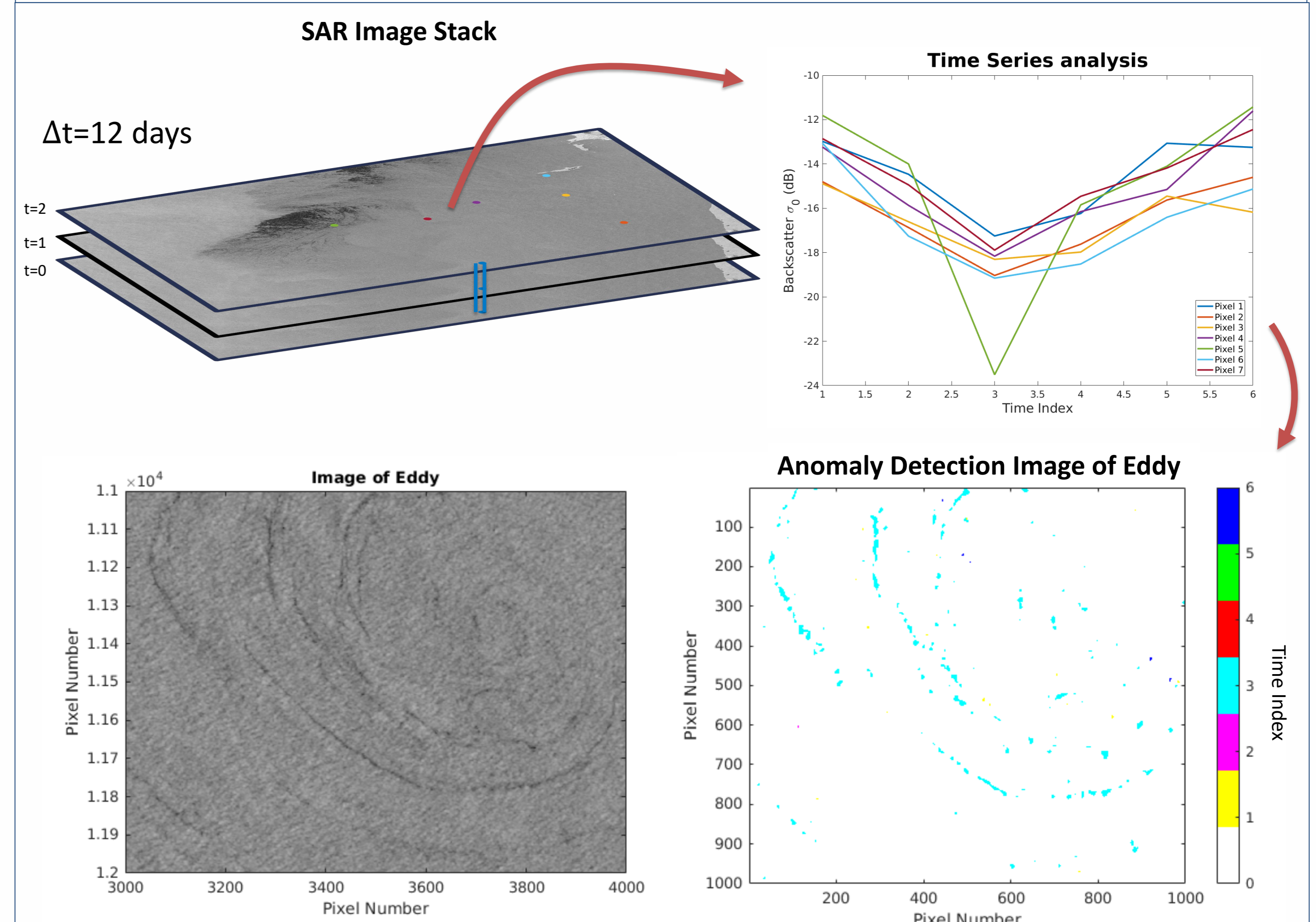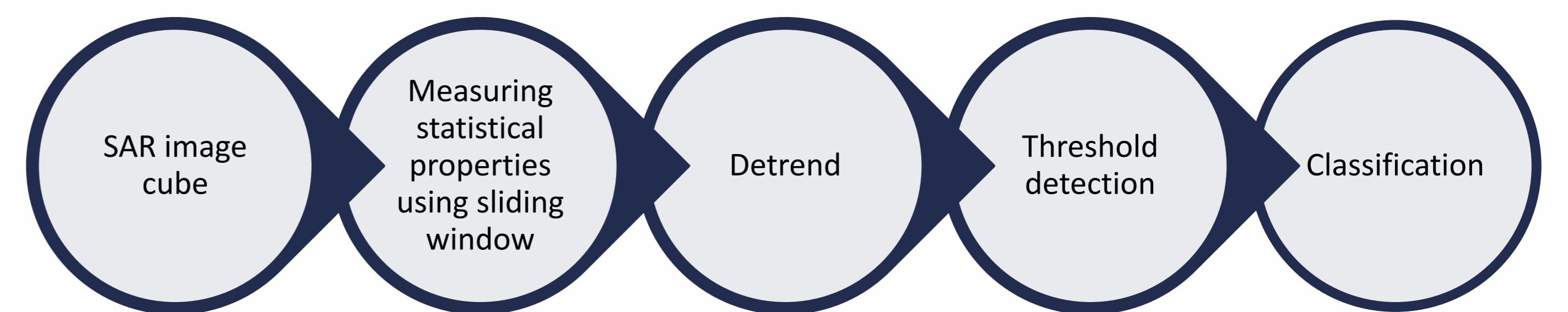**Ocean Currents Around Australia / BOM 2023**

Processing Motivation:
Find anomalous features:
• Point targets (typically using CFAR detector)
• Structural or morphologic features
• Textural analysis

Sentinel 1A SAR image off the coast of Perth Australia with a CFAR Detection process applied
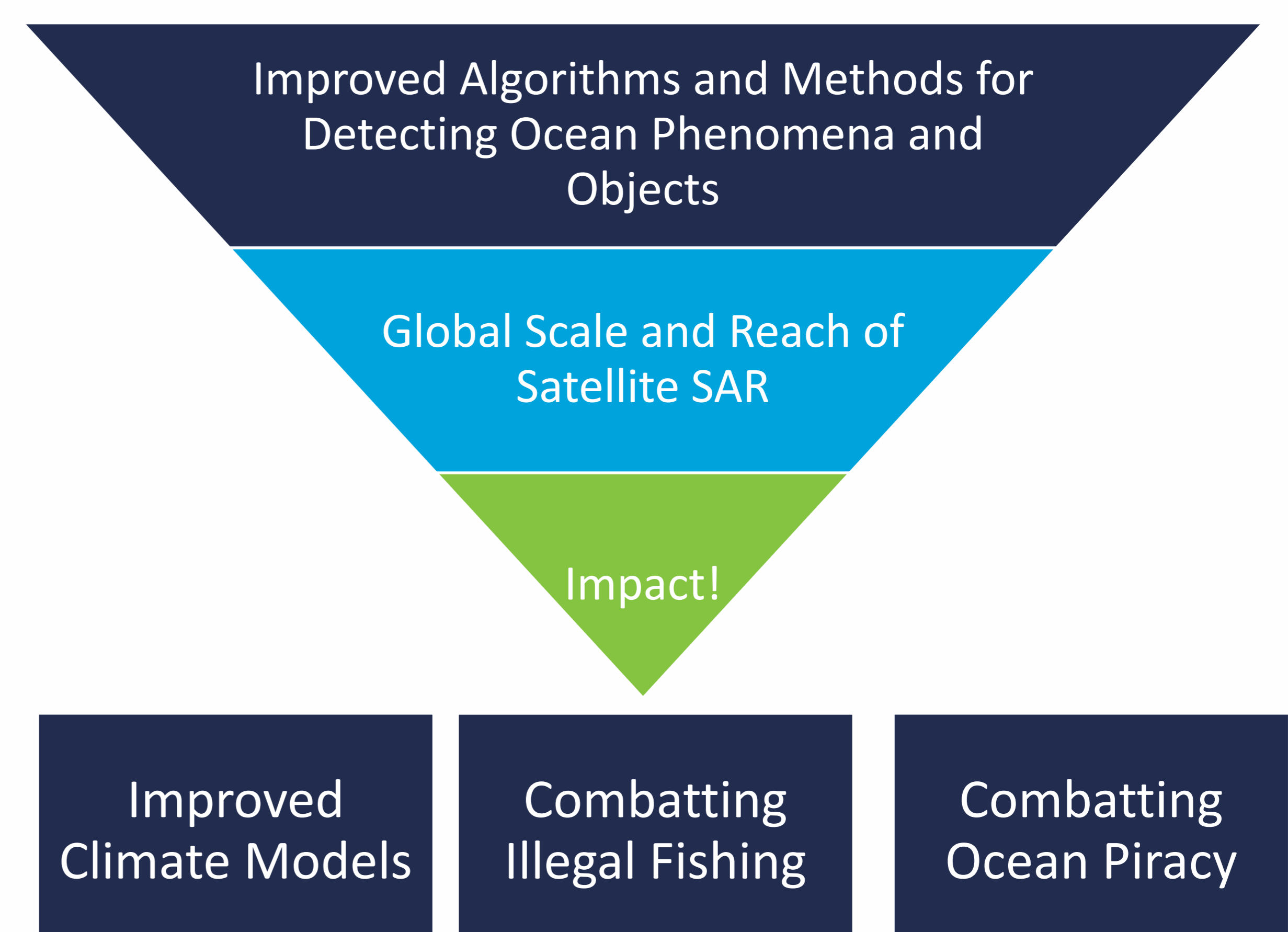
Results

The first two months of the project have focused on exploring time series SAR images over oceans.

Each ocean scene is affected by different weather conditions. However, anomaly detection can still be conducted if these differences are considered. Below is an example of a detection process applied to an ocean eddy.

SAR image cube → Measuring statistical properties using sliding window → Detrend → Threshold detection → Classification

Images showing the detection process of an ocean eddy off the coast of Perth Australia

Predicted Impacts

Improved Algorithms and Methods for Detecting Ocean Phenomena and Objects

Global Scale and Reach of Satellite SAR

Impact!

| Improved Climate Models | Combatting Illegal Fishing | Combatting Ocean Piracy |