WAMSI CONFERENCE 2011

Node 6: Ocean science for offshore and coastal engineering

Node Leader Overview

Greg Ivey

The University of Western Australia

western australian marine science institution

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Node 6 Overview

- Goal is to understand, quantify and predict the effects and impacts of the physical oceanographic processes operating in the WA marine environment.

- Outcomes are of direct benefit to the offshore oil and gas industry, the coastal engineering industry, and the community. Knowledge of physical oceangraphy is essential to understanding the dynamics of the marine ecology and environment.

- Geographic focus is the whole of WA coastal region, but with a primary focus on the North West Shelf (unique to Node 6).

Node 6 Overview (contd)

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•Methods - integration of theory, field measurements and numerical modelling.

•Majority of research staff and students are located in the School of Environmental Systems Engineering (SESE) and UWA Oceans Institute (OI) at UWA: 3 Postdoctoral fellows, 8 PhD students, 8 Honours students

Three Projects in the Node:

6.1 Offshore and coastal engineering and effects of climate change (Chari Pattiaratchi)

6.2 Impact of tides and internal waves on offshore engineering (Greg Ivey)

6.3 Ocean glider deployments of WA (Chari Pattiaratchi)

Project 6.1
Offshore and coastal engineering and the effects of climate change

Chari Pattiaratchi - project leader
Ivan Haigh
PhD students: Cyprien Bosserelle, Shari Gallop, Matthew Elliot
Collaborators: Depts Transport and Planning

Key question: How do we manage current facilities and optimise the design of future facilities in West Australian coastal waters under the influence of climate change?

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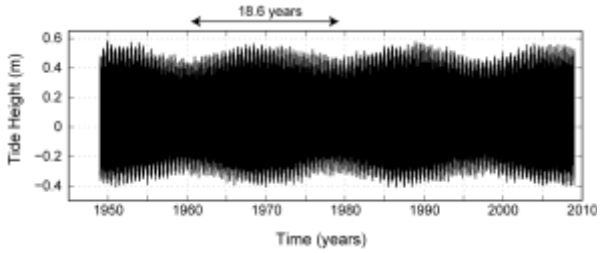
Project 6.1 (contd)

With focus on the entire Western Australian coastline, components of the project were:

1Assessment of the potential future changes to extreme still water levels.

2Determination of potential future changes in the surface wave climate.

3Consideration of impact of past and potential future changes due to the combined impact of mean sea level, storm surges and waves on coastal stability. Yanchep Lagoon was selected as the main study region.



Tide heights

Project 6.1 (contd)

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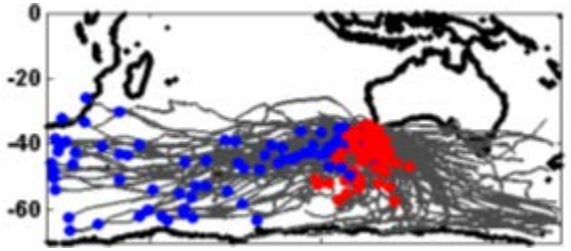
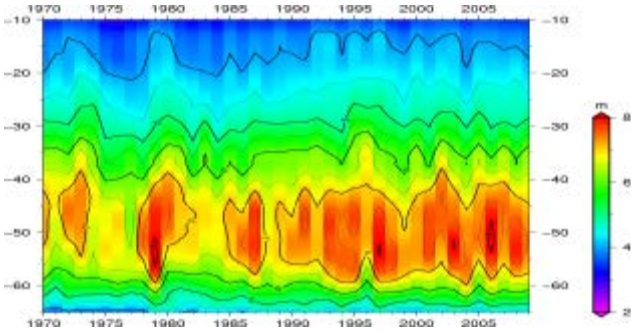
Outcomes:

•Sea levels in WA influenced by mean sea level rise, ENSO cycle, astronomical tide, storm surge, and surface wave climatology

•Considerable variability but there is clear signal that the intensity of storm surges have changed over the past 60 years.



•Wave Heights have increased in the southern Indian Ocean over the past 40 years. However, the band of maximum waves have shifted southwards resulting in negligible changes in south-west Australia



•Has developed tools to predict beach stability and response under different climate change scenarios

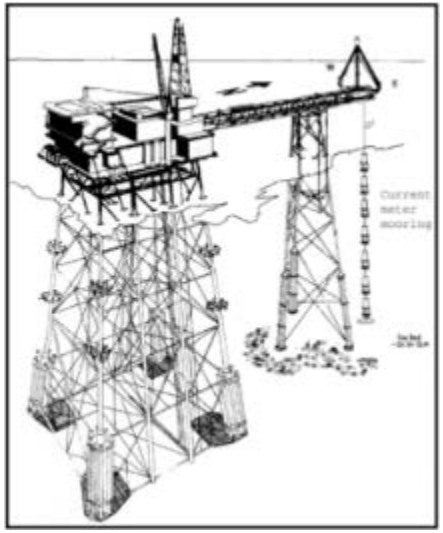
•The work has contributed to the WA Coastal planning guidelines

Project 6.2

The impact of tides and internal waves on offshore engineering

Greg Ivey - project leader
Nicole Jones, Oliver Fringer (Stanford Univ), Richard Brinkman (AIMS), Ryan Lowe, Mike Meuleners
PhD students: Cynthia Bluteau, Kenny Lim, Matthew Rayson, Paul van Gastel
Collaborators: Woodside Energy, AIMS

Key question**:** How do we manage current offshore facilities and optimise the design of future facilities on the NWS in the face of the intense forcing from tidally driven waves and currents?



Project 6.2 (contd)

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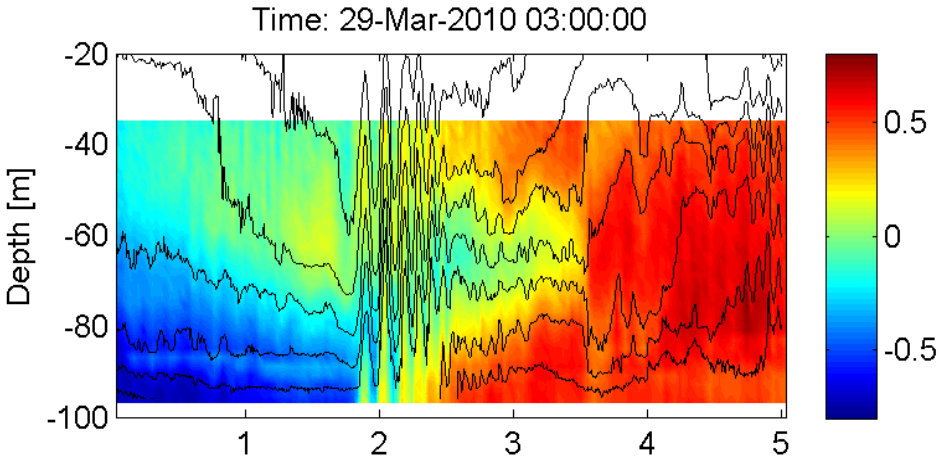
With focus on the NWS, components of the project were:

1 Field measurements of internal wave activity and mixing at:

- Pilbara (NW of North Rankin A)
- Browse Basin
- Ningaloo Reef



Internal waves Browse Basin

2Numerical modelling

Using hydrostatic (ROMS) and non-hydrostatic (SUNTANS) models

3 Theory and laboratory work

Project 6.2 (contd)

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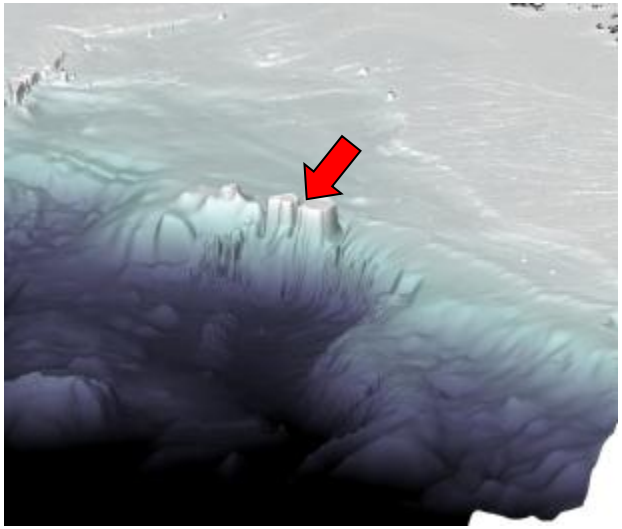
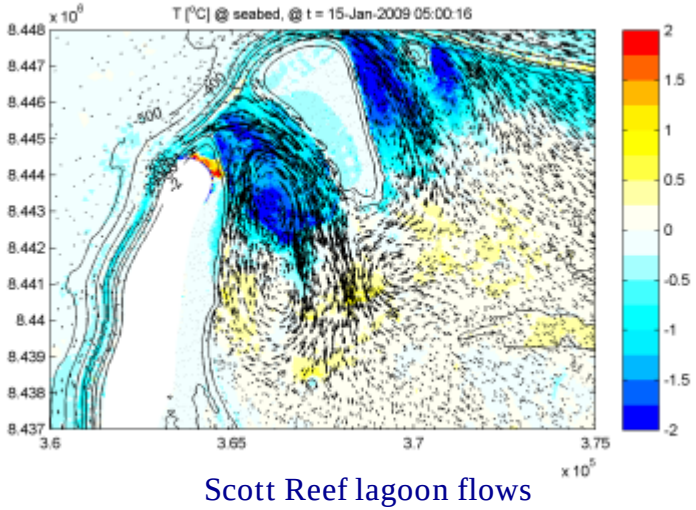
Outcomes:

1For first time, measurements have been made of the rates of ocean mixing due to forcing by the large tides and internal waves which dominate the oceanography of the NWS.

1Numerical models have been developed, and tested against these field measurements. The models can both describe and forecast the ocean hydrodynamics and predict "hotspots" throughout the NWS dominated by the tides and the internal waves they generate.



Browse Basin with Scott Reef



Scott Reef lagoon flows

2The numerical models can be used in the development of engineering design criteria for offshore oil and gas industry projects on the NWS.

3These hydrodynamics models can be used to drive biogeochemical models of the NWS to underpin management of the marine environment.

Project 6.3

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Ocean glider deployments off Western Australia (as part of WAIMOS)

Chari Pattiaratchi - project leader
Christine Hanson
Mun Woo
Collaborator: IMOS

Key question: How do we use the new generation of instrument systems such as ocean gliders to obtain sustained observations of the ocean conditions in Western Australia?

Project 6.3 (contd)

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Outcomes

•A total of 22 Slocum glider deployments were completed between January 2009 and August 2011 traversing along the SRFME Two Rocks line past the IMOS mooring locations and into Perth canyon. New oceanographic phenomena (eg dense water cascades) discovered.

Cross shelf dense water cascade

•A total of 10 Seaglider deployments were completed between January 2009 and August 2011.

Speakers in this session will cover work done under the three projects