RECORD Workshop on Ocean Energy

10 October 2012

Role of the CSIR in Ocean Energy development

Padhraic O' Connor

CSIR
our future through science

CSIR – Council for Scientific and Industrial Research

Multi faceted research organisation

Stellenbosch branch research focus:

- **Natural Resources and Environment**
- **Coastal and Ports Engineering (CPE)**

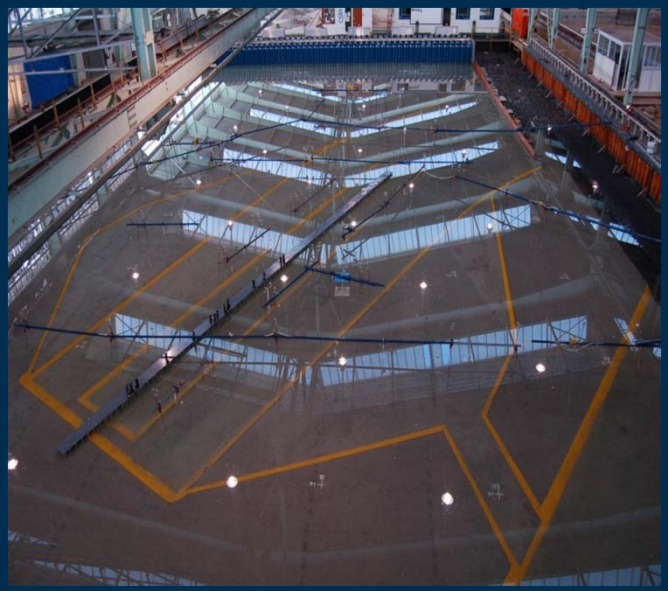
CPE group – few individuals focusing on coastal erosion, port infrastructure, harbour navigation, ship motions, numerical and physical modelling

CSIR Capabilities and Facilities

Physical modelling of coastal structures in Hydraulic Laboratory

Large test area and numerous facilities
3 3D Wave Basins
2 2D Wave Flumes
3 Quasi 3D Wave Basins
1 Deepwater Current Channel
24m Portable Wave Generators

Ship Motion Studies



CSIR
our future through science

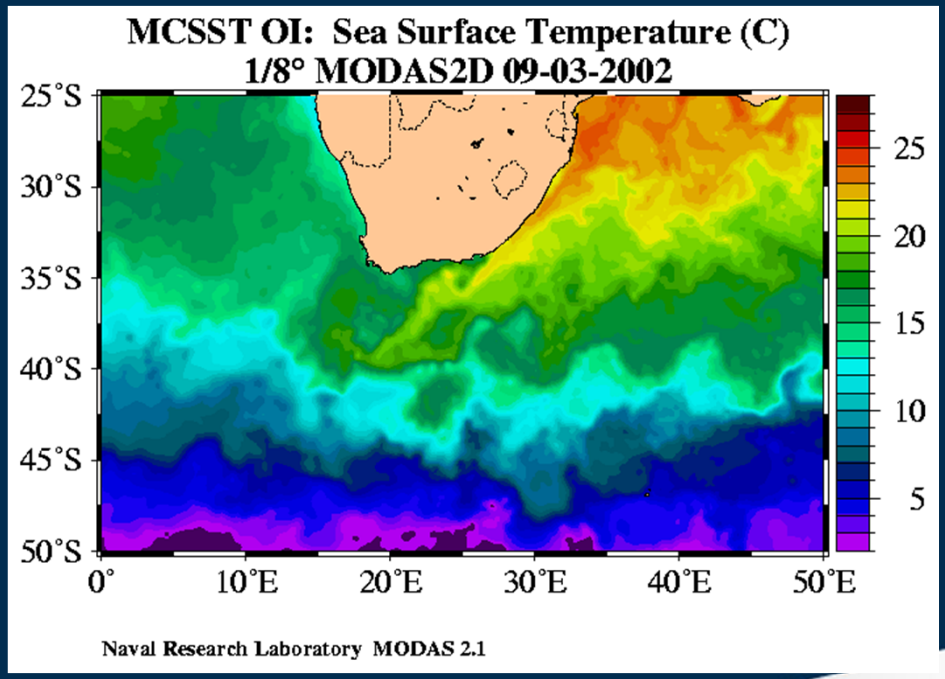
CSIR Capabilities and Facilities

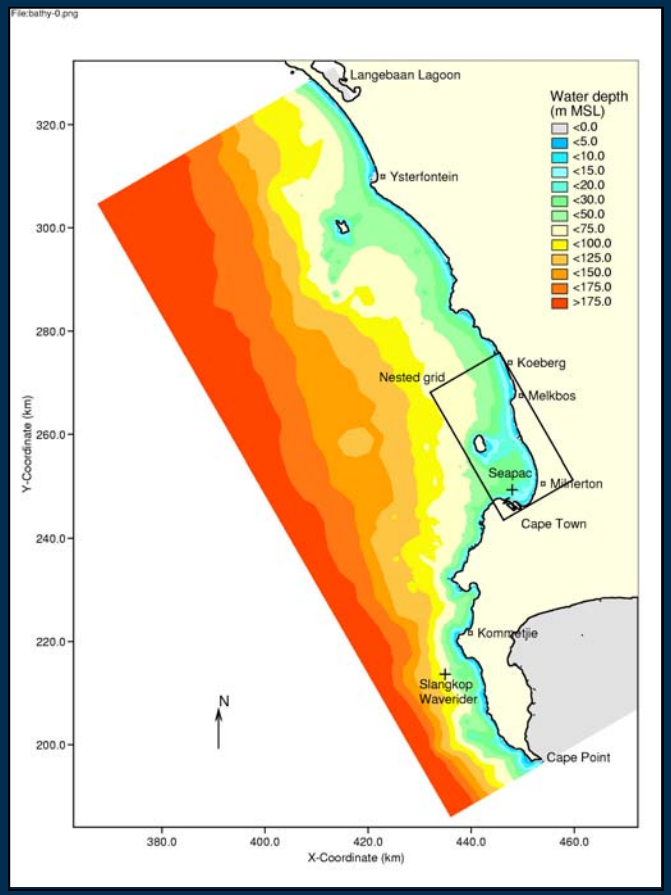
Numerical modelling

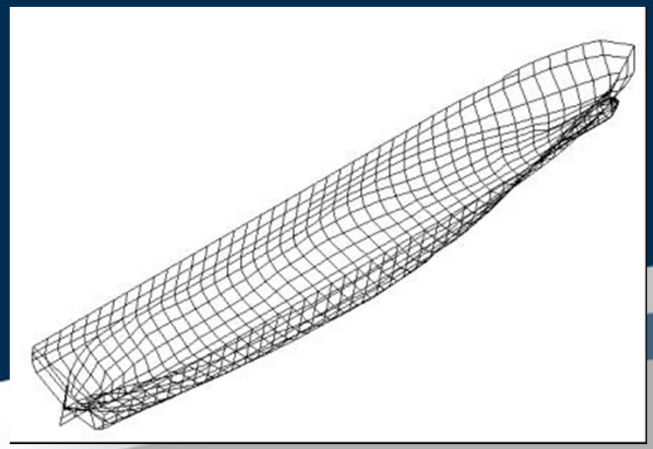
- Hydrodynamic & Wave modelling
- Ship motion modelling
- Ship approach and manoeuvre modelling

MetOcean data collection around SA

EIA studies







How can CSIR contribute to Ocean Energy in South Africa?

3 Key facets

1) MetOcean monitoring around South African coastline

Current/wave/wind/salinity/temperature monitoring and data collection

2) Numerical Modelling and Desktop studies

- **Numerical models and studies can be used to determine Ocean Energy potential**
- **EIA studies**

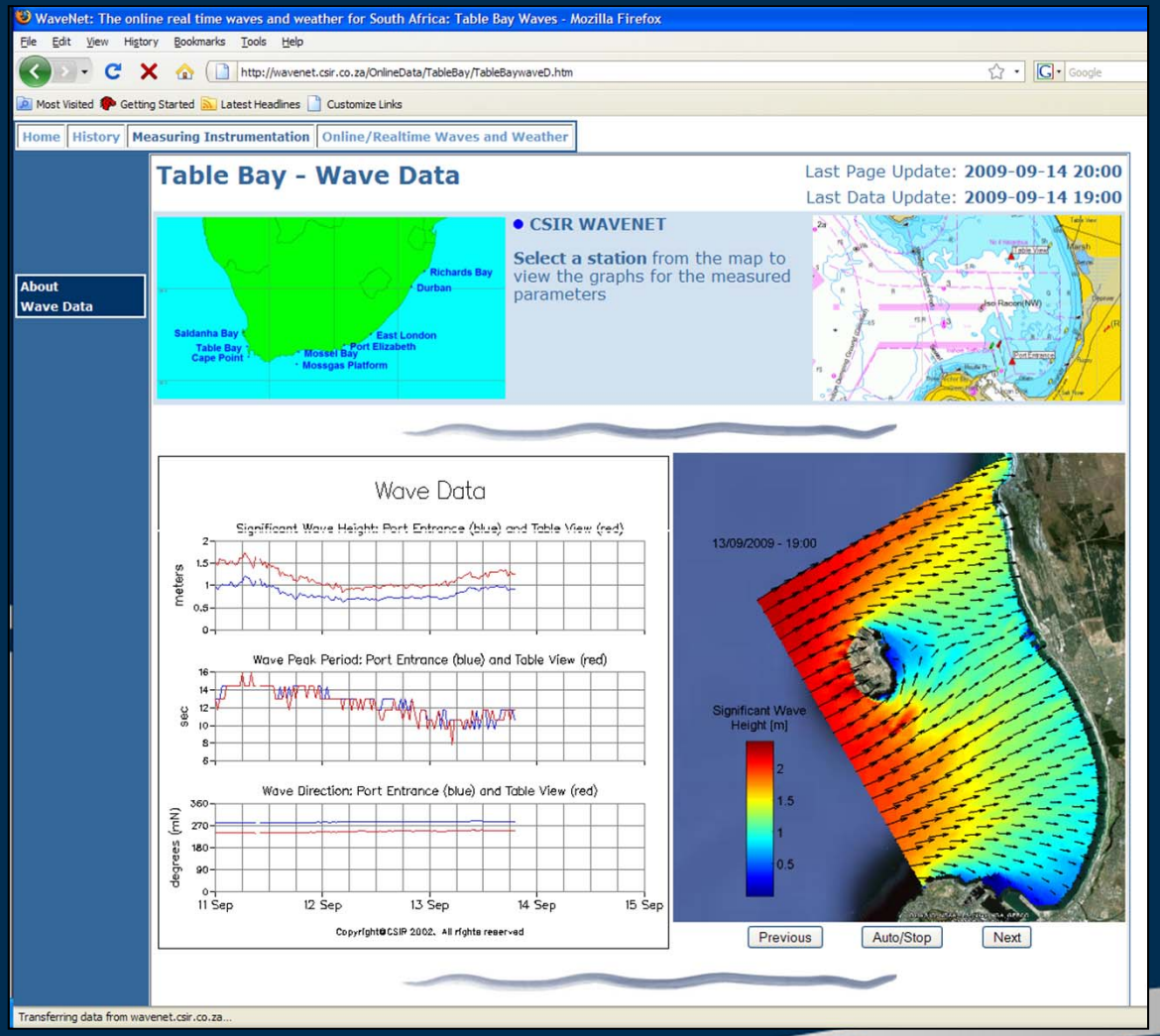
3) Physical modelling – facilitator for model device testing

1. MetOcean Monitoring in South Africa

- 8 Waverider buoys around SA coast – Saldanha, Cape Point, Mossel Bay, Mossgas Platform, Ngqura, East London, Durban, Richards Bay
- Buoys acquire & transmit live wave data (height, period, direction)
- Data instantly added to CSIR database in Stellenbosch

1. MetOcean Monitoring in South Africa

- Live readouts available on *wavenet.csir.co.za*
- Virtual Buoy network: Table Bay, Mossel Bay (forecasting), Algoa Bay (proposed)
- Weather monitoring – wind at ports.

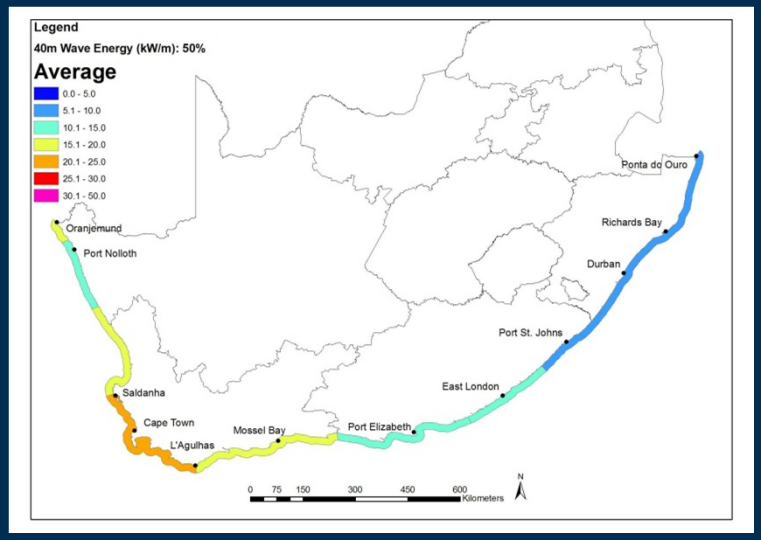


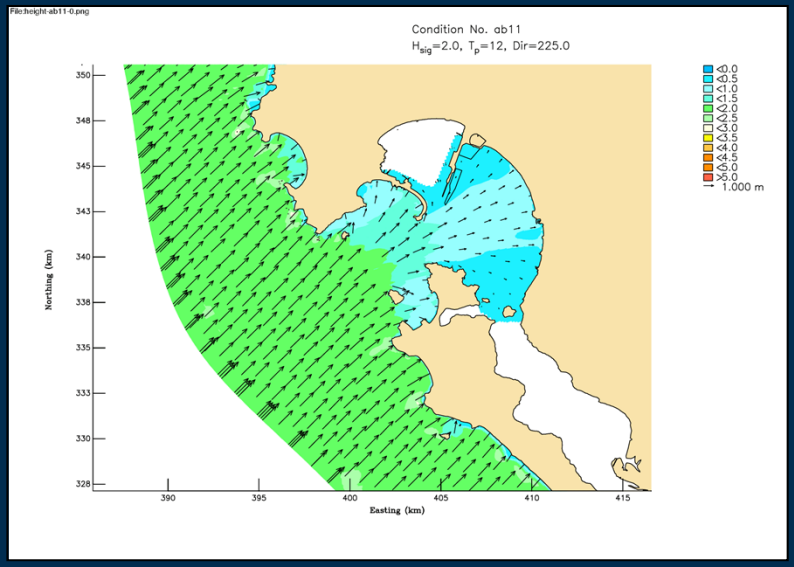
2. Numerical Modelling & Desktop Studies

- **Wave conditions can be extrapolated at any point on the coastline following intense numerical modelling.**

- **Modelled local wave conditions - utilised to determine *potential* wave energy at:**

  a) Swathes of the coastline (low res output) or
  b) Single coastal location (high res output)





Suitability of proposed locations for Ocean Energy schemes can thus be determined. More accurate raw data and coastal models = more accurate site-specific output.

- **EIA studies – Ecological and Environmental awareness**

3. Model Testing of Ocean Energy Devices (OED)

- Lab has many decades experience modelling 2D & 3D waves
- Typically model coastal structures and ship movements – similarities with OEDs
- OED study - different from coastal structures - one monitors *potential energy output* from a device. Specialist hydromechanics/electronics/mechatronic field

- CSIR presently willing to aid developers at *conceptual* stage and *model validation* stage
- A number of concept devices have already been modelled in the lab.

3. Model Testing of Ocean Energy Devices (OED)

Limitations

- **Modelling of Ocean Energy Devices - Young discipline with varying theories on how to model and acquire data. No set standards or procedures.**
- **Initial *Proof of Concept* study is relatively straightforward (small scale observation)**

3. Model Testing of Ocean Energy Devices (OED)

Limitations

- **Modelling of Ocean Energy Devices - Young discipline with varying theories on how to model and acquire data. No set standards or procedures.**
- **Initial *Proof of Concept* study is relatively straightforward (small scale observation)**
- ***Performance* and *Optimisation* phases of design will require a host of specialist knowledge**
- **Assistance in fields of energy absorption, abstraction, power conversion/PTO, power losses, energy transfer, hydraulic engineering etc will be required, among many others**

3. Model Testing of Ocean Energy Devices (OED)

Limitations

- **Modelling of Ocean Energy Devices - Young discipline with varying theories on how to model and acquire data. No set standards or procedures.**
- **Initial *Proof of Concept* study is relatively straightforward (small scale observation)**
- ***Performance* and *Optimisation* phases of design will require a host of specialist knowledge**
- **Assistance in fields of energy absorption, abstraction, power conversion/PTO, power losses, energy transfer, hydraulic engineering etc will be required, among many others**
- **Developers should work in conjunction with CSIR & US/CRSES for specialist advice, direction and delegation. This 3-way collaboration must be promoted to enhance future renewable research and fortify Ocean Energy knowledge in SA**

Future CSIR research and vision for Ocean Energy in South Africa

2 different focuses

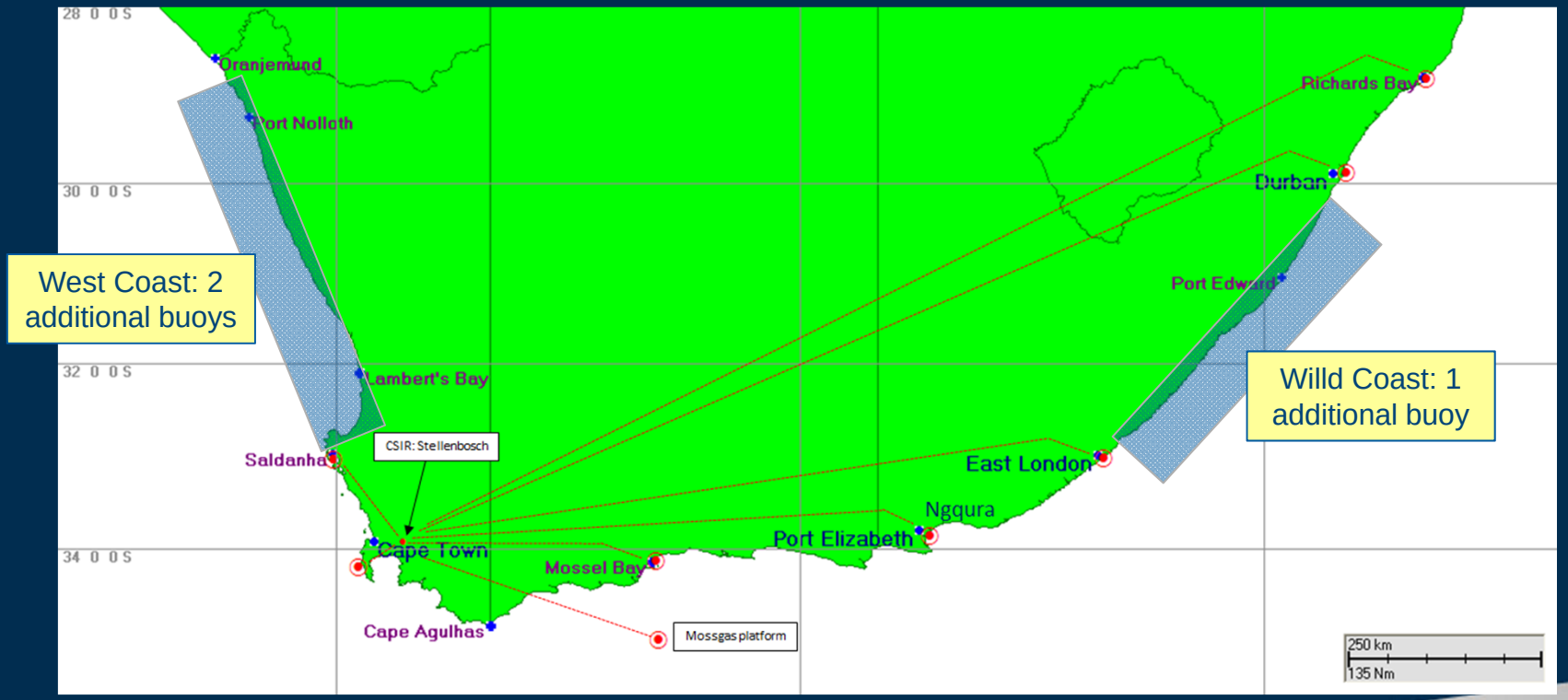
a) **Improve MetOcean data sets**

b) **Develop more structured procedures for Ocean Energy Device development in SA**

Improve SA MetOcean data sets

- **More Waverider buoys will result in:**

Greater covered area, better coastline resolution, improved hindcast data sets, improved forecasting capabilities, promote understanding of long term climate and ultimately wave energy resources



- **Additional Virtual Buoys required**

Definite structure required regarding Ocean Energy development in SA

i) Develop structured guidelines or procedures for ocean energy device developers

Definite structure required regarding Ocean Energy development in SA

i) Develop structured guidelines or procedures for ocean energy device developers

- Developers are diving headlong into testing their small scale devices. No methodology, no procedures, no development plan.
- Little experience with wave energy, marine engineering, power systems or energy networks – all critical aspects of ocean energy extraction
- Unprepared for challenges and long term commitments that lie ahead.

Definite structure required regarding Ocean Energy development in SA

i) Develop structured guidelines or procedures for ocean energy device developers

- Developers are diving headlong into testing their small scale devices. No methodology, no procedures, no development plan.
- Little experience with wave energy, marine engineering, power systems or energy networks – all critical aspects of ocean energy extraction
- Unprepared for challenges and long term commitments that lie ahead.
- Remember: Primary lab tests are highly idealised and simplified, and initial results must be taken as proof of concept.
- Direct developers to relevant specialists via CRSES or through SAOEN
- Refer to recently-published procedures in Europe

ii) Create official SAOEN forum?

ii) Create official SAOEN forum?

Could include:

- **Local renewable news/updates.**
- **International news and available resources (documents, papers, procedures etc)**
- **Local SA energy developments**
- **Routes to funding.**

Perhaps discussion point in afternoon….

Thank You

Discussion on developing guidelines for Ocean Energy development.

"Within the wave energy community there is at present no agreed common approach for the development and evaluation of energy extraction devices." **Brian Holmes, EMEC, 2009**

Outline EU approach to collaboration and guidelines

See

- **EMEC test facilities and grid connection**
- **12 EMEC guidelines for developers**
- **Wavenet**
- **Marinet – 11 EU countries & 30 institutes collaborating**
- **UKERC**

Many others…