The Marine Virtual Laboratory (MARVL) and the MARVL Information System (MARVLIS)

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Virtual Laboratory?

NeCTAR (National eResearch Collaboration Tools and Resources)

$47m EIF to connect researchers to research infrastructure

www.nectar.org

NeCTAR's Virtual Laboratories ...

• Connecting researchers with existing and new research facilities

• Streamlining research workflows

• Adding value to existing investments in research infrastructure

• Creating new abilities

• Creating a new era of connectivity for Australian researchers

The **Marine Virtual Laboratory** aims to make a community tool for ocean and coastal ocean model studies.
Steps in a modelling study

- Decide processes to model
- Decide space / time scales of study
- Decide on choice of model(s)
- Obtain observation or model data for initialisation / boundary conditions
- Format data for input to model(s)
- Obtain observational data for process understanding, validation, data assimilation
- Run simulation(s)
- Visualise / analyse model output, create products
The Marine Virtual Laboratory

**MARVL** is designed to help speed up this process

- Reducing up the time spent on setting up the model
- Allowing more time to be spent on developing knowledge

**Who will benefit?**

- Undergraduate teaching
- Postgraduate studies
- Marine Managers
- Researchers
- Consultants
MARVL will be based on the ROAM framework

- Relocatable Ocean Atmosphere Model (ROAM)
- Developed under Bluelink a CSIRO-BoM-RAN project

Screen shot of the ROAM user interface

- Previously run jobs
- Specifications of the current domain
- Example of a model domain e.g. south-eastern Australia
- Status of the current run
What ROAM does

Runs on a desktop
Allows user to configure a region / time window
Allows user to select hydrodynamics / surface waves simulation
Provides 3-day forecast from fixed data streams (OceanMaps, ACCESS)

Used by the Royal Australian Navy for tactical support

What ROAM doesn’t do

Offer a range of model choices
Offer options for initialisation, boundary conditions
Run hindcasts

And ...
It is only available to CSIRO, BoM, RAN
What MARVL will do

- Enable efficient configuration of a range of community ocean general circulation models to the marine science community in Australia and internationally;
- Enable efficient model inter-comparisons;
- Allow assessment of the sensitivity of model results to different model parameterisations (e.g., mixing schemes) and configurations (e.g., oceanic and atmospheric forcing);
- Deliver ensemble prediction capability – to help quantify uncertainty;
- Enable model evaluation through model-observation comparisons;
- Enable downscaling of IPCC models and the ACCESS forecast models;
- Provide options for running simulation (‘take-away’, cloud, grid computing); and
- Provide for analysis and visualization of the model outputs, including linking to support tools for decision making (through the ANDS-funded MARVLIS).

MARVL will be Open Source, web browser based
Staged process

- MARVL Early Initiative (now)
  - Transform ROAM components to be browser-based (SHOC, SWAN)
  - Embed IMOS/AODN search capability
  - Demonstrate hindcast operation in SE Tasmania
  - Provide ‘take-away’ bundle
AODN?

- Distributed data network of Australian marine data and resources
  - IMOS
  - Australian Ocean Data Centre Joint Facility
    - AIMS, AAD, BoM, CSIRO, GA, RAN
  - State Governments
  - NCRIS programs (ALA, TERN)
  - National programs (CERF, NERP (MBH))
  - Universities, …
  - Climatologies (e.g. CARS)
  - Model products

http://portal.aodn.org.au
Why SE Tasmania?

Extensive observational program (Derwent Estuary Program + IMAS, CSIRO ...)
Quasi-operational modelling (CSIRO, ICT & CEM; phys / biogeochem)
Existing coordinated science programs (INFORMD, SENSE-T)

Environmental quality questions affecting
• Public health
• Aquaculture management
Staged process

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• MARVL Stage 2 (2013-2014)
  – Increase range of models available (SHOC, SWAN, + MOM, ROMS, WW3)
  – Increase options for initialisation, forcing (BRAN, HYCOM, GLORYS, NCEP, CORE-1, CORE-2,...)
  – Demonstrate cost-benefit in six regional applications
  – Provide cloud and GRID computing options
User specifies:
- Time-space domain
- Model grid
- Model (e.g., ROMS, MOM, ...)
- Parent ocean model
- Met forcing
- Deployment option:
  - Take-away
  - Nectar Cloud
  - HPSC

Generic model configuration (boundary conditions, forcing etc)

Data-extractor and re-griddrer

Take-away bundle compiled

Parent ocean model datasets: BRAN, HYCOM, GLORYS, Climate Projections, ...

Topography (global 1 km)

Meteorological forcing: NCEP, CORE 1, CORE 2, ...

IMOS Observations

Take-away bundle delivered to user

Cloud deployment

HPSC deployment

Link to RDSI
MARVL test/study areas

AIMS
Darwin Harbour & Beagle Gulf
ROMS
WW3/SWAN

CSIRO
Ningaloo
SHOC

UNSW
Solitary Islands
ROMS
WW3/SWAN

UWA
Perth Canyon
ROMS

SARDI/Flinders
South Australian Shelves
ROMS

BoM
Tasman Sea
MOM
Test regions map over to IMOS
MARVLIS ... an Information System for MARVL

MARVLIS will

• generate a data collection for the Derwent publishable in the ANDS Data Commons

• develop data products from the underlying observational and model data to address two distinct aspects of the management of the greater Derwent Estuary

  a) *public health*, and
  b) *ecosystem health*

In essence this is a separation between real-time, short term information and information influencing the longer term state

• demonstrate how MARVLIS can improve ‘State of the Derwent’ assessments and thereby contribute to policy decisions
Derwent Estuary Beach Watch

Present state of beach water quality information

- Weekly chart between November and March
- Published on Saturday
- Based on Enterococci measurements taken on Tuesday
- Takes no account of environmental factors
- Rainfall known to affect water quality, but not considered
- Published in the Mercury newspaper and online http://www.derwentestuary.org.au/beach-watch/
MARVLIS - example public health data product prototype beach water quality indicators

Opportunities to blend observations and model data to deliver better information
Integrating CONNIE-2 for risk assessment
Benefits of MARVLIS ...

• add to MARVL a library of system enhancements to generate data products of value to environmental assessments and to aid management decision making

• Integration of MARVLIS software into MARVL ensures the portability of the software tools to any region.

• MARVLIS will work closely with
  - Derwent Estuary Program
  - INFORMD
  - SenseT

  to develop a lasting information system of value to the community.
Summary

MARVL provides a framework for model/observation studies

MARVLIS provides value-added tools for exploiting datasets from models and observations
The End (or the beginning)

MARVL is a partnership between IMOS, TPAC, CSIRO, UWA, UNSW, AIMS, SARDI, BOM & NCI

MARVLIS is a partnership between IMOS, TPAC, IMAS, CSIRO, DEP

DEP ... Derwent Estuary Program
http://www.derwentestuary.org.au/