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

Roger Proctor[1], Peter Oke[2]

[1]University of Tasmania, Hobart, Tasmania, roger.proctor@utas.edu.au
[2]Csiro Marine and Atmospheric Research, Hobart, Tasmania, peter.oke@csiro.au

Notwithstanding great advances Australia is making in ocean-based sensing, marine information infrastructure development, numerical modelling of marine and climate systems, and visualization of outputs, *integration* remains a key challenge. Nationally, we currently lack a research environment within which to explore the science questions around seamless integration of these components. This need is explicitly noted in DIISRTE's '2011 Strategic Roadmap for Australian Research Infrastructure' (http://www.innovation.gov.au). The creation of a Marine Virtual Laboratory (MARVL), through the NeCTAR VL program (www.nectar.org) aims to address this.

MARVL can provide all the tools necessary to construct a virtual environment of a region of interest. Comprised of a suite of complex models (e.g. ocean circulation, waves, water quality, and marine biogeochemistry), a network of observing sensors, and a host of value-adding tools, MARVL can underpin research to understand the dynamics, interactions, and connectivity of an estuarine/coastal region, continental shelf region, or open ocean domain.

The foundation of MARVL is a modelling system of ocean circulation and wave environment. We are developing a prototype web-based environment builder (WebMARVL-lite, see schematic below) that will allow researchers to see the potential of being able to:

1. efficiently configure a range of different community ocean and wave models for any region, for any time period, with model specifications of their choice, through a user-friendly web application,
2. access data sets to force a model and nest a model, and
3. discover and assemble ocean observations from the Integrated Marine Observing System (IMOS, www.imos.org.au) and the Australian Ocean Data Network (AODN, http://portal.aodn.org.au/webportal/) in a format that is suitable for model evaluation or data assimilation.
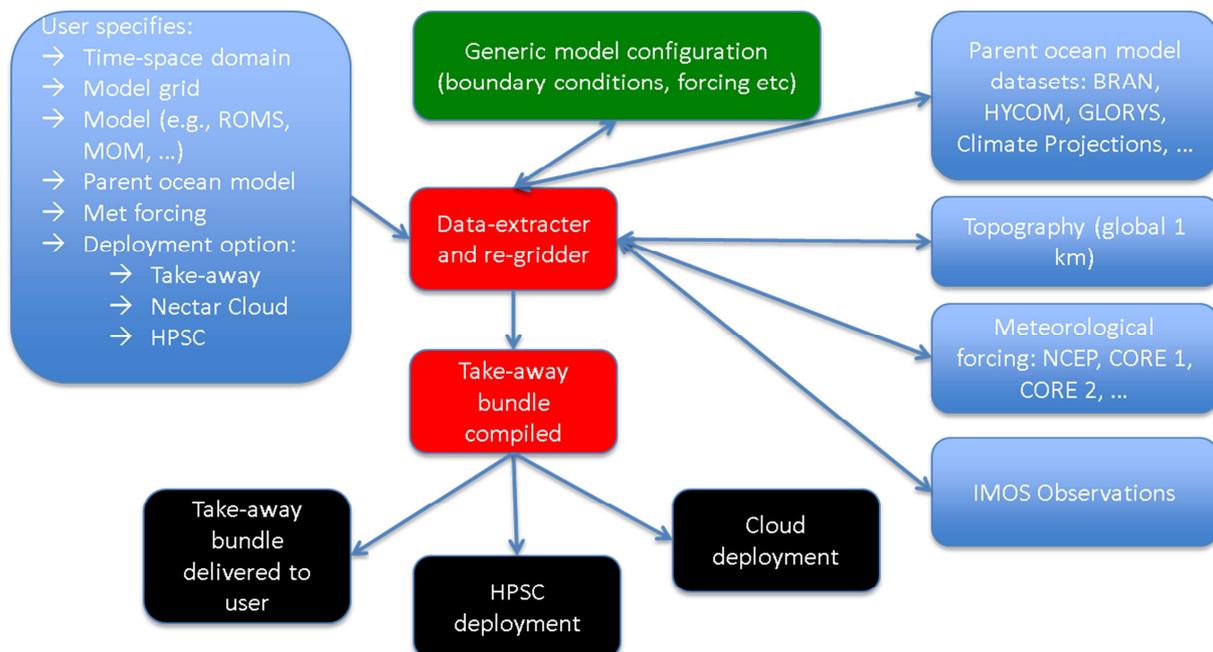

To show its potential here, we will focus on an estuarine / coastal region in the Derwent Estuary of Tasmania, which has an established observing system, modelling system, and management regime. We will use the MARVL infrastructure to explore scenarios, and demonstrate how a virtual laboratory can enable underpinning science in support of marine management in a specific regional context.

Through its Applications program the Australian National Data Service (ANDS, http://andsapps.blogspot.com.au/) has funded a program to utilise the MARVL framework and build a library of applications tools to support local management of the estuary. This library will interface directly with MARVL thus allowing the framework to be extended to better support marine management (as indicated in the figure below). The library is collectively known as the MARVL Information System (MARVLIS) and will be developed in support of the Derwent Estuary MARVL demonstration. The Derwent has an extensive observation network and a near-real time coupled physical-biogeochemical suite of models and has specific issues associated with a strong aquaculture industry and environmental water quality.

The primary outcomes from MARVLIS will be to:
- *generate a data collection for the Derwent, routinely used in environmental assessments, publishable in the ANDS Data Commons.*
- *investigate two scenarios which are likely to arise in the management of aquaculture and environmental assessment. These scenarios consider aspects pertinent to both the aquaculture operations and environmental assessment, namely 1) public health, and 2) ecosystem health.*
- *create a software library, compatible with MARVL, containing modules to generate data products of value to the scenarios.*

So, aside from MARVLIS assisting MARVL by delivering a transportable library of 'functions', MARVLIS will be directly benefiting local business, organisations and community, who use and have a vested interest in the Derwent estuary. Local shellfish and fish farmers will have access to current water quality and project future trends, allowing them to be more productive and prepared for changes in the local eco-system. Local government and councils will also have access to additional information, allowing them to be more pro-active and informed, allowing them to better manage the Derwent estuary. The new data products provided by MARVLIS will help in the management of risks in regard to public health, and will lead to quicker closure and opening of farming and swimming beaches. It will also assist in building the local fishing industry through enhanced modelling and 'what-if' scenarios, allowing new farms and infrastructure to be added for a sustainable future for the local Derwent eco-system.
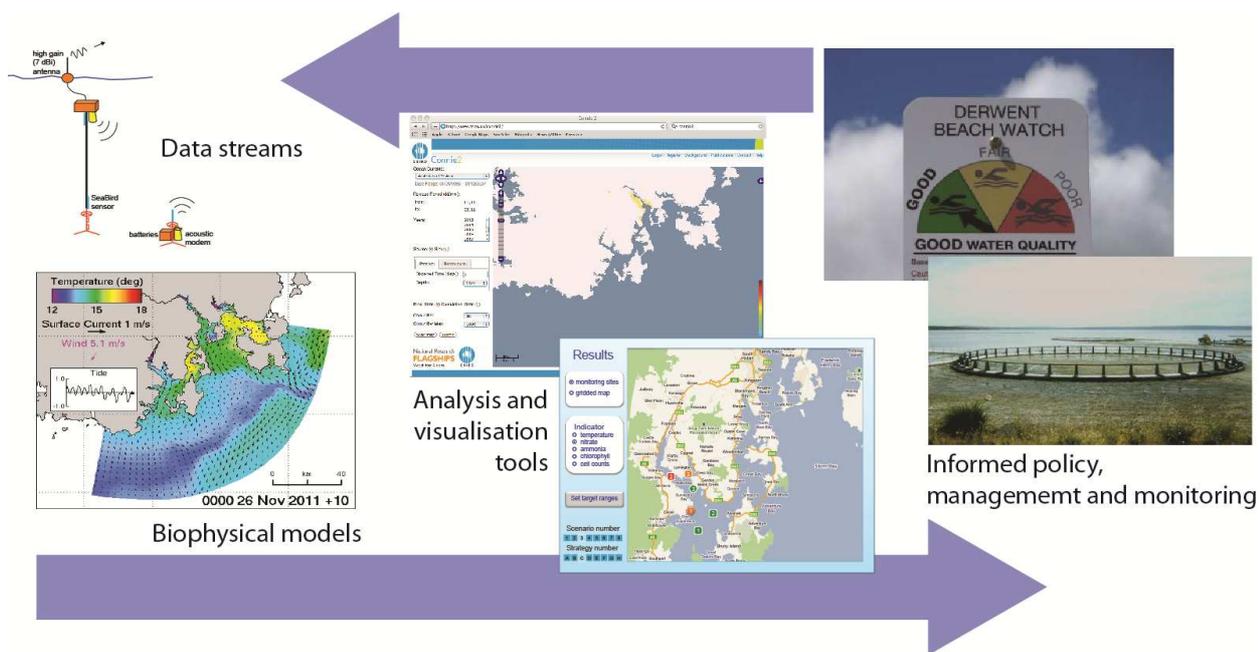
SHORT BIOGRAPHIES

Roger Proctor is Director of the eMarine Information Infrastructure for IMOS (Integrated Marine Observing System) and Director of the Australian Ocean Data Network, based in the University of Tasmania at Hobart. He has a research background in the integration of models and observations. He is firm believer in collaborative eResearch and is a member of the NeCTAR Board, the US-IOOS Data Management and Communications Steering Team and an Advisory Board member on two European projects on data interoperability.

Peter Oke is a research scientist at the CSIRO Marine and Atmospheric Research establishment in Hobart specializing in Ocean Modelling and Data Assimilation. He is in the 'Wealth from Oceans' flagship and is involved in the BlueLink modeling program, being responsible for the BlueLink re-analysis products, and leads in the development of the Relocatable Ocean Modelling Framework.