BLUE ECONOMY
COOPERATIVE RESEARCH CENTRE

Australian Government
Department of Industry, Science, Energy and Resources

AusIndustry
Cooperative Research Centres Program

SHORT SUMMARY

4.20.002 Operational Modelling for Offshore Aquaculture and Energy

INTRODUCTION

The goals of this scoping study are listed below.

- Understand the global trends that will influence the move towards Offshore Aquaculture (OA) and Offshore Renewable Energy Systems.
- Determine the present uses of operational modelling systems by industry.
- Determine the likely future operational modelling needs of the OA and ORES sectors as they move into more exposed and energetic offshore environments.
- Review the state of the science of Operational Modelling to support OA and ORES.
- Identify the research and development needed for operational models to support the information requirements of industry.

KEY POINTS

An online survey was conducted and collected responses from 33 participants across six sectors associated with the Aquaculture and Renewable Energy sector.

Through the survey results and subsequent detailed discussion with industry it was found that the industry already uses a number of operational modelling products, however, they are not currently tailored to the needs of industry as the sector moves offshore.

From industry feedback there was a clear need for some specific model products on new time scales and involving new variables, in particular:

- Multi-week forecasts with processes and time/spaces scales relevant to offshore facility managers, with the ability to capture both the mean and extreme site conditions.
- Move away from a single deterministic forecast and towards probabilistic forecasts.
- A number of additional variables would be useful, specifically:
  - Water Clarity
  - Harmful Algal Blooms, Jellyfish and pathogens.
  - Phase resolved wave fields.
- A central location that data (observed and modelled) can be discovered, used and contributed to.

Operational modelling to support site selection was also identified as a high priority and has strong links in other BE CRC research programs.

THE CHALLENGE

To determine the future operational modelling needs of industry and identify the research and development required to achieve these needs.

THE OPPORTUNITY

The aquaculture and renewable energy sector currently uses operational modelling products in their daily decision making. However, as the industry moves offshore, it is recognised that there will be a reduction in the number of human hours that a site can be occupied and therefore a shift towards higher levels of automation of tasks on site. Having the ability to predict the environmental conditions on a site multiple weeks into the future and out to seasonal scales, will allow for better operational decision making.

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OUR RESEARCH

The research that underpinned the findings of this study focussed on a combination of survey techniques. The first method used was a broad online survey was conducted, that took approximately 20 minutes to complete. This was then followed up with detailed discussions with eight industry representatives selected from the OA, ORES, Offshore Engineering and Consulting Industries.

OUTCOMES

During the detailed discussions with industry, there was a general recognition across the OA, ORES and associated support sectors, that as industry moves offshore, the time windows available for the safe human occupation of the site to undertake functions such as maintenance and feeding operations will be less than at sheltered inshore sites. This will lead to a growing reliance on autonomous systems and ROV's that use underwater video systems to relay real-time information back to various control centres. Therefore, the following operational modelling products will need to be developed to support these shifts in operations:

- Multi-week probabilistic forecasts at scales relevant to farm/device operations, this will increase the lead times available for planning to be onsite.
- Water Clarity predictions to understand when AUV/ROV and diver led operations can take place.
- Data needs to be easily accessible with methods to interface with Decision Support systems.

For the OA, ORES and engineering/consulting sectors that assist in the planning and site selection stage, there was a strong need for modelling products rapidly deployable tools to aid in site selection.

Specific to OA, the online survey and in-depth discussion with industry representatives highlighted the need for operational prediction systems that can estimate the likelihood of Harmful Algal Blooms (HABS) and the presence of Jellyfish. Both HABS and Jellyfish impact on production at a site, and if these phenomena were predictable, operational management actions could be taken to mitigate their impact.

The ORES industry has few sites in operation, but it is expected that short-term forecast (i.e. on forecast time scales of the next 30-180 seconds) of the phase resolved wave field would be useful for the optimisation of the power take-off system.

NEXT STEPS

A number of recommendations for general projects were made on the back of the report's findings that would be off benefit to both the OA and ORES sectors. Some general suggestions include:

- Multiweek Probabilistic Forecasts tailored to OA and ORES needs.
- Rapidly Deployable Model Systems to make regional/global forecasts relevant to a facility site.
- BE CRC Data infrastructure that operational modelling systems can interrogate and deliver into.

There are a number of ideas reported that cut across many of the BE CRC Research Programs. These would be of high value as they typically aim to develop decision Support System that built on the output of operation models.

A number of barriers to the use of operational models were identified, and recommendations from this section will assist in facilitating a smooth uptake of modelling output in operational decision making.

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PROJECT REPORTS/PUBLICATIONS

Jones et al., (2020). Operational modelling for offshore aquaculture and energy, 4.20.002. Hobart: Blue Economy Cooperative Research Centre.

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