Earth Systems and Climate Change Hub

National Environmental Science Programme

climate change **science brief**

Climate change services for Australia's blue economy

The blue economy refers to the sustainable use of ocean resources for economic growth, improved livelihoods and jobs and ocean ecosystem health.

Australia's blue economy is currently worth approximately $47 billion per annum, growing at a rate 2-3 times that of the rest of Australia's GDP. Australia's blue economy industry sectors are all exposed to climate change-related risks to associated offshore infrastructure and operations.

The Earth Systems and Climate Change Hub has established a set of climate change projection products to support development of offshore climate change management and adaptation strategies.

Offshore assets exposed to climate risks

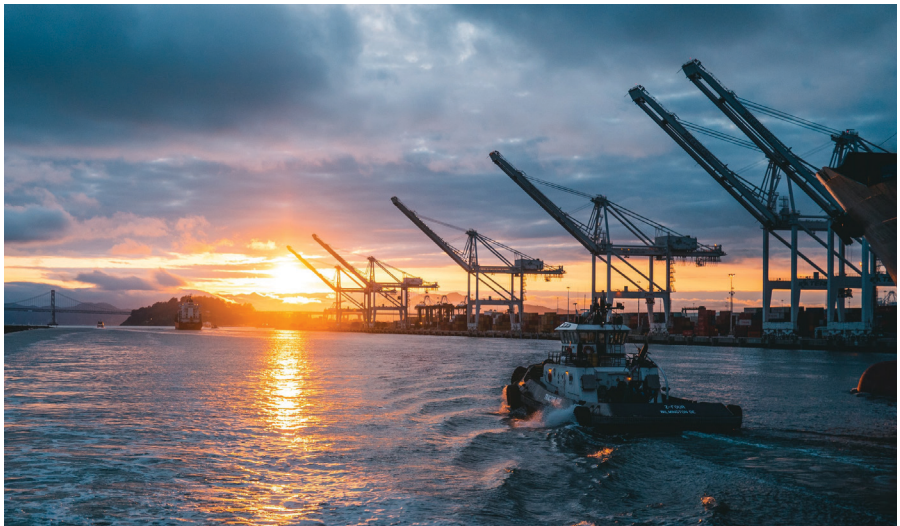
Australia's blue economy industry sectors include tourism, ports, oil and gas, fishing and aquaculture, shipping and renewable energy. These blue economy sectors are responsible for significant infrastructure projects and deploy a wide range of offshore and coastal assets.

These assets are built to meet a range of environmental design criteria based on historical and present-day climate conditions across a broad range of climate variables and their associated extremes. Climate variables of particular importance to the blue economy include marine wind and wave conditions and sea-level. These influence environmental loads on, and operations at, key assets.

Climate risks vary for each blue economy sector and further engagement is still required to refine critical climate variables for current and future design and operations in each industry. With increasing recognition of the need to disclose climate change-related financial risks, a comprehensive methodology to evaluate climate change risks for these sectors needs to be established.

Informing offshore operators

Offshore industries need to consider how climate change is likely to influence future offshore infrastructure and operations. The Earth Systems and Climate Change (ESCC) Hub has produced a range of climate change data products that provide an opportunity to progress climate change services for Australia's blue economy and support development of offshore climate adaptation strategies. The new products produced by the ESCC Hub include projected 21st Century changes in extreme sea-levels (tides and surges), winds and surface wave fields under a range of future climate scenarios, for Australian and global waters. These products provide offshore operators with access to the best available science to inform adaptation decisions and operational activities into the future.



LEFT: **Australia's blue economy industry sectors are all exposed to climate change-related risks**
Unsplash/Ronan Furuta
TOP: istock.com/Alexwise

Climate stressors and risks for blue economy sectors

Examples of climate stressors to Australia's blue economy sectors, include:

Ports: Increased coastal flooding and overtopping associated with sea-level rise and climate-driven changes in wave conditions. Heat stress impacts at higher temperatures.

Offshore oil and gas: Changes in sea-level, winds and waves influence platform design and certification, and further influence offshore operational windows.

Aquaculture: Increasing sea-surface temperatures influence fish health. Changing winds and waves influence infrastructure loads and offshore operating windows.

Offshore wind: Changing winds, waves and sea-level influence design, certification, optimisation of offshore wind turbines and resource availability, and further influence offshore operations.

>>> CASE STUDY

Implications of climate change for the Newcastle offshore industry

On the central NSW coast of eastern Australia, Newcastle is a hub of offshore industry. The Port of Newcastle is the largest seaport on the east coast and third largest in Australia, contributing $1.6 billion and over 9000 jobs to the local economy per annum. In addition to the seaport, major offshore projects are being proposed, with the City of Newcastle advocating for major offshore wind projects in the Hunter Renewable Energy Zone.

Fossil-fuel based energy projects are also being considered, with gas exploration currently permitted in the region.

To investigate the potential implications of 21st Century climate changes to offshore industries in Newcastle, the ESCC Hub analysed projected changes in 'acceptable' sea conditions ('windows of opportunity') for operations to occur offshore of Newcastle.

Industry requirements for safe operating conditions mean that adverse sea conditions can lead to an offshore turbine or platform being inaccessible for some period. This can limit achievable operations within set time restrictions. The sea conditions threshold at which the site may be inaccessible will depend on access type (e.g. size of vessel, or helicopter) and operation. Offshore industries routinely apply decision frameworks to seek windows of opportunity to carry out their operations.

Using an ensemble of 21st Century wind-wave models with climate scenarios produced by the ESCC Hub, future changes in the frequency of adverse sea-state conditions for operations at the Newcastle offshore industry hub were projected. These indicate that there is likely to be a decrease in frequency of adverse events over the next 100 years for this location under a high-emissions scenario. This projected decrease would be associated with a decrease in the frequency of east coast lows projected throughout the winter months.

For Newcastle, this projected decrease in the frequency of adverse conditions for operation would imply that windows of opportunity for offshore operations are likely to increase in a future climate, easing future access for the burgeoning sector. In other regions, climate change would influence drivers of adverse sea-state events differently, and other signals of change would arise.

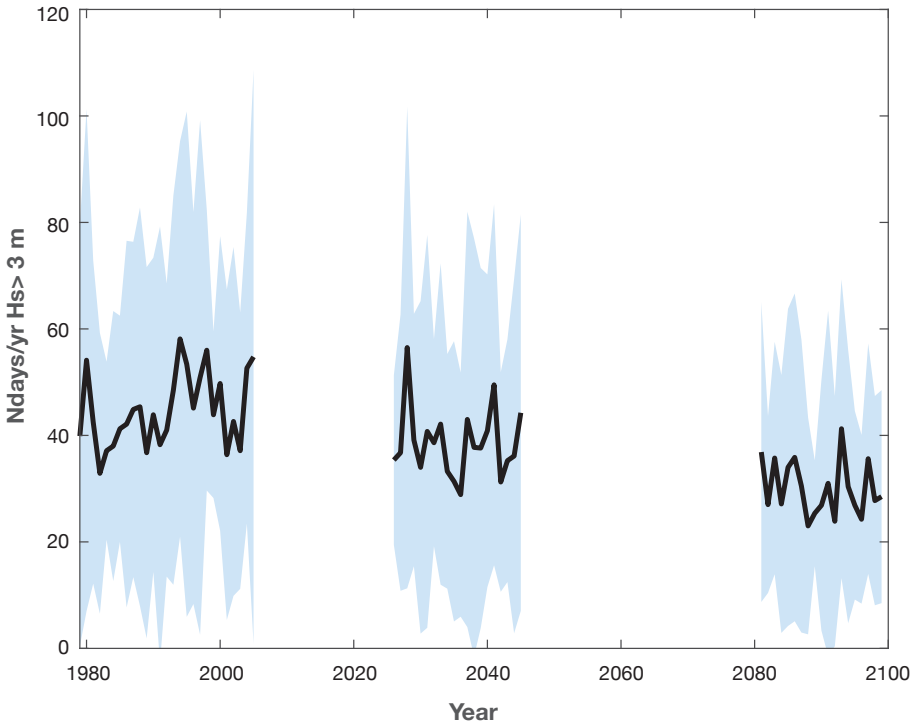
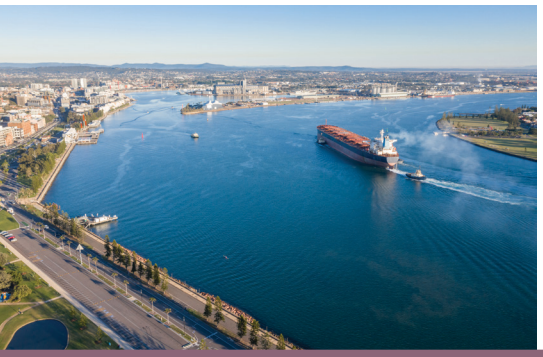


FIGURE 1 **Projected 21st Century climate-driven changes in the frequency of occurrence of events where wave heights exceed 3m, off the coast of Newcastle (154°E, 29°S) under a high emissions scenario (RCP8.5).** Black lines represent the ensemble mean, while the blue shading represents the ensemble range.



LEFT: **Climate change projections can support future development decisions for the Newcastle offshore industry.** iStock.com/bjeayes

This research was led by ESCC Hub **Project 5.8: Marine and coastal climate services for extremes information.**

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