

**Decadal-scale forecasting of climate drivers for marine applications**

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Climate influences marine ecosystems on a range of time scales, from weather-scale (days) through to climate-scale (hundreds of years). Understanding of interannual to decadal climate variability and impacts on marine industries has received less attention. Predictability up to 10 years ahead may come from large scale climate modes in the ocean that can persist over these time scales. In Australia the key drivers of climate variability affecting the marine environment are the Southern Annular Mode (SAM), the Indian Ocean Dipole (IOD), the El Niño/Southern Oscillation (ENSO) and the Interdecadal Pacific Oscillation (IPO), each has phases that are associated with different ocean circulation patterns and regional environmental variables. The roles of these drivers are illustrated with three case studies of extreme events – a marine heatwave in Western Australia, a coral bleaching of the Great Barrier Reef, and flooding in Queensland. Statistical and dynamical approaches are described to generate forecasts of climate drivers that can subsequently be translated to useful information for marine end users making decisions at these time scales. Considerable investment is still needed to support decadal forecasting including improvement of ocean-atmosphere models, enhancement of observing systems on all scales to support initiation of forecasting models, collection of important biological data, and integration of forecasts into decision support tools. Collaboration between forecast developers and marine resource sectors – fisheries, aquaculture, tourism, biodiversity management, infrastructure – is needed to support forecast-based tactical and strategic decisions that reduce environmental risk over annual to decadal time scales.

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