GREAT AUSTRALIAN BIGHT
RESEARCH PROGRAM

GAB RP August 2017– Oceanography: the science that underpins
John Middleton, David Griffin & teams
Key Objectives:

• To develop high resolution (1-4 km grid) validated hydrodynamic models that will provide the best understanding of the circulation of the Great Australian Bight and nutrient paths for the ecosystem

• To provide other research themes with oceanographic information (eg., integration Theme, Petroleum Theme (tar balls), Ocean colour etc)

Models:

1) Two ROMS & SHOC are nested inside:
   a) BRAN2015 – a global re-analysis (“best fit to data”) model for April 2009 - July 2015
   b) TPXO (ROMS) and CSR global tidal (SHOC) models

2) BRAN2006 is used for inter-annual studies of the Leeuwin Current (next)
Upwelling- what is it?

Alongshore winds drive surface water off to the left. Water is replaced by drawing water from depths of 200 -300 m. This water contains nutrients and with sun light, feed tiny marine plants (phytoplankton) that form the basis of the marine ecosystem.
Downwelling all year round in mid-GAB found from benthic observations – see also theme 3 (Benthos):

Results consistent with previous and current ocean models of GAB
Nutrient Paths (summer)

Downwelling all yr round

Mid-GAB: shutdown by downwelling
Western GAB: shutdown by CTWS (de’Oliviera and Middleton 2017)

Wind-forced Upwelling –enhanced by submarine headlands (de’Oliviera and Middleton 2017)
Central Gab: downwelling ROMS (upper), data (lower) transect at 130.8 E – temperature: summer downwelling caused by collision of Sverdrup transports (Middleton and Platov 2003): Downwelling all year round opposes nutrient upwelling. But........

Nx nutrients lies at depths 300-350 m.

Uplift opposed by “downwelling.

Convective overturning, mechanical mixing, double diffusion?
Western GAB, upwelling shut-down by CTWs: evidence -- (Middleton and de’Oliviera 2017)

Above MSLP chart (Feb 8th 2008) implies stronger upwelling winds in west BUT no SST upwelling signature: (1994-2016 data confirms)
Nutrient Paths (winter)

NH$_4$ – near-shore detritus flushed to shelf slope in winter – nutrient source?
Key Findings and Implications

1) Shelf circulation of SHOC and ROMS similar and reproduces IMOS and other data well (including upwelling and its arrest.
Give confidence that:

2) Nutrient paths outlined – notably upwelling shut-down in west, downwelling mid GAB, and enhanced sub-marine headland upwelling in east (Bonney Coast/KI region).

3) Sensitivity studies can be done of upwelling paths to winds, LC inflow and density driven circulation (including climate change).

4) Monitoring System for changes to ocean circulation (upwelling) can be designed (SAIMOS –key).