Nitrogen fixation in the Indian Ocean
N cycle
Background

N₂-fixing microorganisms

- First sightings date back to the voyages of Captain Cook (1772) and C. Darwin (1889)
- N₂-fixing microorganisms occur in low nutrient and stratified oceanic habitats

Paradigm shift in global N cycle

- New Bio-Geochemical tracer approaches
- More extensive field observations
- Accurate model outputs and algorithms
- Increased phylogenetic diversity
- Greater spatial coverage and distribution
- Revised global N₂ fixation rates

Trichodesmium bloom, Eastern Indian Ocean 2012

Adapted from Karl et al. 2002
Project

Primary hypotheses

1. Nitrogen fixation is a key driver of planktonic CO$_2$ absorption in the eastern Indian Ocean

2. Availability of iron is the main parameter controlling fixation rates in this region, due to the occurrence of iron rich aeolian dust along the northwest of Australia
Values > 2.0 fine, particles, smoke particles and sulfates
Values near zero, coarse particles eg. desert dust (Eck 1999).
Research..so far

Two voyages covering the eastern Indian Ocean (Phillips et al and Wilcox et al)

- First regional estimates of N₂-fixation rates, covering major parts of the coastline of Western Australia
- Phylogenetic samples to determine fixating, nitrifying, ammonifying and denitrifying microorganisms
  - Microarray (Roh et al., 2010)
- New microbiological method to determine active C an N fixing communities
  - In situ Nif H and Rubisco hybridisation (Philhofer et al., 2008)

Red dots, N₂ fixation stations Aug/Sep 2012
IMOS data

http://oceancurrent.imos.org.au/

Ocean Current - Ocean Surface Currents and Temperature

Ocean News: An even higher sea level event in the Great Australian Bight (29 Aug 2012) [more...]
The Day the East Australian Current vanished (13 Aug 2012) [more...]
Technical News: Persistent problems with major IT infrastructure - but all good today (12 Oct 2012) [more...]

Prepared maps and animations

[Source Data] [what's shown] [animation won't play?]

Imagery for import into Google Earth

[West Australia last 6 days] [2008 now]
[East Australia last 6 days] [2008 now]

Temperature and salinity down to 2000m - Argo profiling floats
IMOS data
IMOS data
IMOS data

http://www.pmel.noaa.gov/tao/rama/moorings.html
Using IMOS data

Water Temperature [°C] vs Section Distance [km]

Fluorescence

Chl a vs
Future use of IMOS data

Adapted from Karl et al. 2002
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Thank you
Any questions?