Project Manta

East Australian Current (EAC) Region: Oceanographic conditions report

March – May 2013

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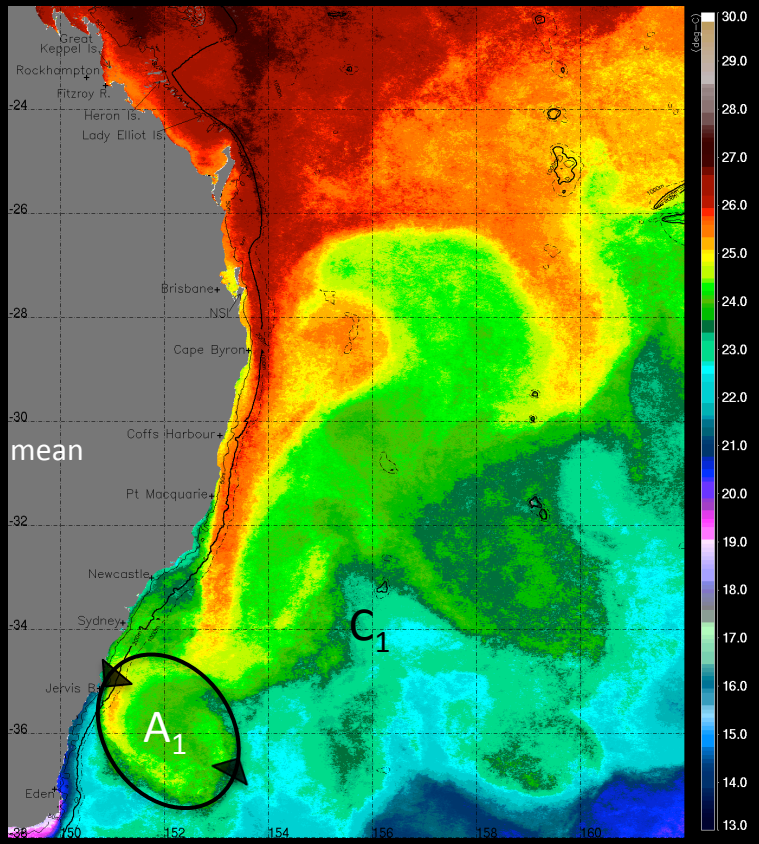
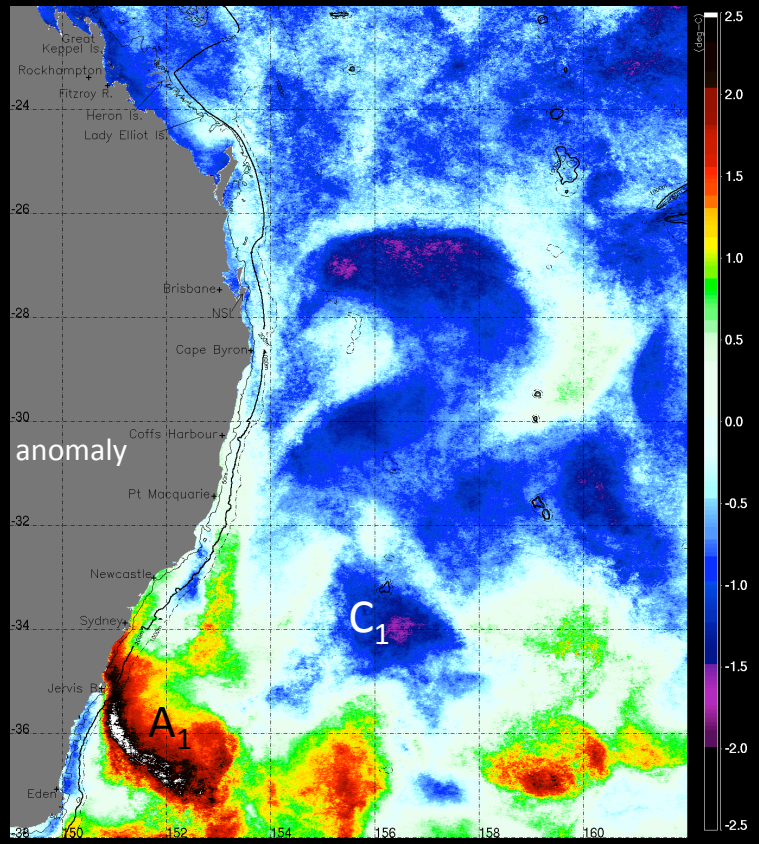
UQ-GPEM Biophysical Oceanography Group

Overview

- Monthly and weekly means and anomalies of MODIS SST for March and April 2013 indicating strong eddy activity.
- Monthly and weekly means and anomalies of MODIS chlorophyll-a concentrations for March and April. Chlorophyll patterns related to the behavior of the EAC and strong eddy activity.
- Monthly means and anomalies of photic depth for March and April.
- Monthly means of surface oceanic currents (OceanMAPS).
- Summary of manta sightings at NSI and Byron Bay during April.

EAC Monthly MODIS SST (D+N): March 2013

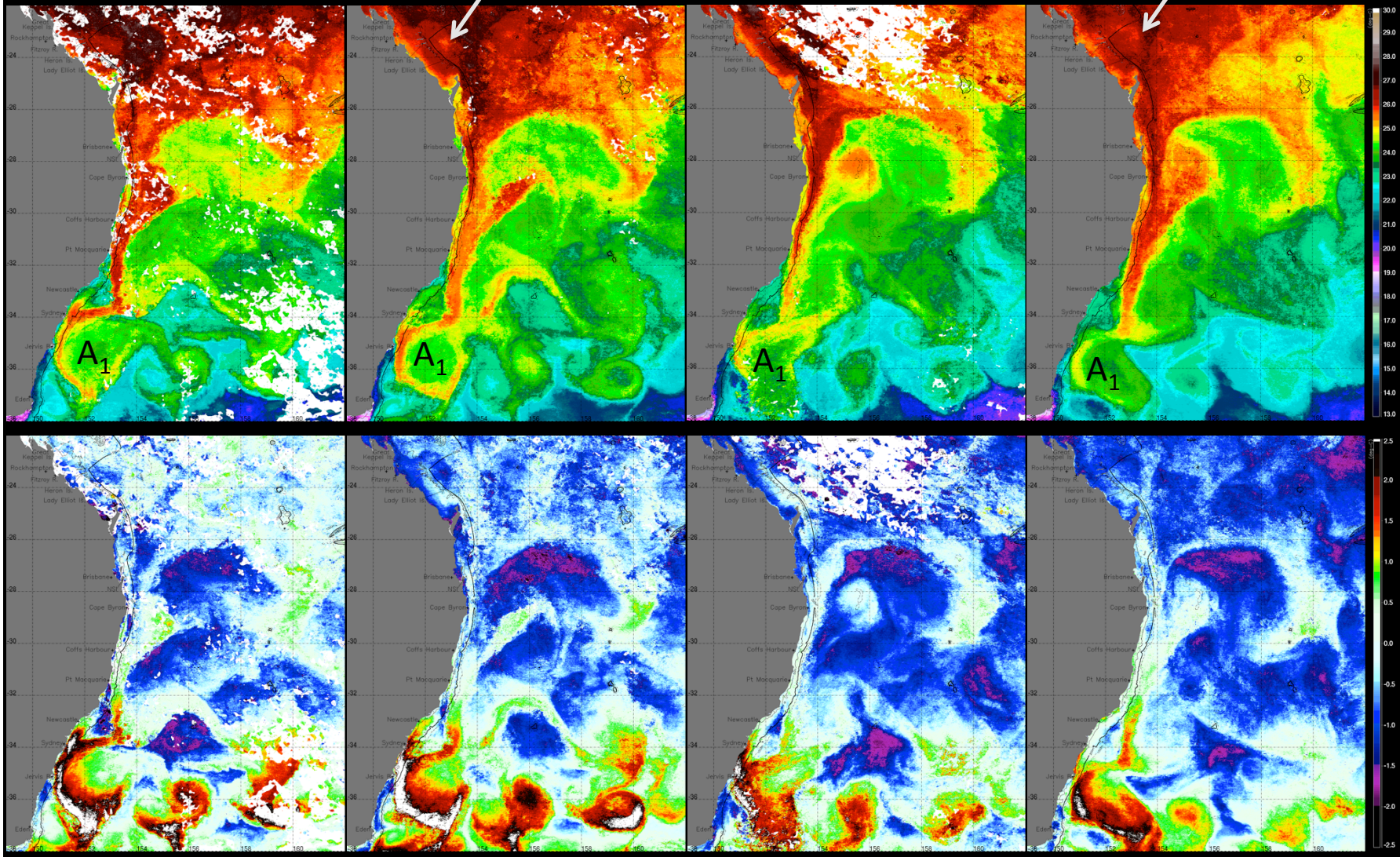




- Strong EAC primary flow encroaching onto the shelf down to ~33°S. From this point, EAC extends ~200km further south before separating (from the shelf) north-eastward into the Tasman Sea
- Eddy pair from previous month still persistent in March:
  - * Anticyclonic eddy (A_1) now located further south and closer inshore off Jervis Bay resulting in intense positive SST anomalies on the shelf between Sydney and Jervis Bay and offshore along the southern boundary of the eddy/EAC extension.
  - * Cyclonic eddy (C_1) now located further offshore associated with relatively weaker negative SST anomalies compared to previous month.
- Mild negative to average SST anomalies south to 32°S associated with the EAC primary flow while strong positive SST anomalies characterise the southern extension. Average to strong negative SST anomalies characterise offshore regions (to ~35°S). Also apparent is an offshore cyclonic eddy feature off Newcastle and Sydney with strong negative SST anomalies within its core.

Weekly MODIS SST means (top panel) and anomalies (bottom panel)

From 1-7 Mar 2013



- Weekly means showing the dynamics of the anticyclonic eddy (A_1) pinching off from the main EAC flow and continuing southwestward, & associated with intense positive SST (+4°C!) anomalies.
- Surface manifestation of the Capricorn Eddy apparent during the second & last weeks

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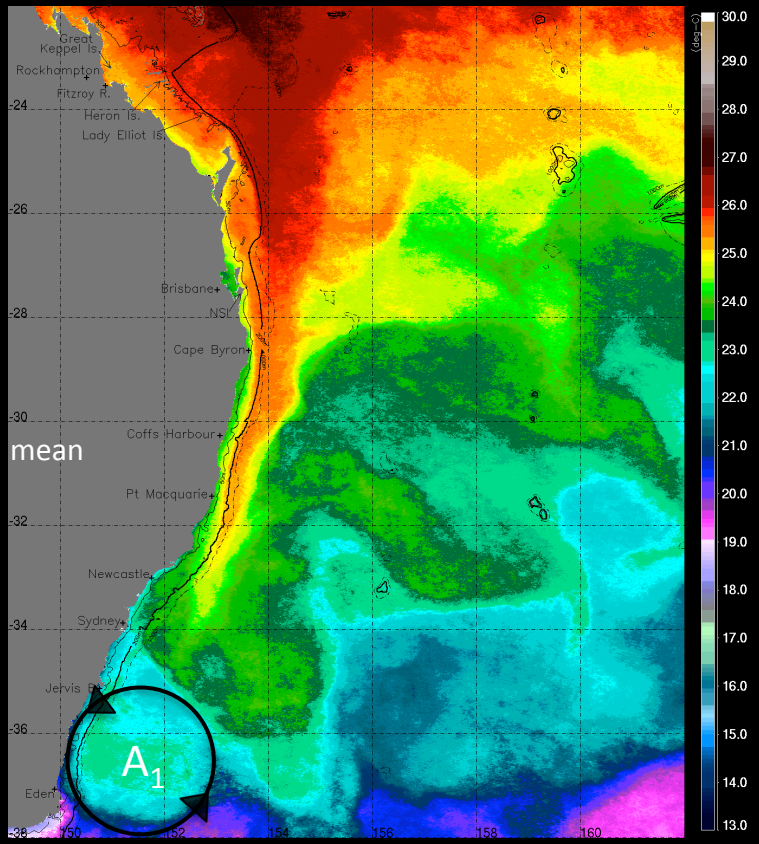
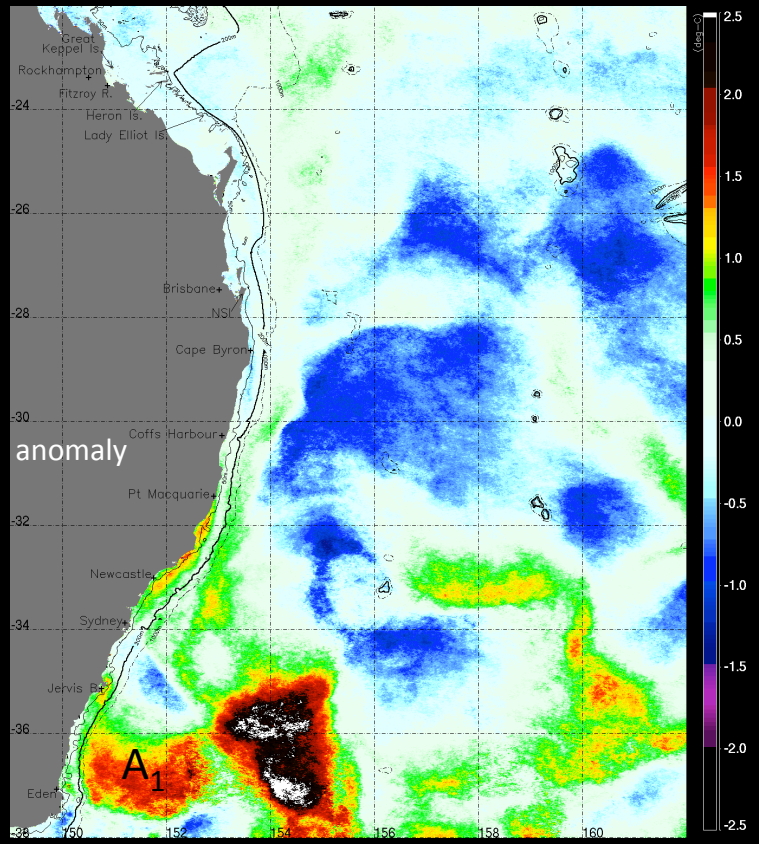
EAC Monthly MODIS SST (D+N): April 2013





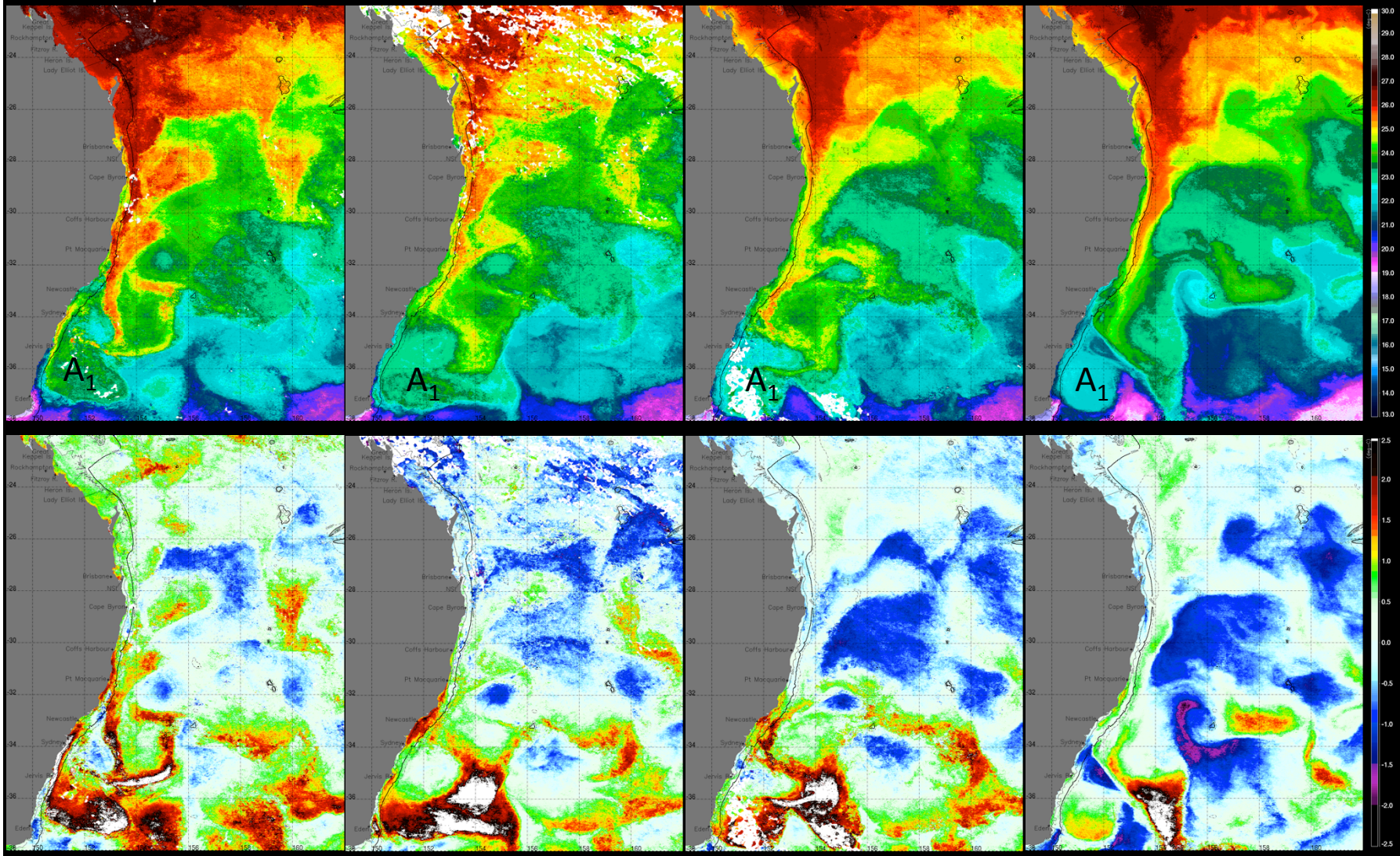
- EAC primary flow relatively weaker compared to March as EAC slowly retreats northward and becomes cooler

- Anticyclonic eddy (A_1) has moved southwestward close inshore during April, as it is shed from the primary EAC - A_1 now located between Jervis Bay and Eden.
  - Core of the eddy is associated with persistent strong positive SST anomalies.

- Adjacent offshore: intense positive SST anomalies related to EAC separation from the coast as it pushes/extends around eddy, A_1

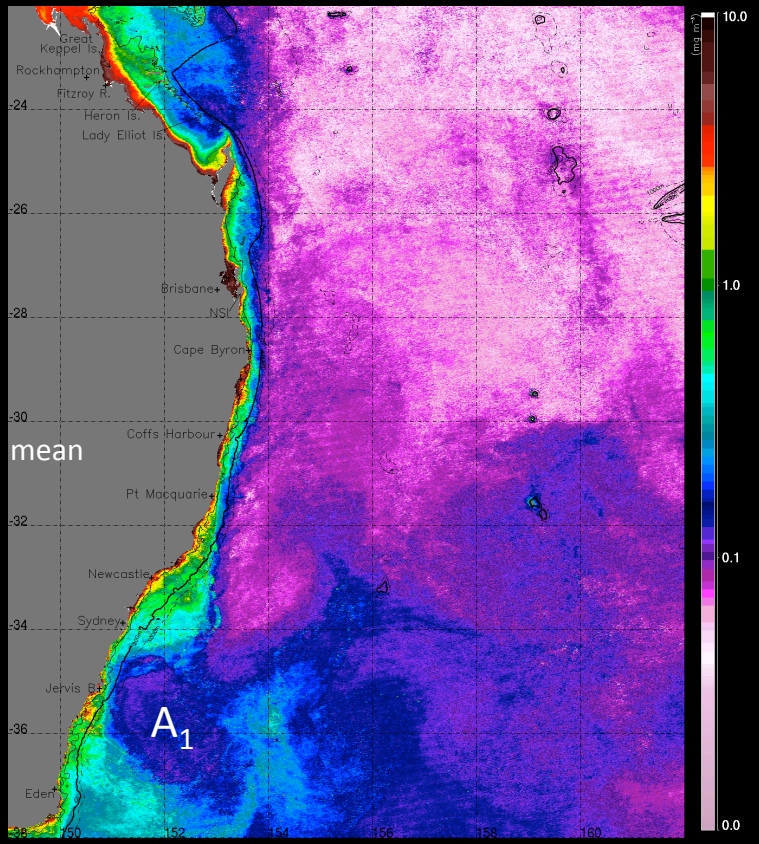
Weekly MODIS SST means (top panel) and anomalies (bottom panel)

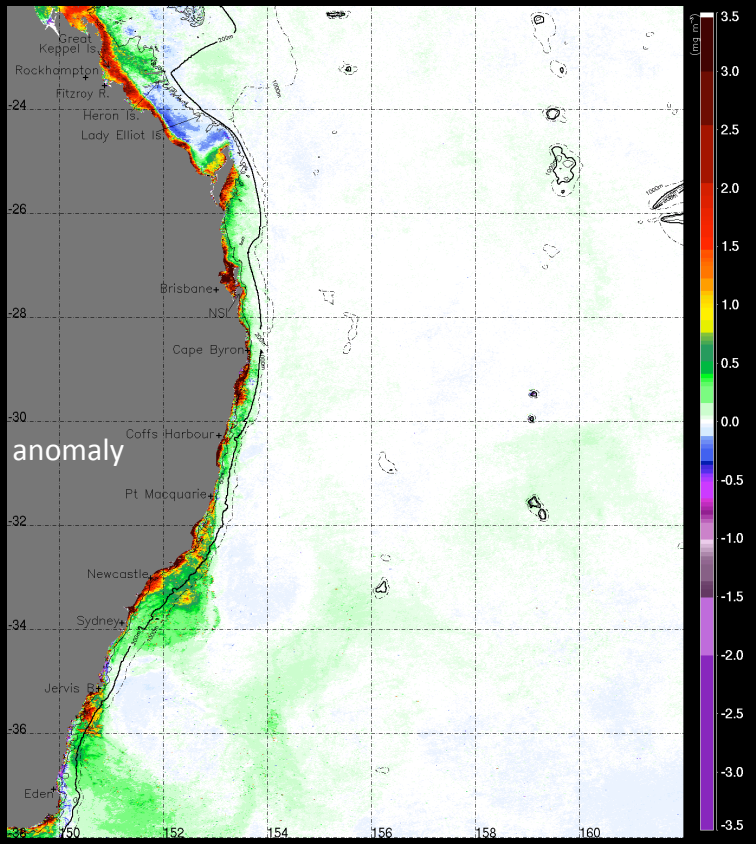
From 1-7 Apr 2013



- Weekly means showing the movement Anticyclonic eddy (A_1) further southwestward as it is shed from the primary EAC flow
- Also apparent are the intense positive SST anomalies (+4°C!) related to the EAC separation from the coast as it pushes/extends around eddy, A_1

EAC Monthly MODIS Chlorophyll: March 2013

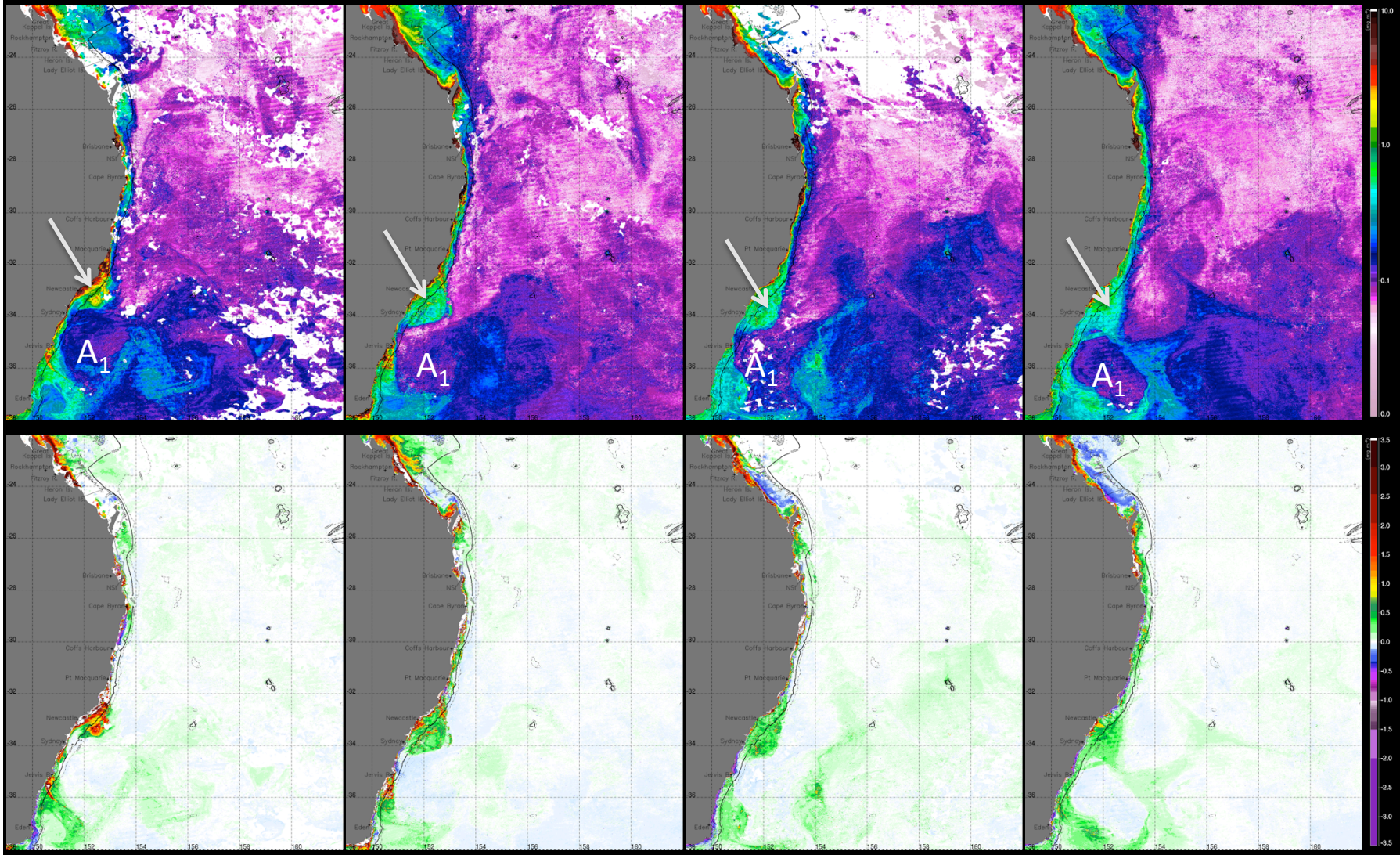




- Intense chlorophyll-a signal inshore in the southern GBR region due to river outflow and intense vertical mixing
- Sharp chlorophyll-a gradient along the length of the shelf down to 32°S as EAC flow very close inshore. Close coastal proximity of the EAC uplifts the thermocline and nutrients (shelf-edge upwelling), leading to increased phytoplankton (high chlorophyll concentrations).
- Intense positive chlorophyll-a anomalies off Newcastle and Sydney resulting from a localised cyclonic eddy inshore of primary EAC flow
- Elevated chlorophyll-a concentrations also apparent along the outer boundaries of the anticyclonic eddy (A_1) but most pronounced inshore south of Jervis Bay and along the eddy's southwestern boundary

Weekly MODIS Chlorophyll means (top panel) and anomalies (bottom panel)

From 1-7 Mar 2013



- Weekly means showing the dynamics of the anticyclonic eddy (A_1) pinching off from the main EAC flow and continuing southwestward, & associated with intense low chlorophyll signal.
- Weekly means also showing the evolution of the Intense positive chlorophyll-a anomalies off Newcastle and Sydney resulting from a localised cyclonic eddy inshore of primary EAC flow

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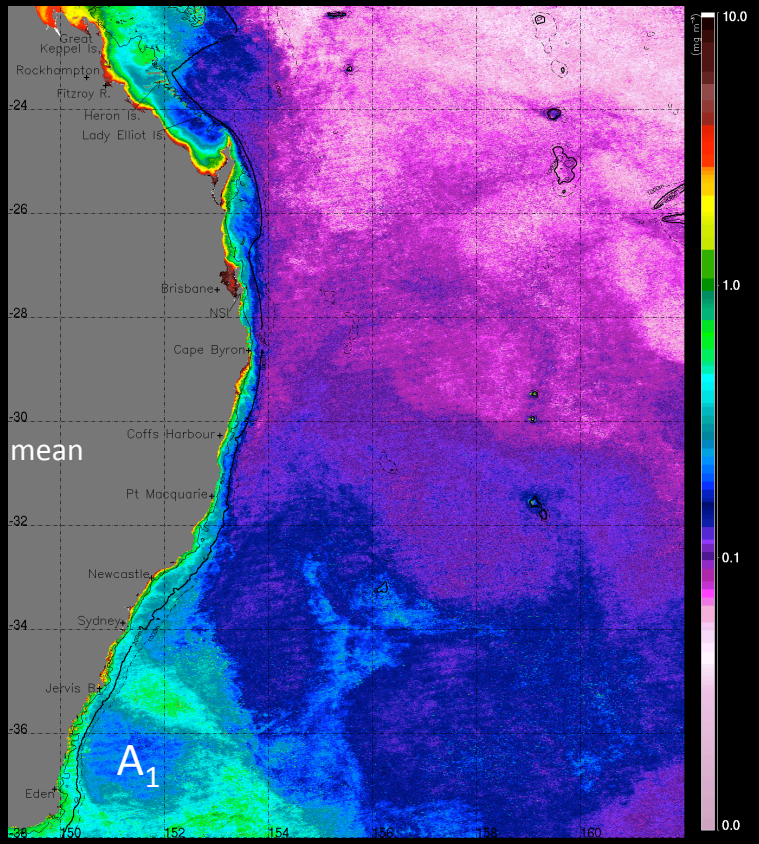
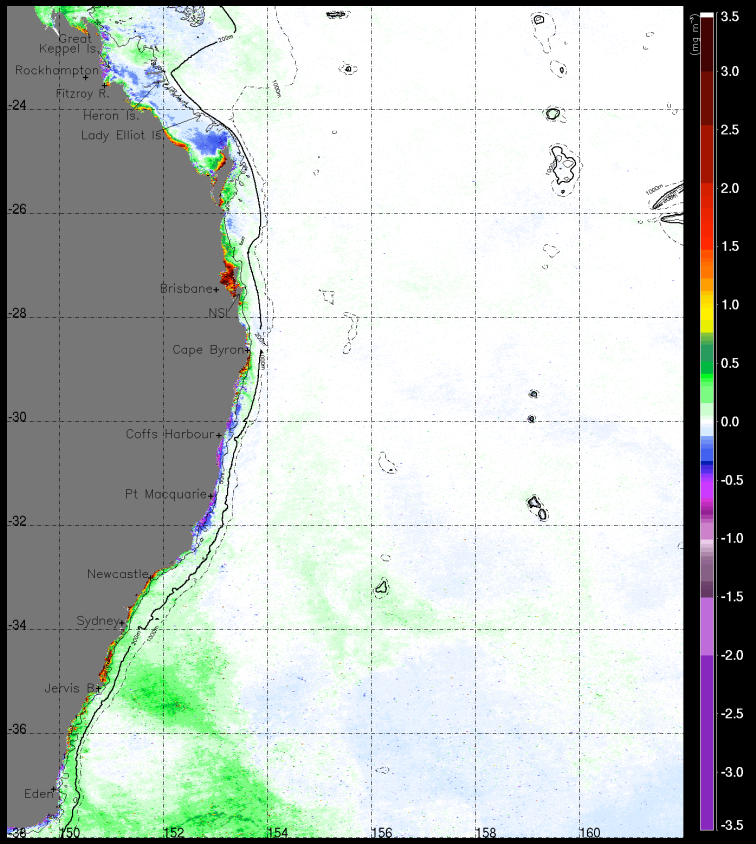
EAC Monthly MODIS Chlorophyll: April 2013



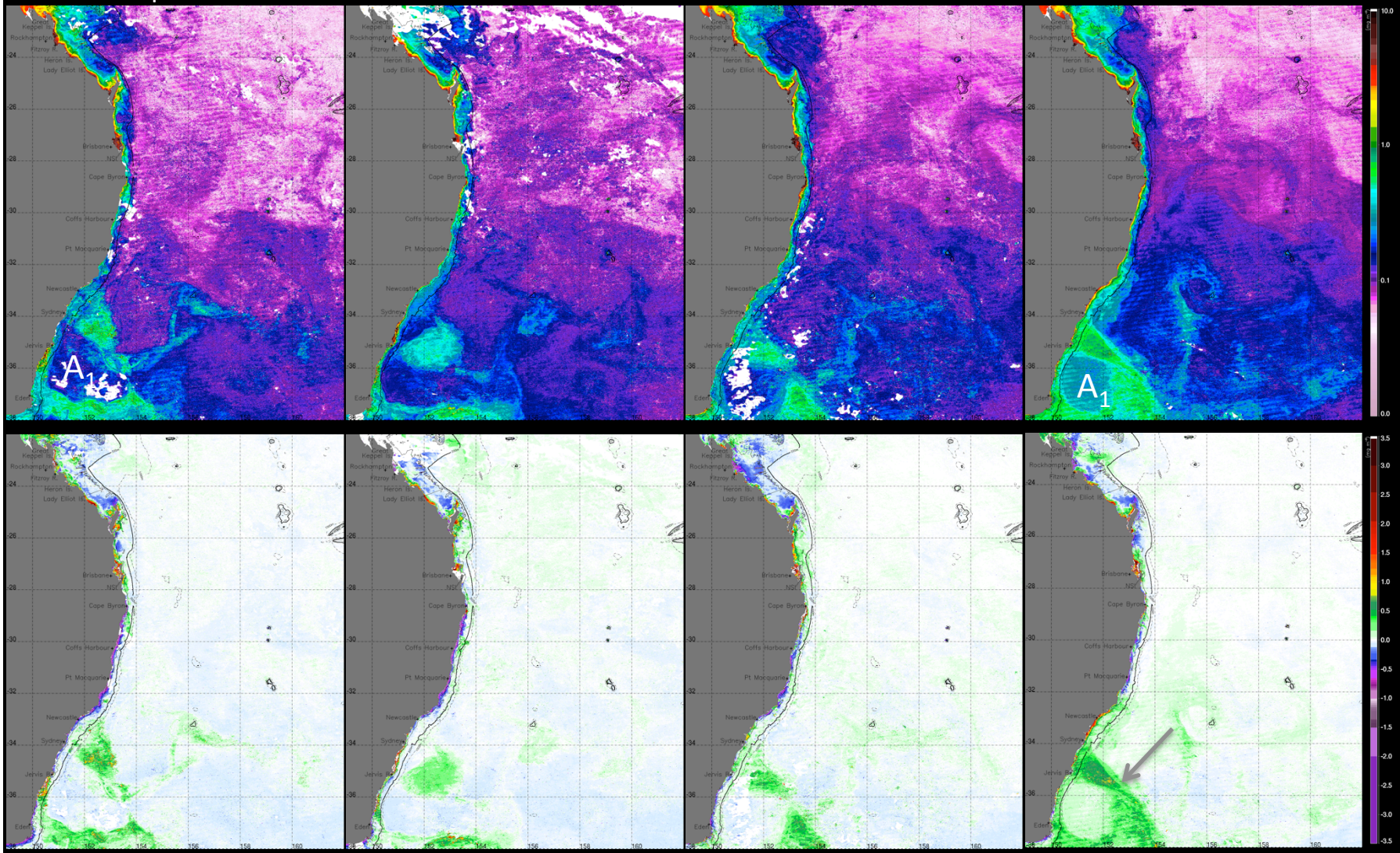


- Chlorophyll-a gradient along the shelf still apparent
- intense chlorophyll-a signal inshore in the southern GBR from previous month has significantly dissipated

- Elevated chlorophyll-a anomalies concentrations still apparent along the boundaries of anticyclonic eddy A_1
  - –indicates offshore advection of these productive waters as anticyclonic eddy (A_1) is shed from the primary EAC

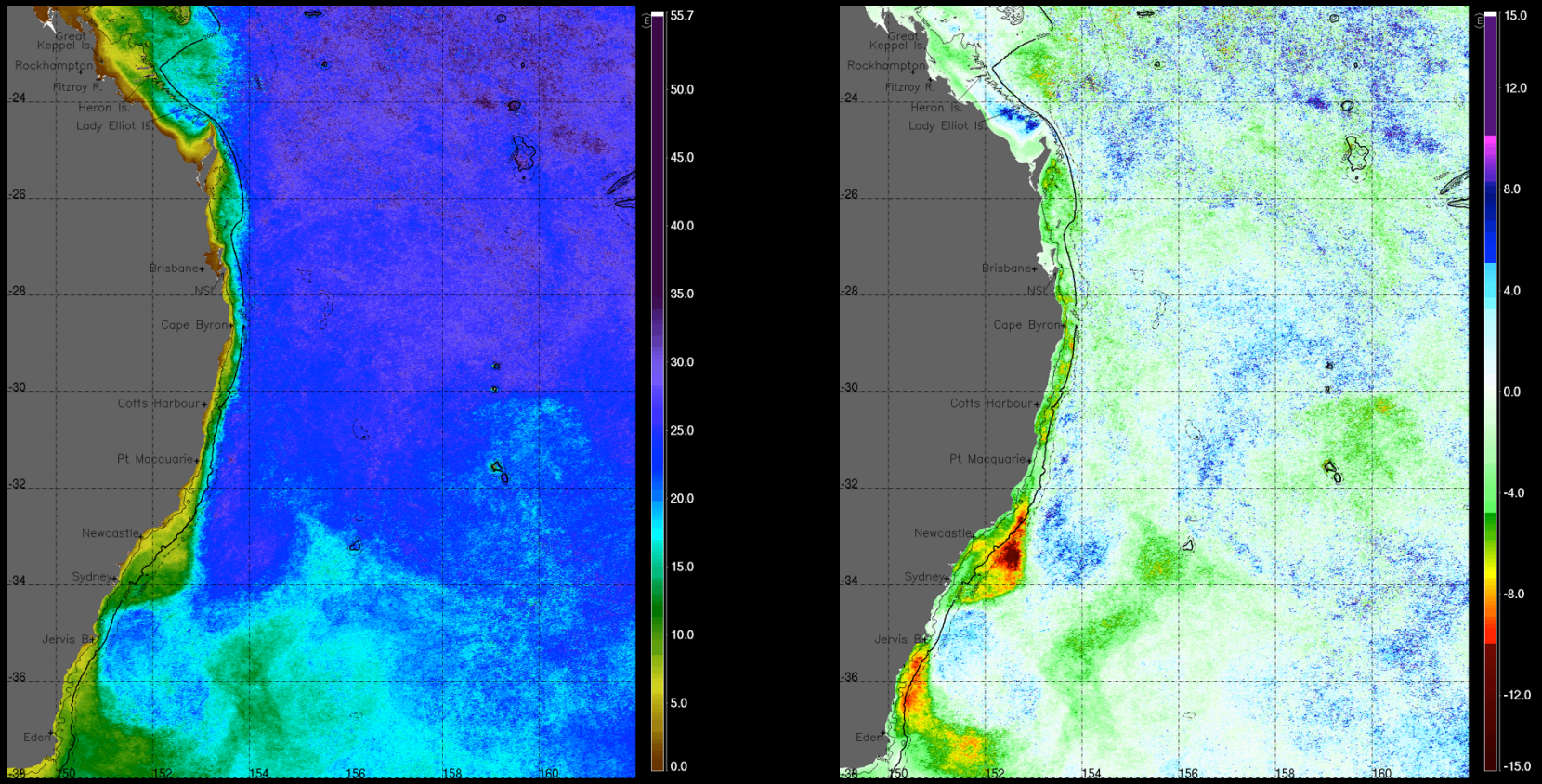
Weekly MODIS Chlorophyll means (top panel) and anomalies (bottom panel)

From 1-7 Apr 2013



- Weekly means showing the movement Anticyclonic eddy (A_1) further southwestward as it is shed from the primary EAC flow.
- The chlorophyll-a anomalies concentrations along the boundaries of the anticyclonic eddy strengthen towards the end of the month.

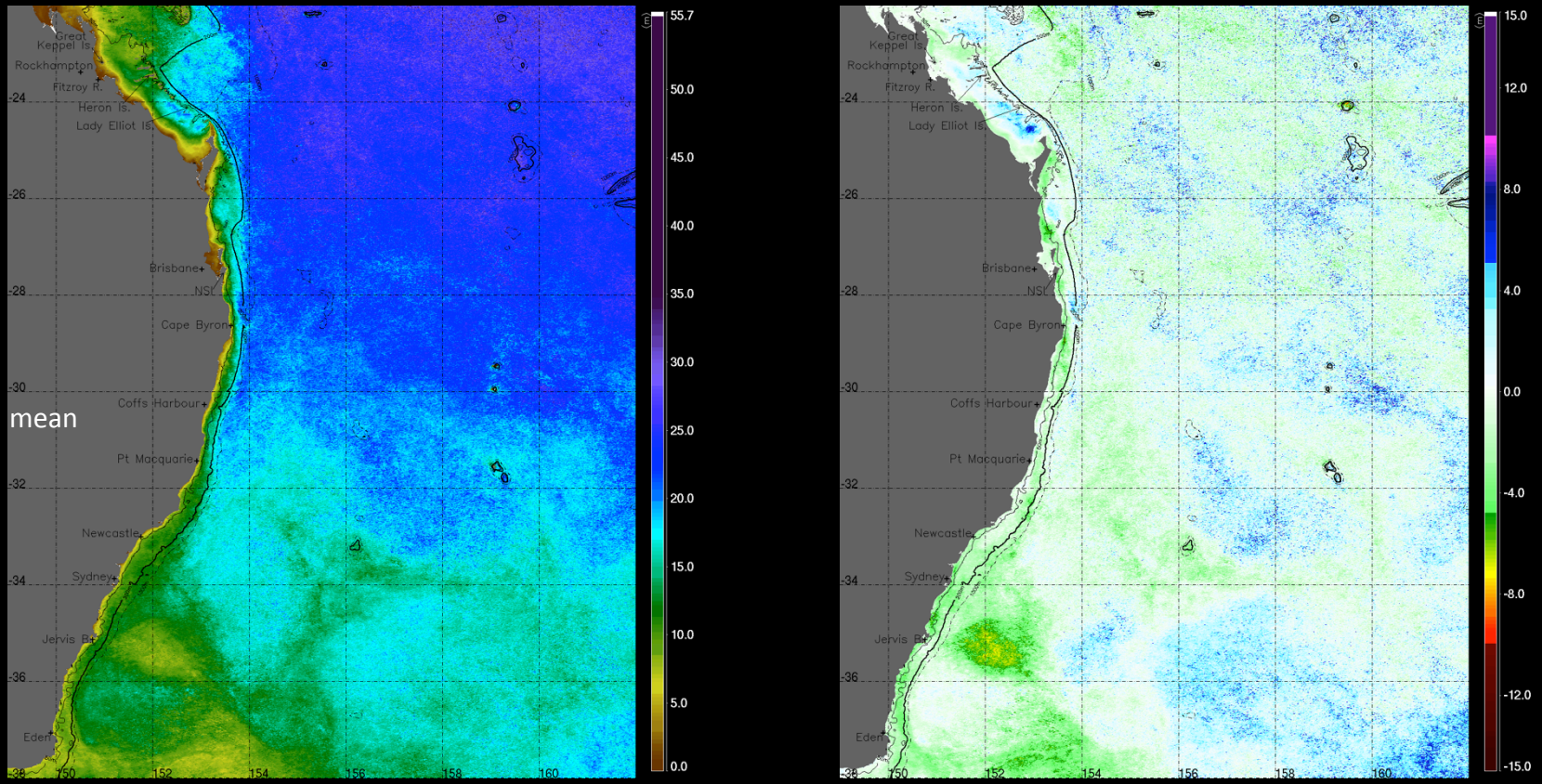
EAC Monthly MODIS Photic Depth: March 2013



- Satellite-derived photic depth mean for March generally indicative of reduced water clarity along the coast.
- In the southern GBR region, very shallow photic depth likely due to river influence and intense vertical mixing, and is associated with weak negative anomalies.

- Anomalously low water clarity further south coincide with regions of high eddy activity:
  - (i) at 32-34.5°S due to the localised cyclonic eddy and associated intense eddy upwelling; and
  - (ii) south of 35°S due to frontal boundary and associated upwelling.

EAC Monthly MODIS Z-Secchi Depth: April 2013



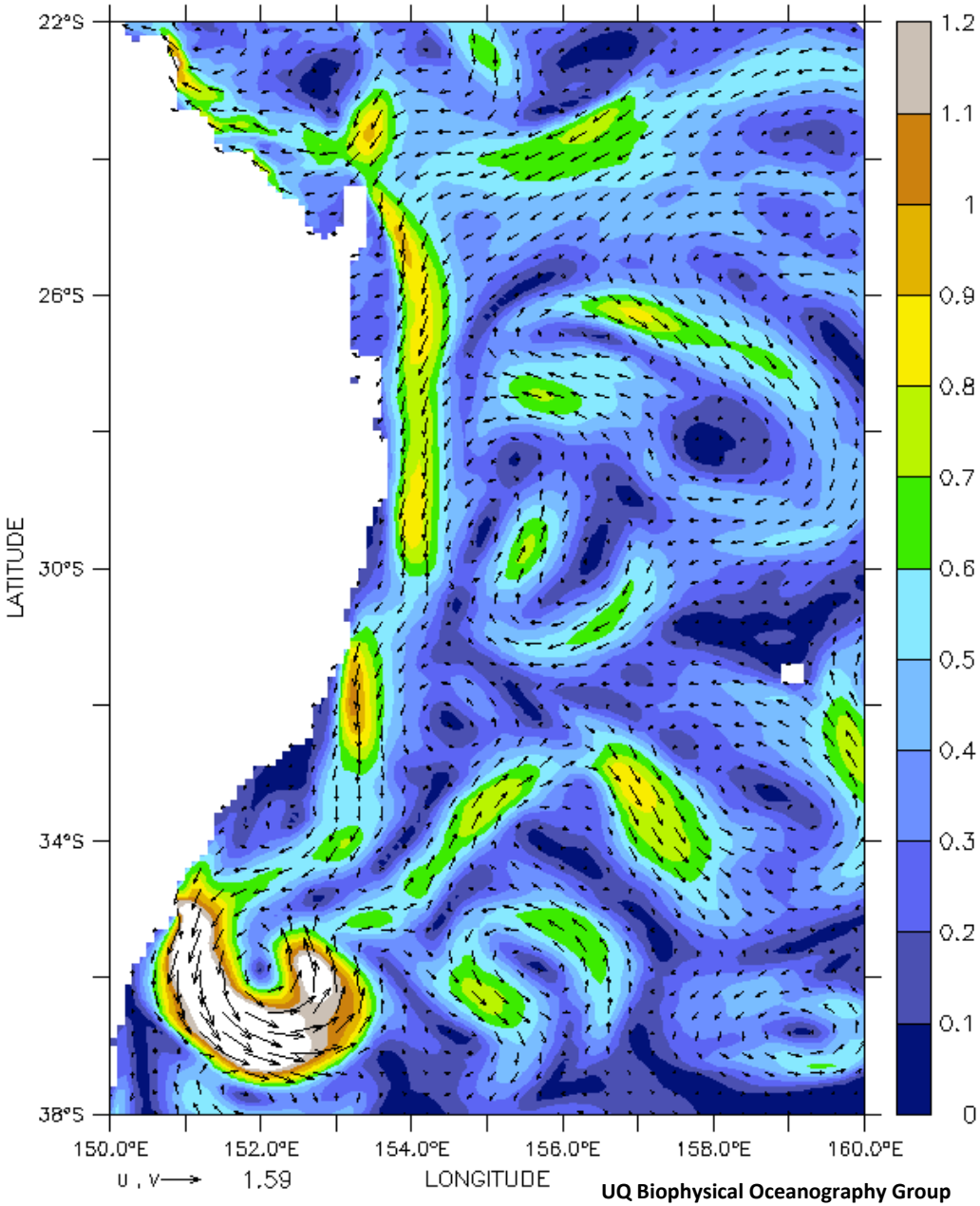
- Photic depth gradient along the shelf still apparent – due reduced water clarity along the coast
- In the southern GBR region, very shallow photic depth likely due to river influence and intense vertical mixing, has significantly dissipated since March

- Anomalously low water clarity further south still apparent in regions of high eddy activity:
  - (i) between Sydney & Jervis Bay, due to offshore movement of the localised cyclonic eddy; and
  - (ii) south of 35°S due to frontal boundary and associated upwelling.

OceanMaps: March 2013 mean

Depth integrated (0-15m) currents from OceanMaps reveal intensified EAC flow along the shelf edge from ~24°S off Fraser Island during March

Further south, the southern limb of the EAC particularly strengthened from 31°S (off Smoky Cape), feeding the strong anticyclonic eddy (A_1)as previously described using the MODIS images.



http://godae.bom.gov.au/oceanmaps_analysis/ocean_diag_brt/ocean_diag.shtml

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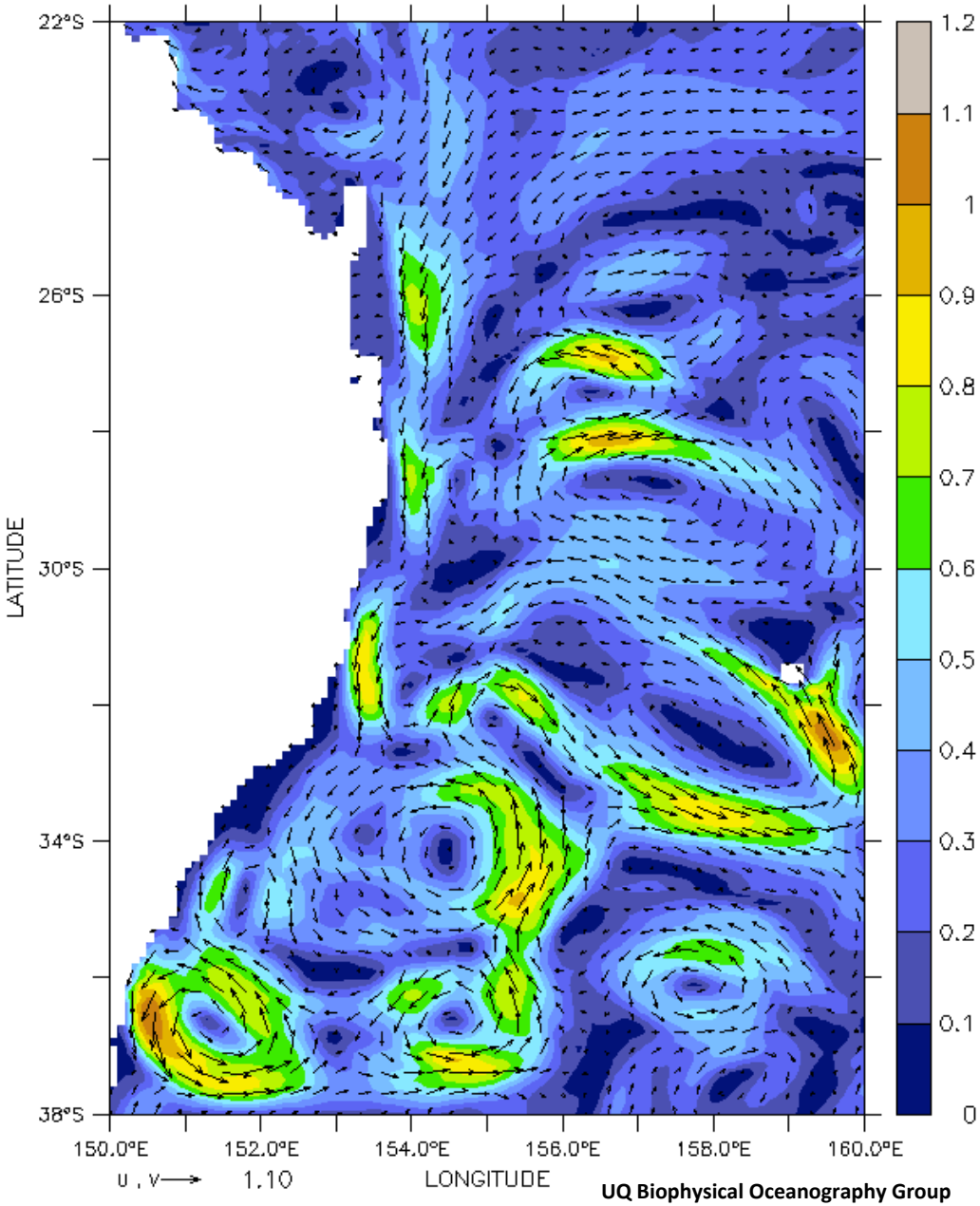
OceanMaps: April 2013 mean

Depth integrated (0-15m) currents from OceanMaps for April shows a much weaker EAC flowing along the shelf which is typical during this period.

Further south, the currents confirms the presence of the persistent A_1 anticyclonic eddy seen from the MODIS images.

Strong eddy activity further offshore in the Tasman Sea.



http://godae.bom.gov.au/oceanmaps_analysis/ocean_diag_brt/ocean_diag.shtml

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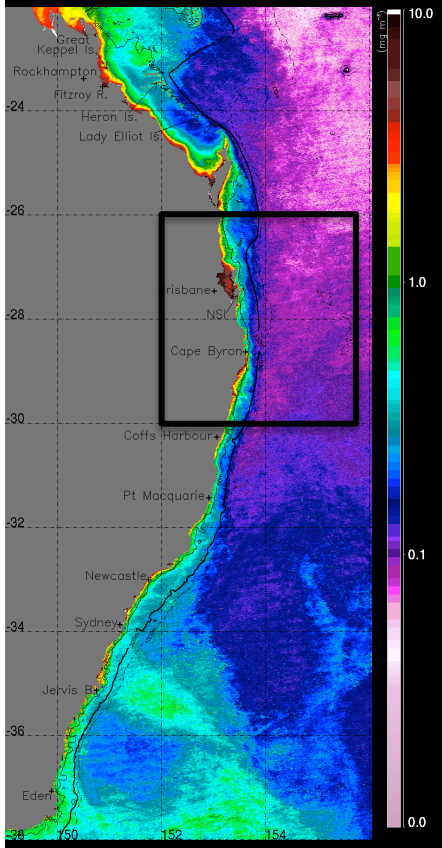
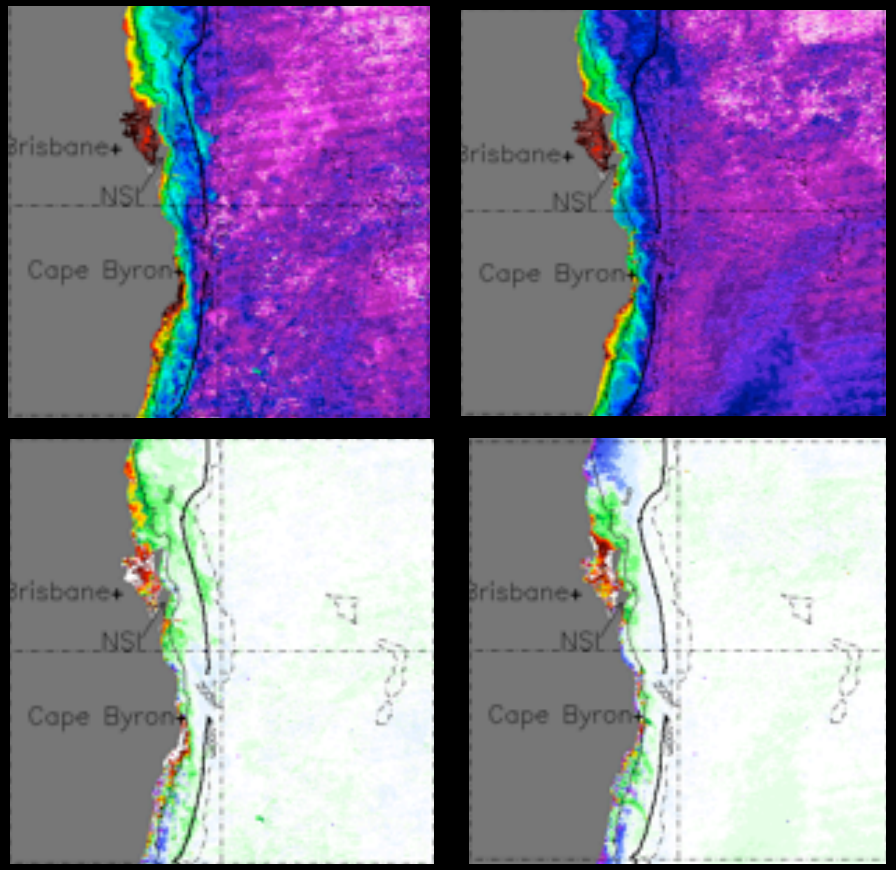
Manta sightings



Mean Monthly MODIS Chlorophyll

16-23 Apr 2013

24-30 Apr 2013



Mean (top) and anomaly (bottom) weekly MODIS Chlorophyll

Manta sightings at NSI (April)

12/04 (1)
17/04 (3 - including Pinocchio which was tagged at LEI in Feb 2013)
18/04
19/04 (7)
25/04 (3)

Manta sightings at Byron Bay (April)

27/04(1)
03/05(1)
there were a few mantas seen throughout the month there. (without photos, ~6-7 reported)