Modelling the South-Western Indian Ocean and the South-east Madagascar Bloom

Fehmi Dilmahamod[1]

University of Cape Town

Supervisors:

Prof. Chris Reason[1]

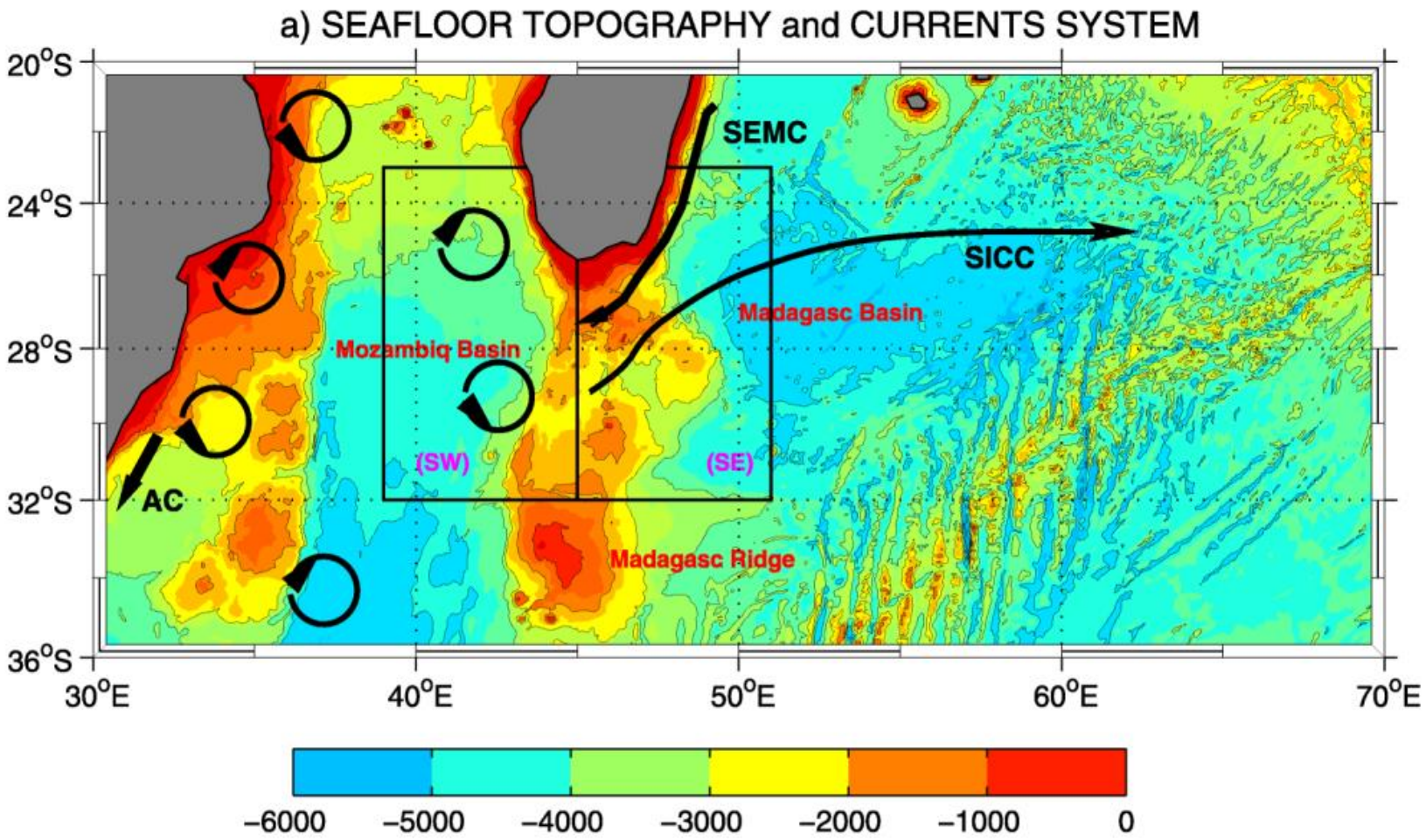
Dr. Juliet Hermes[1,2]

Dr. Pierrick Penven[3]

[1] Department of Oceanography, University of Cape Town.

[2] South African Environmental and Observational Network, Cape Town

[3] Laboratoire de Physique des Oceans, IFREMER, France

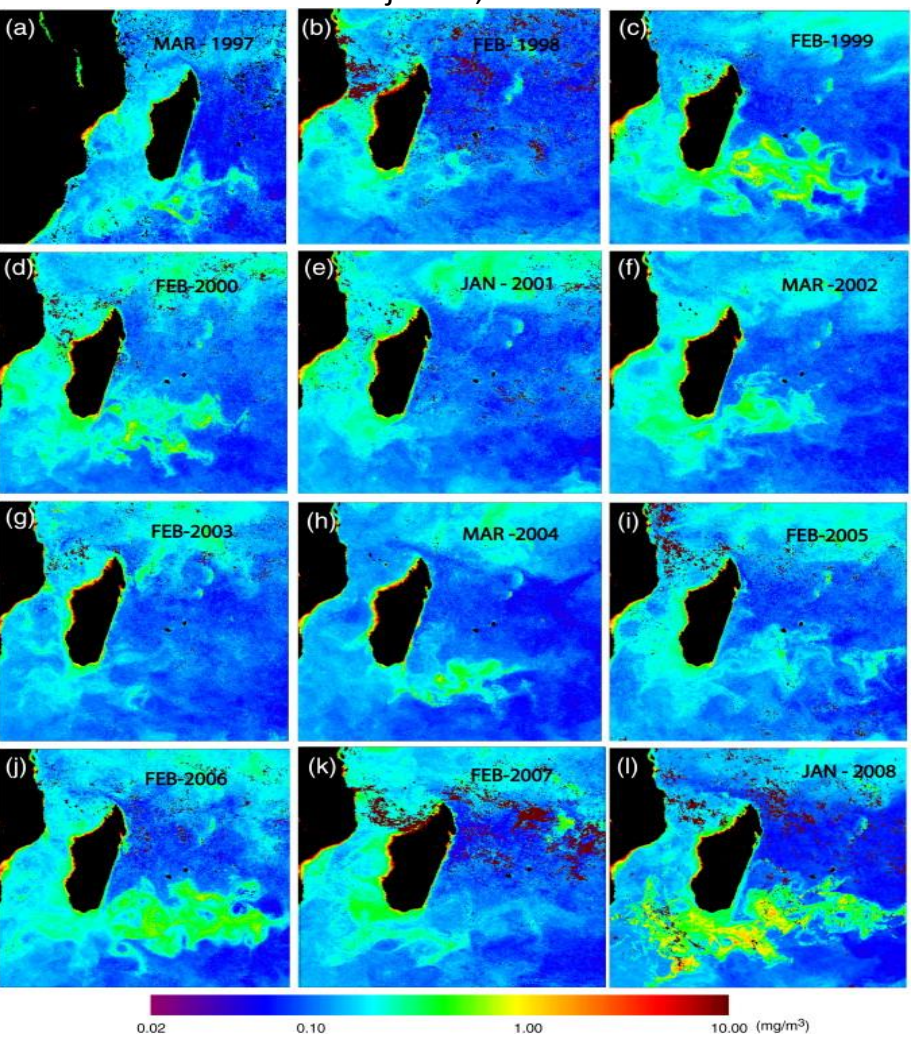


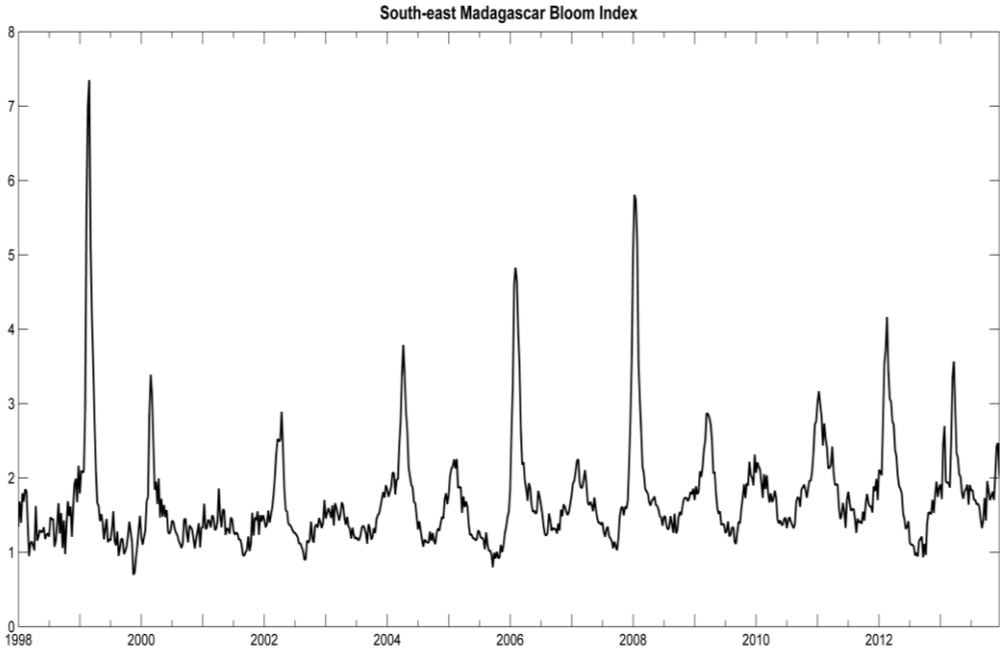
Halo et al., 2014

❑ **Advance our understanding of the South-West Indian Ocean, with a particular focus on the westward-propagating eddies and the termination of the East-Madagascar Current.**

Southeast Madagascar Bloom

Raj et al., 2010



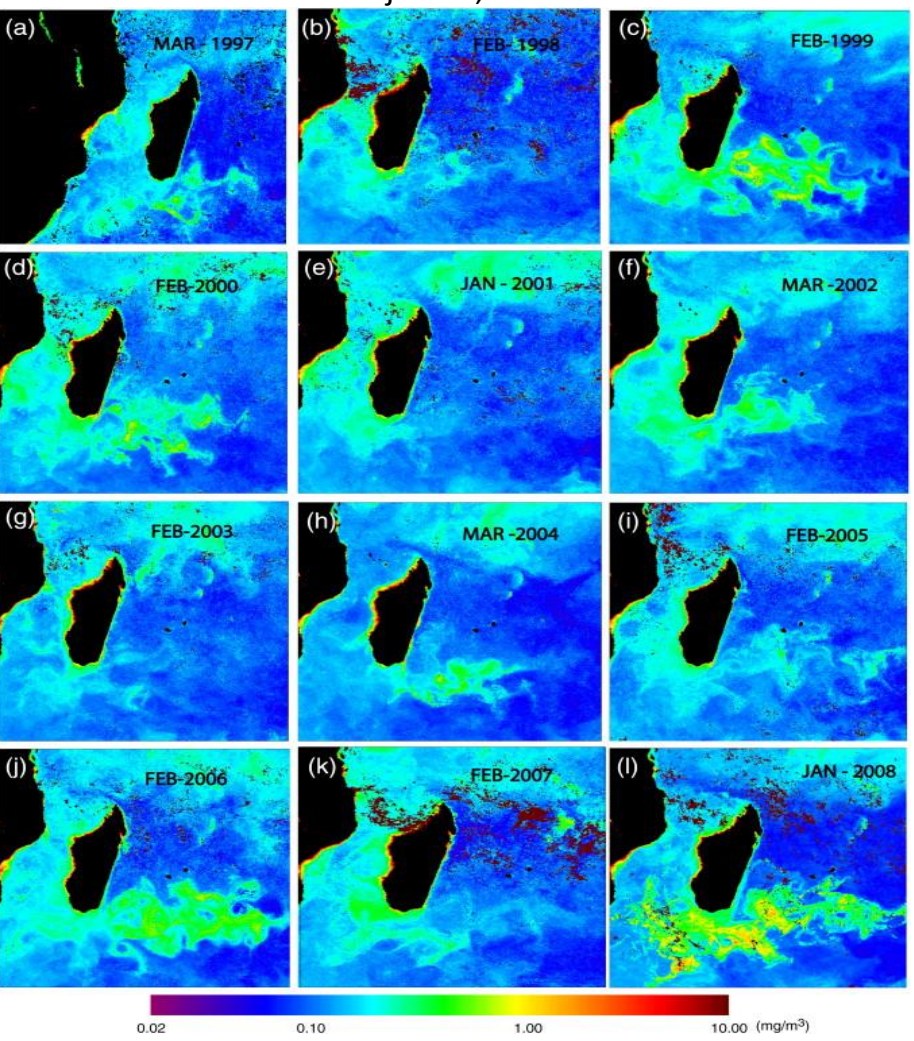


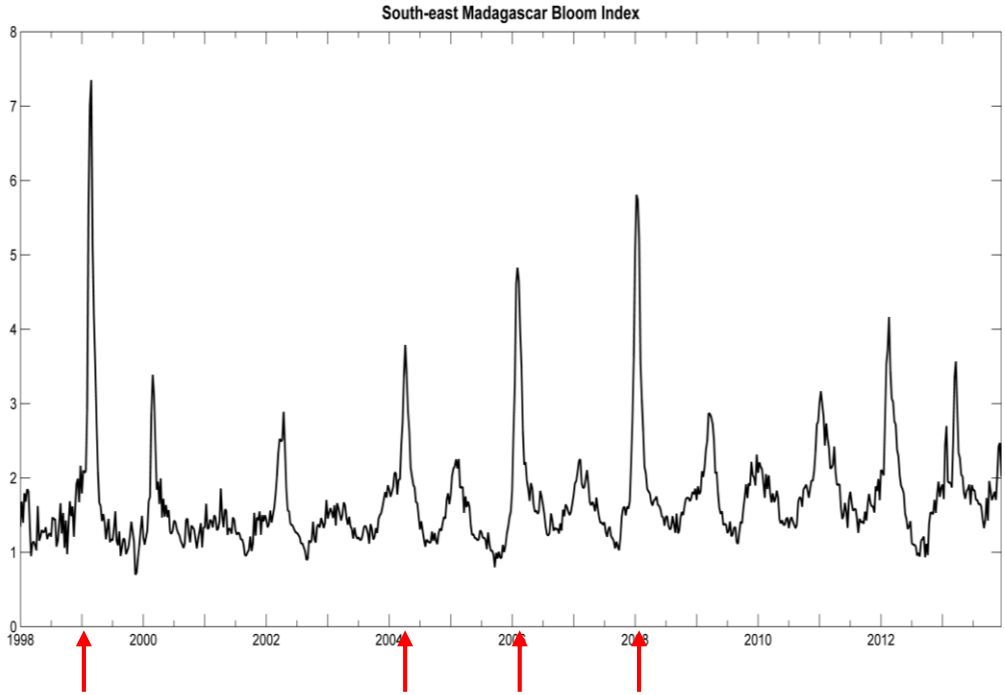
- Unique feature of the South-West Indian Ocean and one of the largest dendroid blooms in the world.
- Can cover up to 2500 km^2 when well-developed (up to 70°E).

❑ **And to ultimately understand the physical mechanisms driving the sporadic South-east Madagascar Phytoplankton bloom.**

Southeast Madagascar Bloom

Raj et al., 2010



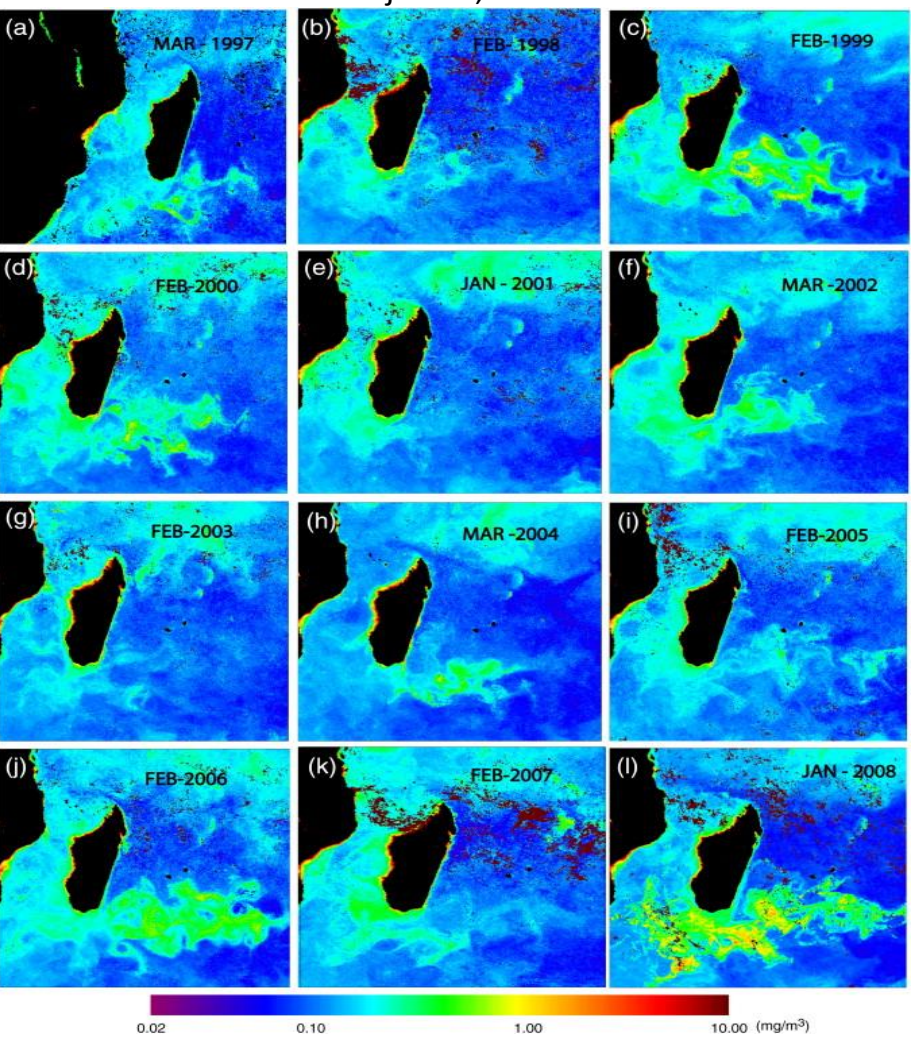


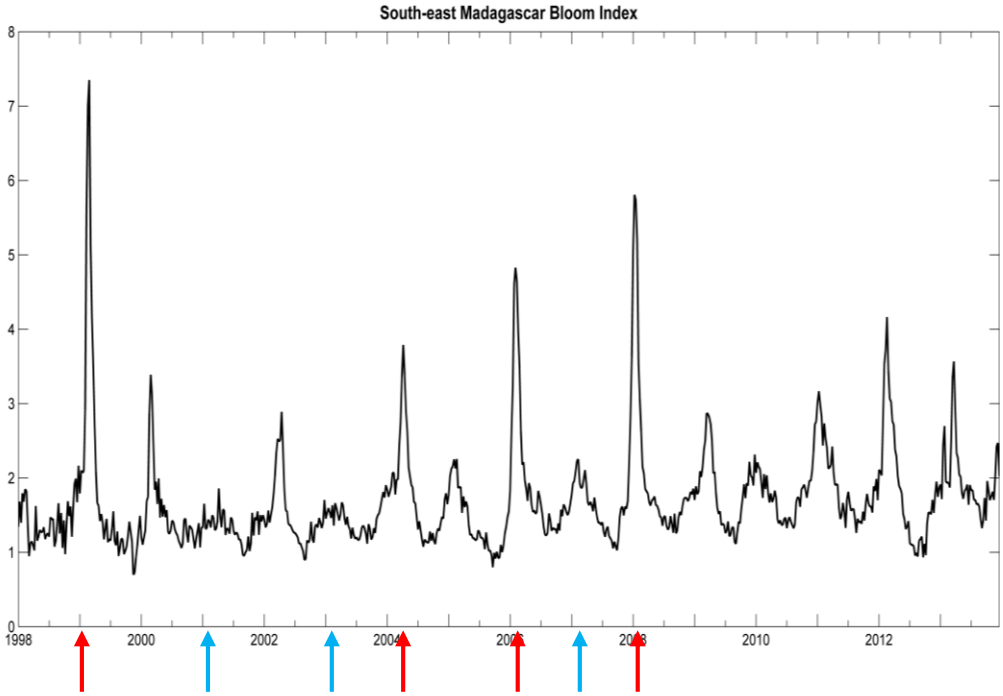
- Unique feature of the South-West Indian Ocean and one of the largest dendroid blooms in the world.
- Can cover up to 2500 km^2 when well-developed (up to 70°E).

❑ **And to ultimately understand the physical mechanisms driving the sporadic South-east Madagascar Phytoplankton bloom.**

Southeast Madagascar Bloom

Raj et al., 2010





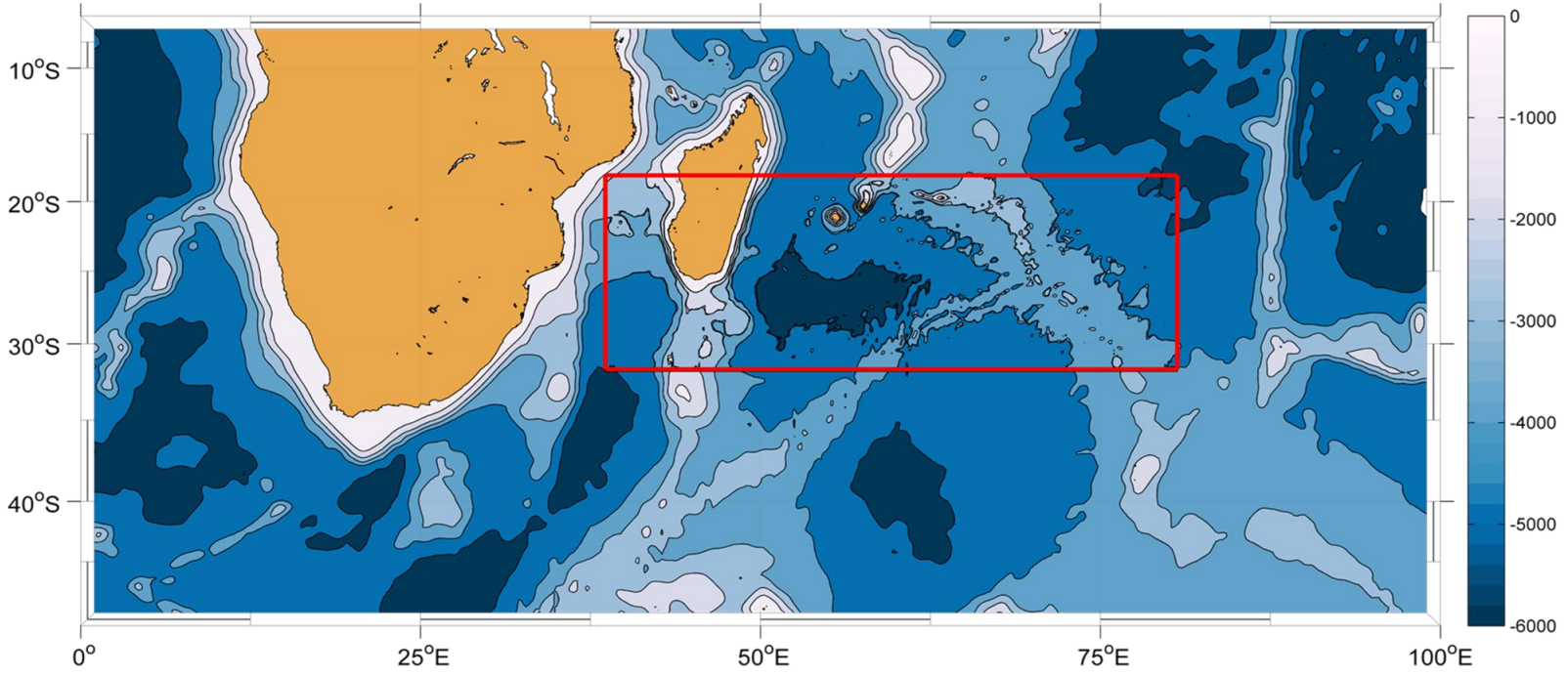
- Unique feature of the South-West Indian Ocean and one of the largest dendroid blooms in the world.
- Can cover up to 2500 km^2 when well-developed (up to 70°E).

❑ **And to ultimately understand the physical mechanisms driving the sporadic South-east Madagascar Phytoplankton bloom.**

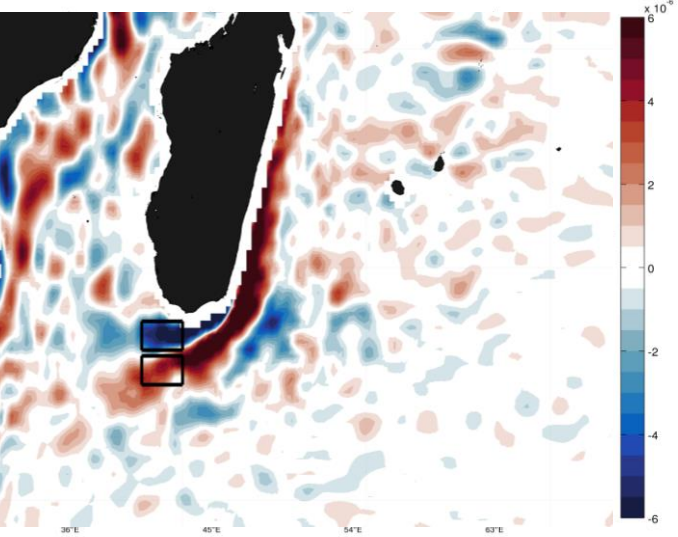
Modeling Work

- Regional Ocean Modeling System (ROMS)
- Parent Domain (1/4°) & Child Domain (1/12°) horizontal resolution.
- Two-way nesting
- Inter-annual Simulation [1993 to 2013]
- Forced by GLORYS2V3-FREE [Boundaries] and ERA-Interim [Surface]

- Coupled with PISCES (Pelagic Interactions Scheme for Carbon and. Ecosystem Studies)
- Forced by BIOMER GLORYS2V3-FREE [Boundaries]



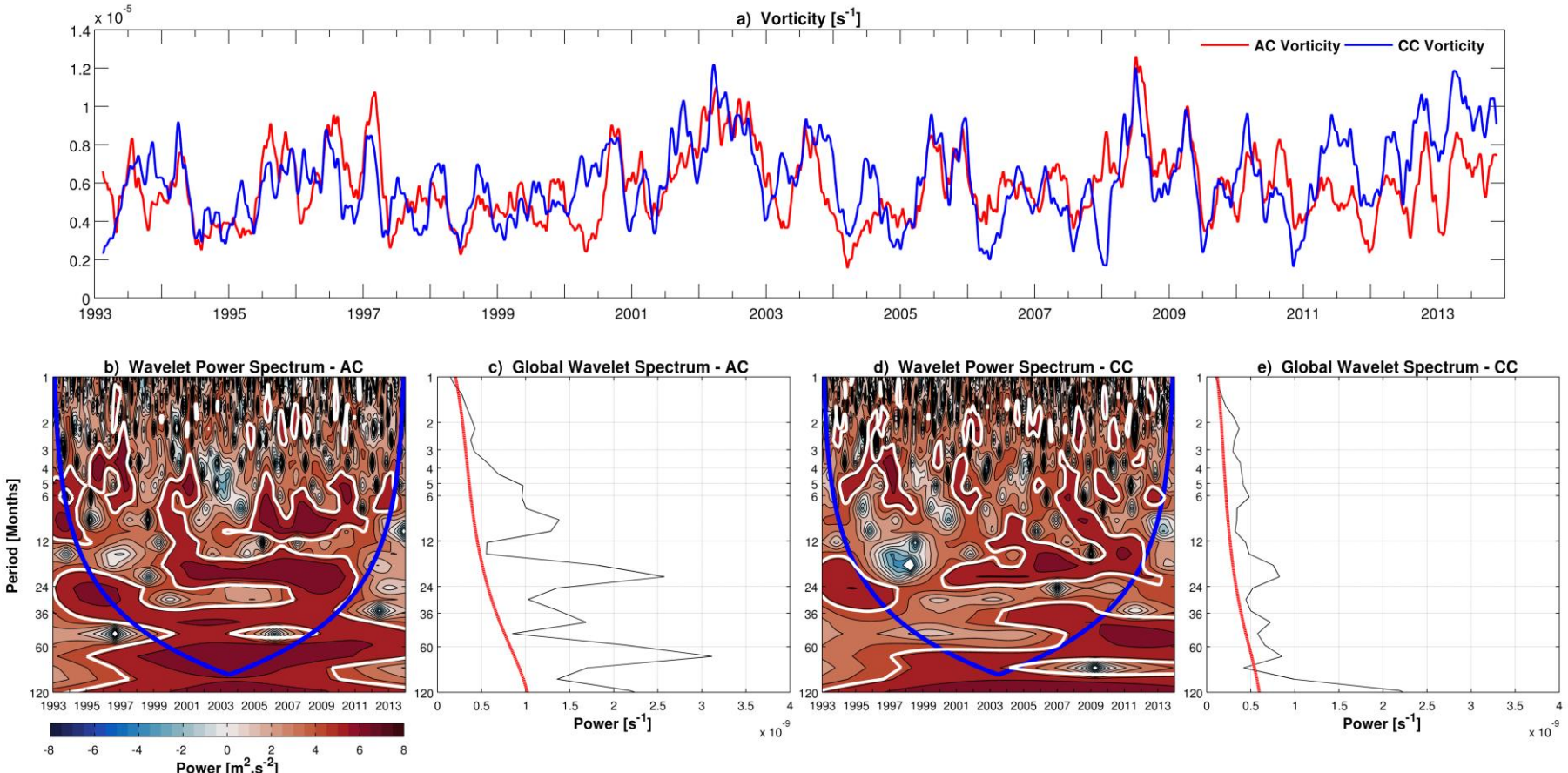
South-West Indian Ocean Model (SWIO)

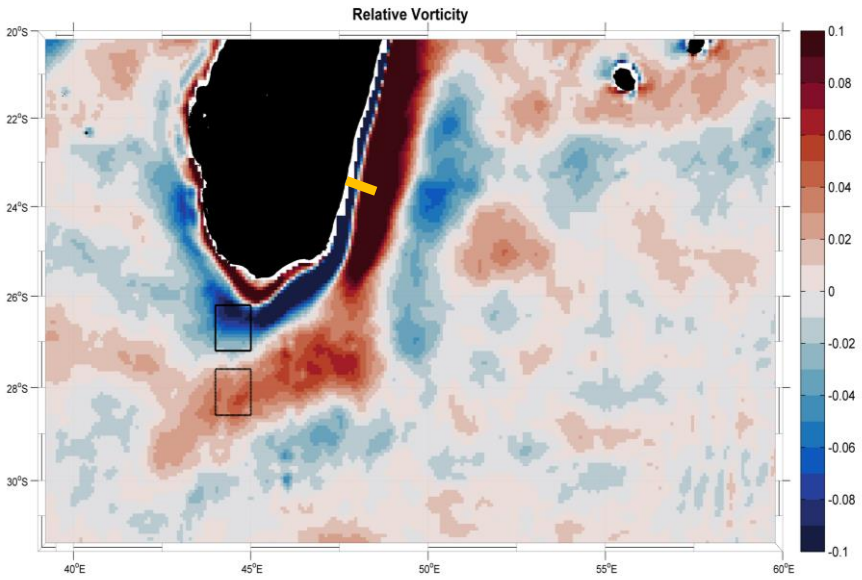


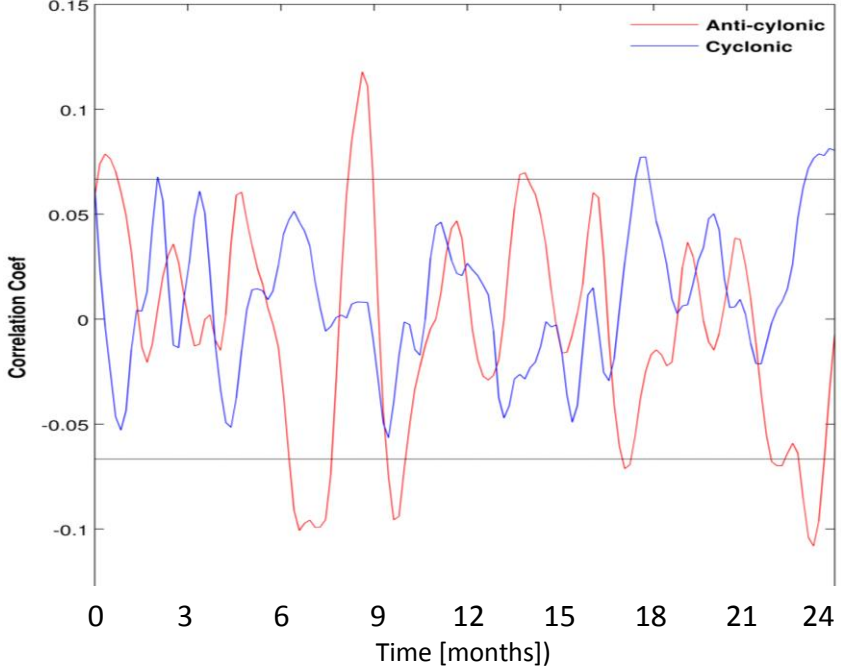
- Anti-cyclonic vorticity is more prominent in the region with a 11-month, 22-months and a 62-months signal.

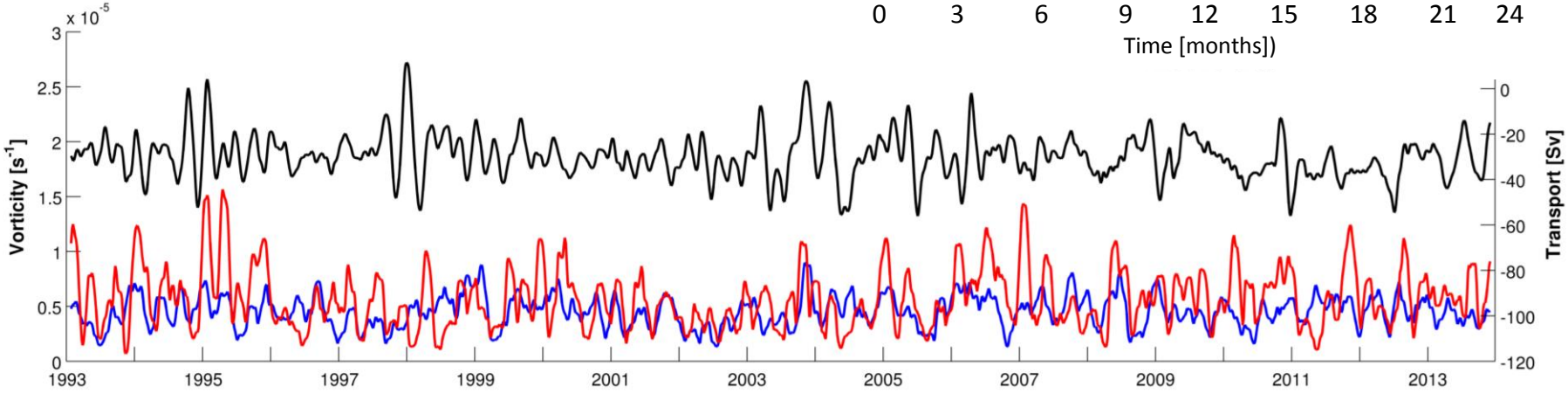
- On another note, cyclonic vorticity peaks mostly at 22-months and 62 months.

Relationship with El Nino









A lag-correlation exists between anti-cyclonic vorticity and the transport of EMC.

Anticyclonic Vorticity →A positive correlation at lag of approximately **1 month** and **8-9 months**
Cyclonic Vorticity →A slight positive correlation at an approximate lag of **2.5 months.**

1-month lag can be due to travel time of eddies from 21°S region to the anti-cyclonic box.
2.5 months lag can be due to bi-modal scale of eddies in the high eddy band at 25°S.

NEXT STEP:

- Correlate those different significant periodicities to other variables (Wind speed? Wind stress curl?)

- Investigate any decadal variability of the EMC termination region.

- How cyclonic eddies and anticyclonic eddies interacting with EMC influence its course?

- Move on to the biogeochemical model outputs and study the South-east Madagascar bloom

NEXT STEP:

- Correlate those different significant periodicities to other variables (Wind speed? Wind stress curl?)

- Investigate any decadal variability of the EMC termination region.

- How cyclonic eddies and anticyclonic eddies interacting with EMC influence its course?

- Move on to the biogeochemical model outputs and study the South-east Madagascar bloom

THANK YOU