IndOOS review: Extreme Events

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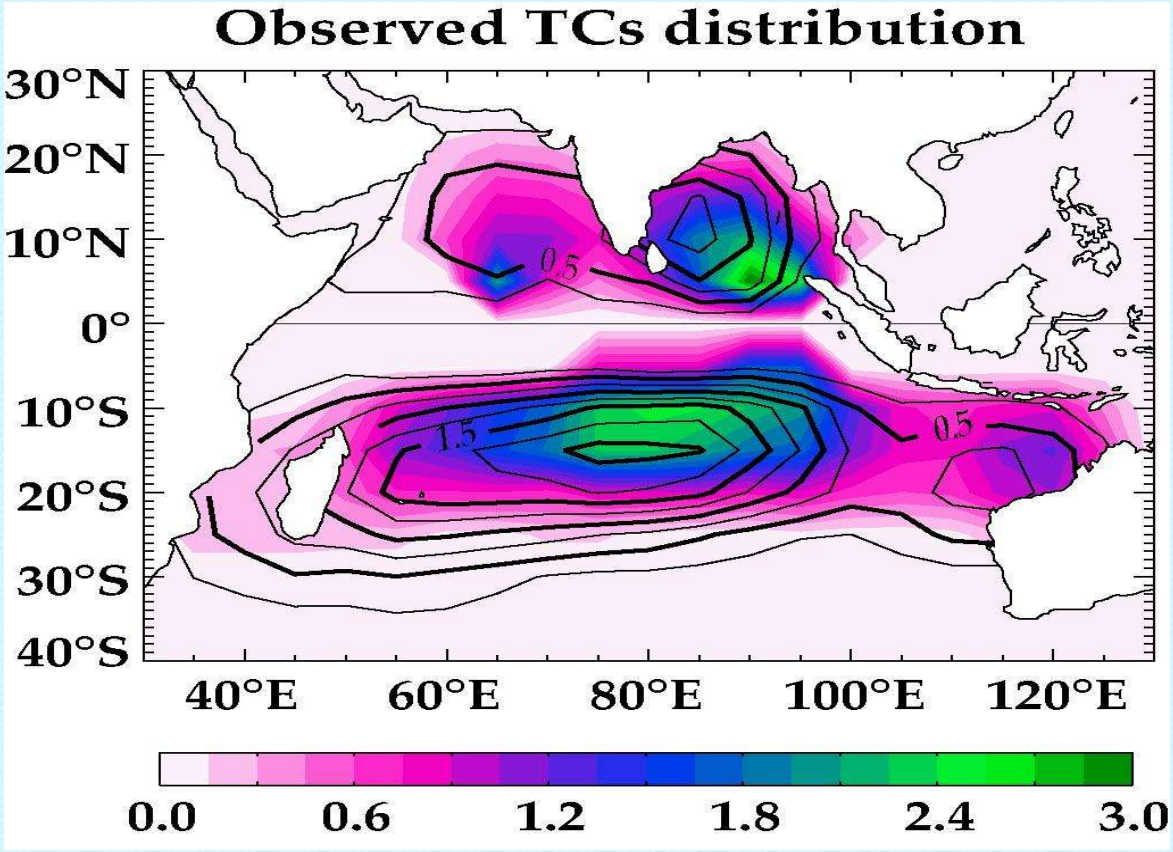
22nd March 2018

Tropical Cyclones: Introduction



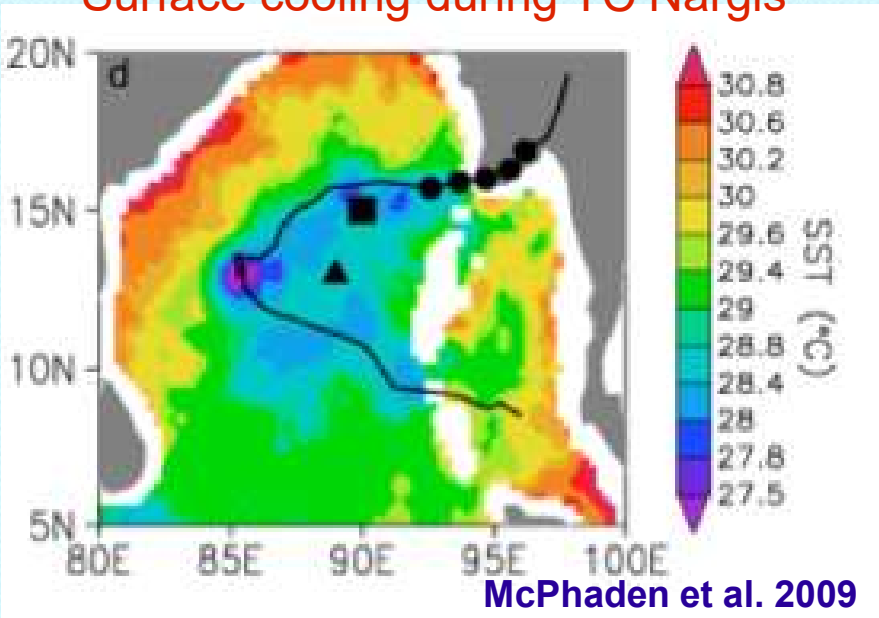
- 21% of global TCs activity in the IO

- BoB only 5% of global TCs activity but accounts for 80-90% of TC fatalities and property loss

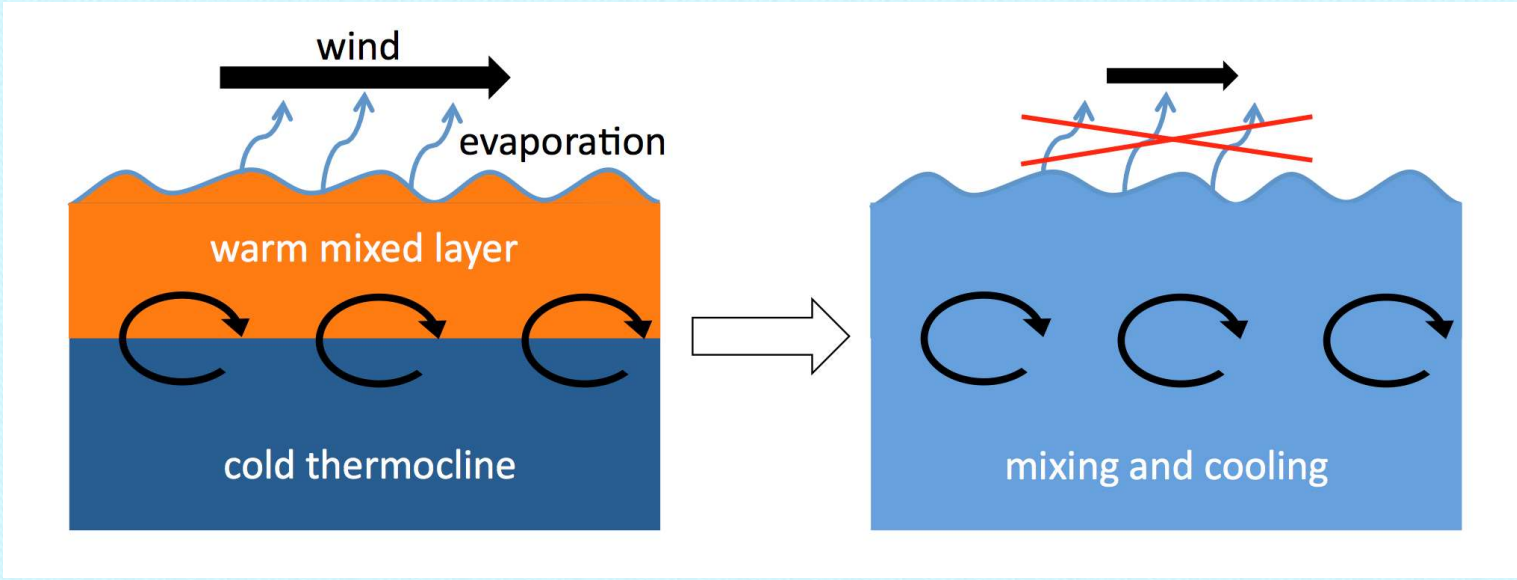
- Low-lying heavily inhabited coastal areas causes disastrous impact

Tropical Cyclones: Air-sea coupling

Surface cooling during TC Nargis

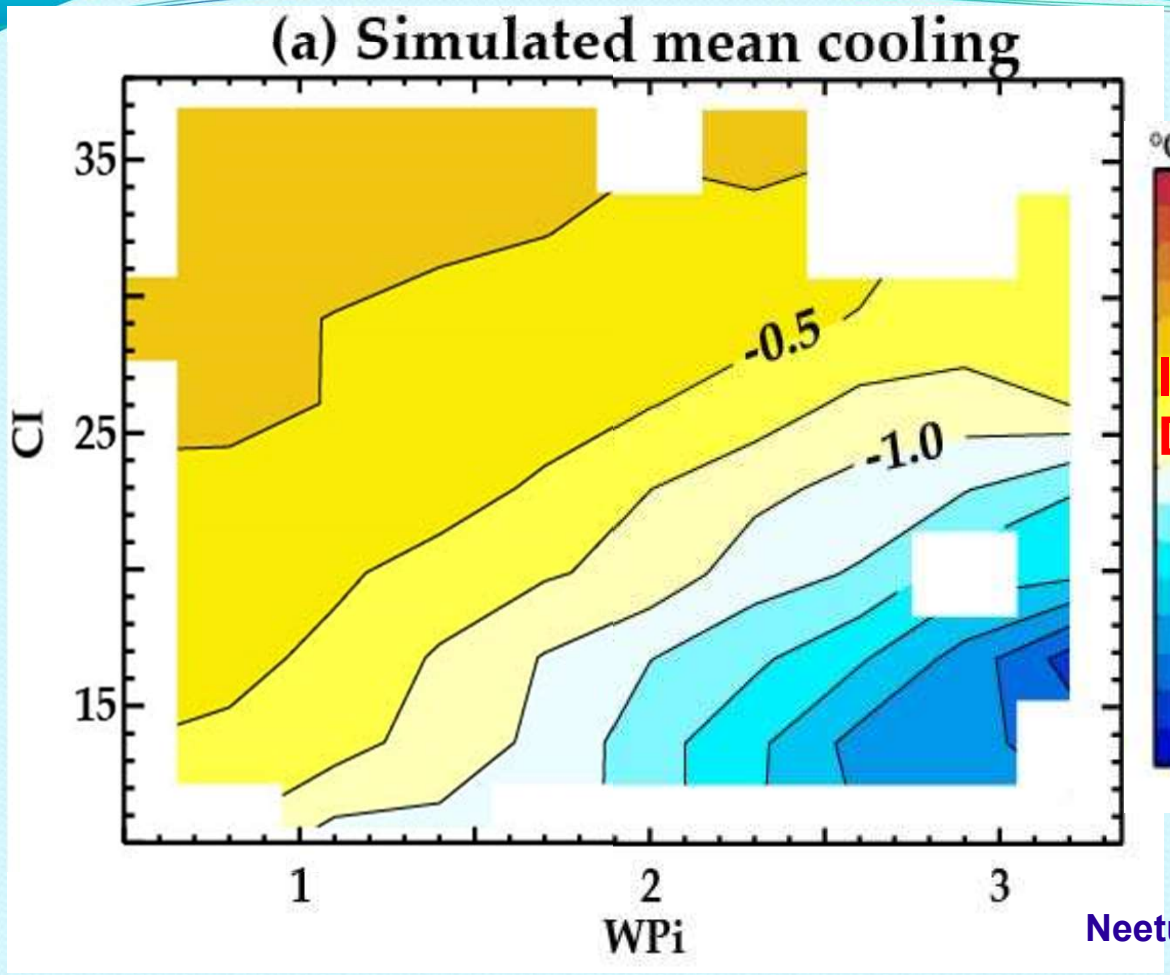


McPhaden et al. 2009



TCs winds → vertical mixing → Surface cooling → decrease in enthalpy fluxes -> less intensification

Tropical Cyclones: Role of upper ocean stratification



Ocean Stratification Index→

Wind Energy Input→

SST cooling :

Increases with TCs wind

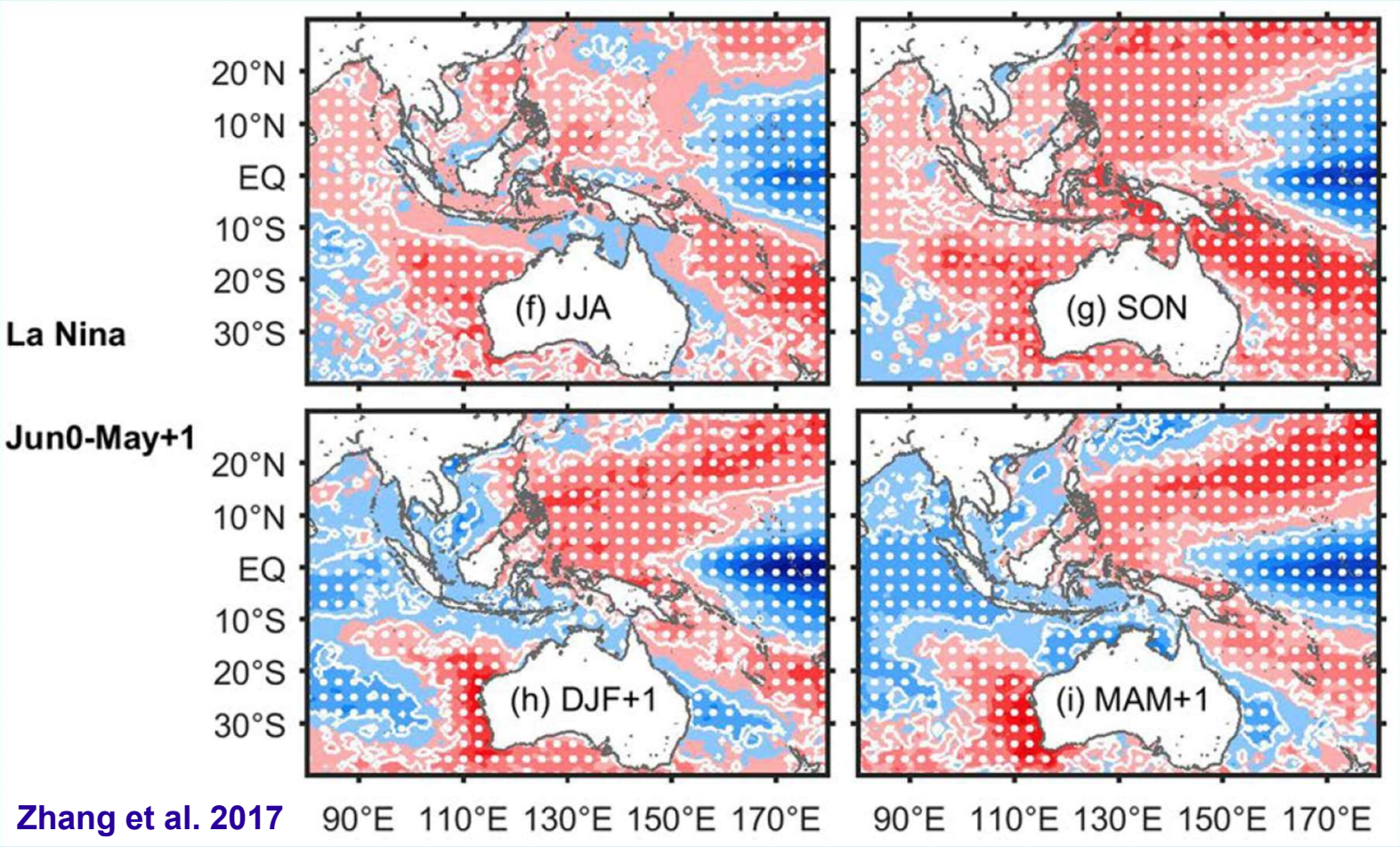
Decreases with ocean stratif.

Neetu et al. 2012

Contrasted thermohaline structure in the IO:

- **Northern Bay of Bengal: sharp salinity stratification**
- **southwestern IO: shallow thermocline lying below warm surface waters.**

Marine Heat Waves



Zhang et al. 2017

- MHWs = episodic warm SST extremes that persist for days to months
- Severely affect ecosystems (coral bleaching, fish community shift)
- Occur along the west coast of Australia and western Indian Ocean
- Related to IOD and ENSO variability

EOVs

TC prone regions:

- **Heat and momentum fluxes, sea level pressure, sea-level and waves (hourly resolution)**
- **Sea Surface Temperature, importance of in situ measurements (hourly resolution)**
- **Upper ocean (0-200m) thermohaline stratification in IO (weekly resolution)**
- **Punctual upper ocean thermohaline and currents profiles (~3hr resolution) in northern BoB and thermocline ridge**

Marine Heat Waves:

- **Boundary current systems in the IO**
- **Mixed layer processes and air-sea fluxes in the MHW hotspots**

Actionnable recommandations

1. **Maintain satellite observations and intercalibration-work (wind and SST in rainy/cloudy regions) to monitor TCs surface signature (e.g. MEGHA-TROPIQUES)**

2. **Maintain satellite altimetry and coastal tide-gauge measurements (BoB). Encourage development of high repetitive constellation of altimeter satellites , e.g. Jason-2, SARAL, SWOT to improve surge monitoring**

3. **Encourage drifters deployment with barometers (TC-prone regions). Experiment drifting buoys with surface measurements (pressure, wind, temperature etc…) to improve monitoring of TCs surface signature**

4. **Maintain the Argo network in the IO. Encourage deployment of Iridium profilers (TC-prone regions to provide higher temporal-resolution upper ocean observations near TCs**

5. **Maintain the RAMA meridional sections at 55° E and 90° E and all moorings in the southwestern IO (between 55° E and 80° E south of 5° S) to monitor the thermohaline stratification in the IO TC-prone regions**

6. **Establish a RAMA flux mooring site in the Northwestern Australian basin (~15° S; 120° E) to be able to capture the MJO and TC evolution and dynamics in the region**

7. **Establish or maintain ocean boundary current observing systems (Leeuwin, Agulhas) for Marine Heat Waves**