SPATIAL AND TEMPORAL CHANGES OF THE WINTER BLOOM IN THE ARABIAN SEA DURING THE PAST TWO DECADES

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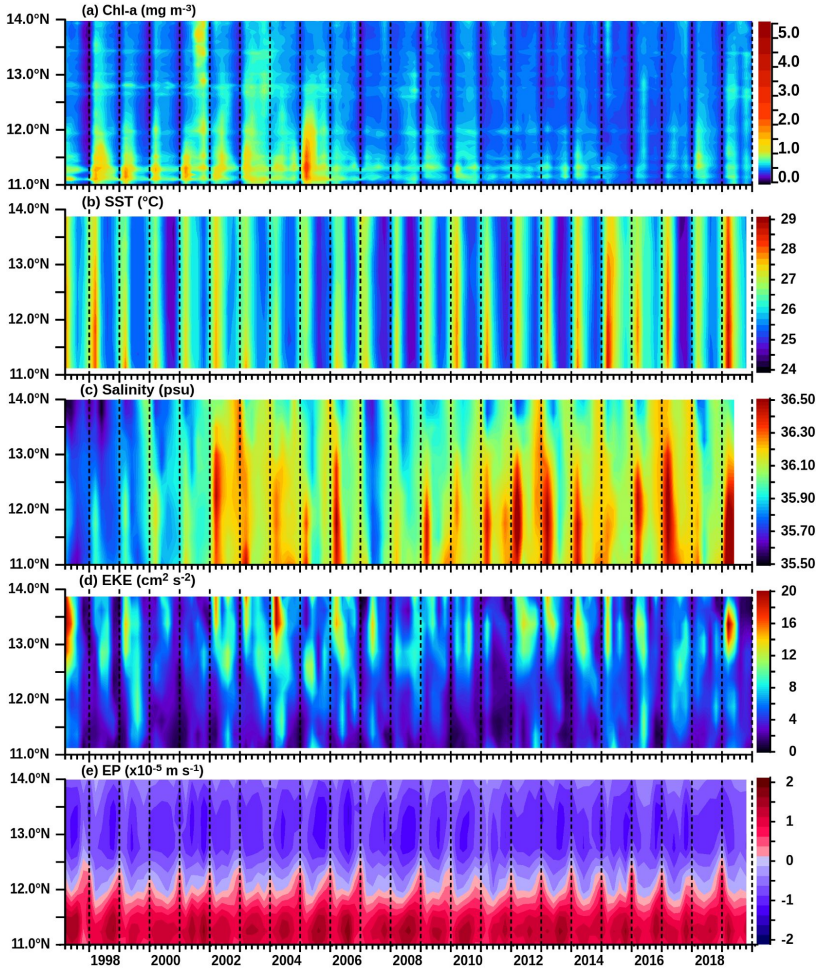
SUPPLEMENTARY FILES

Inter-annual changes in bloom and drivers

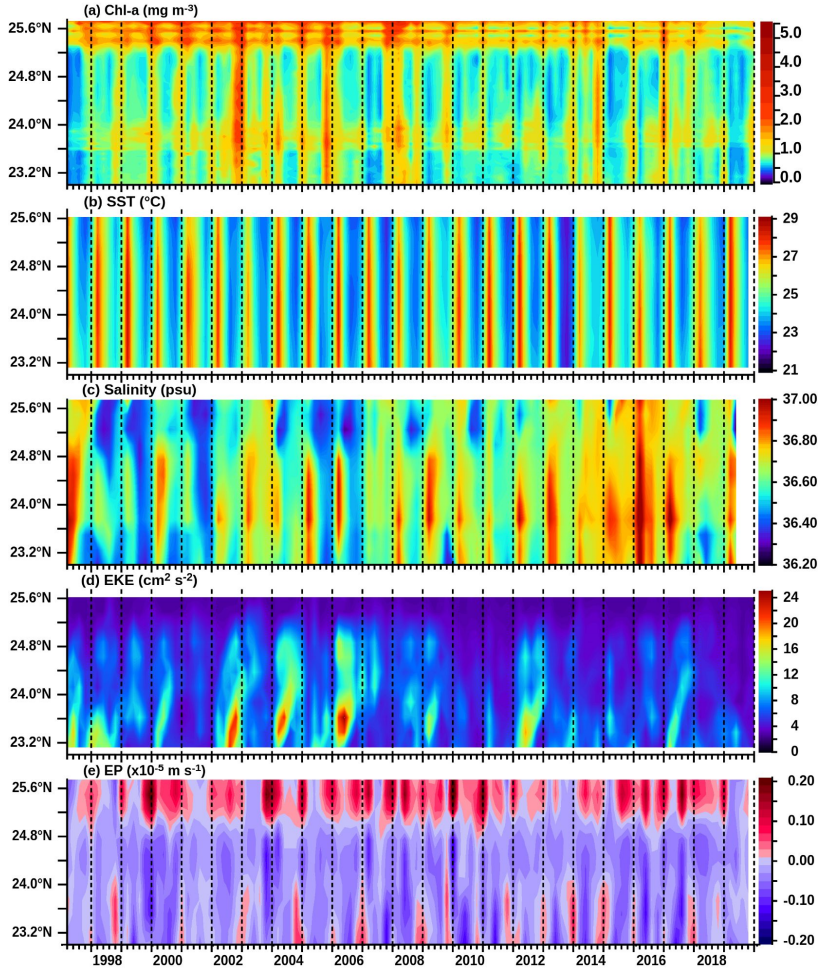
Gulf of Aden

- High Chl-a concentrations in the south, which weakens in the recent decade
- Inverse relation between SST and bloom is weak: bloom peak and SST minimum are not in agreement
- Weakening of bloom in recent decades
  - Increase in SST: **Stratification** and poor nutrient supply
- No considerable changes in EKE and EP
  - **Secondary role** in governing long-term variation



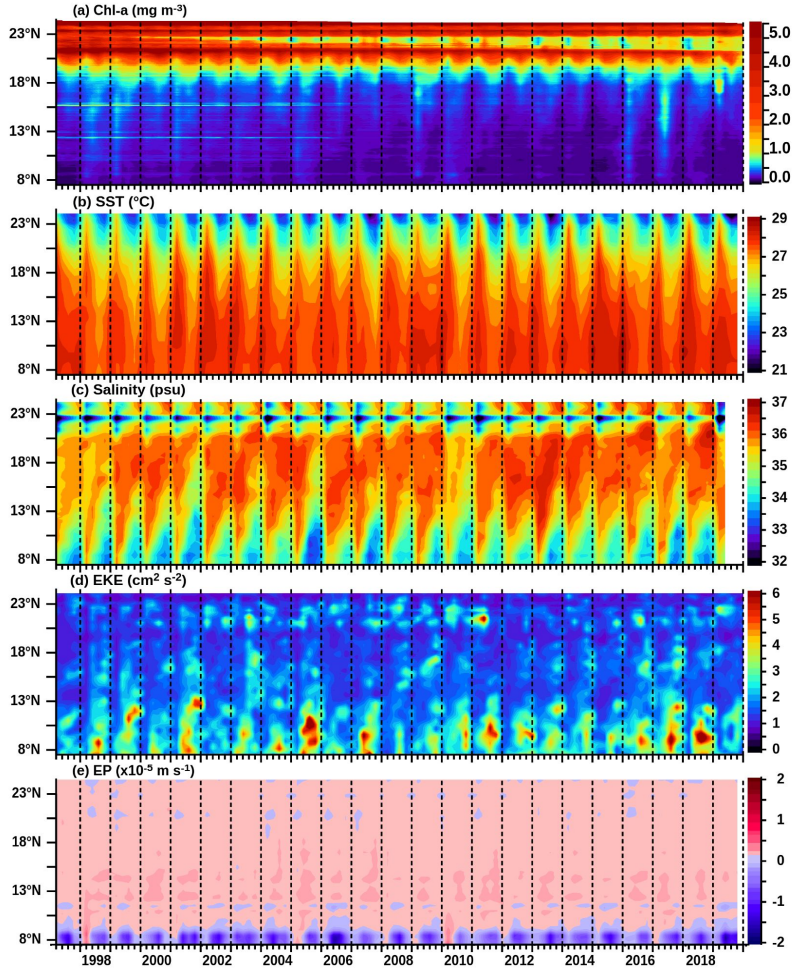
Gulf of Oman

- Weakening of bloom is evident
- Strong inverse relation between SST and bloom peak: bloom peak coincide with low SST
- **High salinity events** (>36.5 psu) during 2013–2017 adversely affects bloom
- Decrease in EKE is analogous to the drop in Chl-a
- Uneven EP distribution in GO

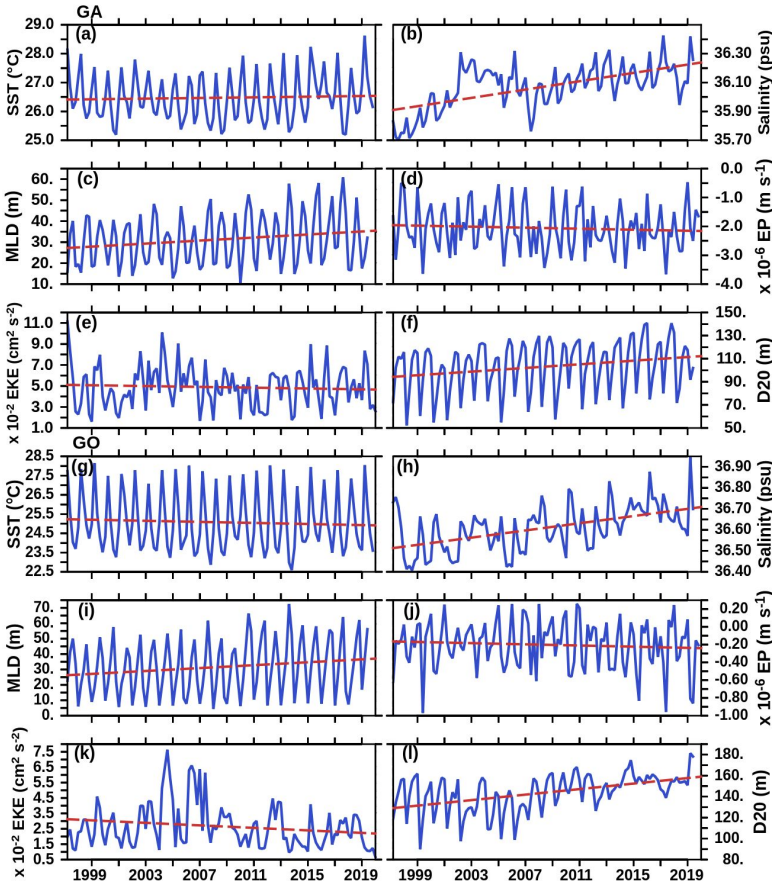


West coast of India

- Winter bloom is mainly confined to **north of 18° N**
- Southward extension of high Chl-a matches with intrusion of **low SST**
- Significant change in the bloom pattern from 2003 onwards
  - Chl-a in 20° N (Gulf of Khambhat) in November is found to be decreasing
- EKE and EP exhibits poor inter-annual variability
  - Minimal influence in long-term variation of bloom



Role of drivers

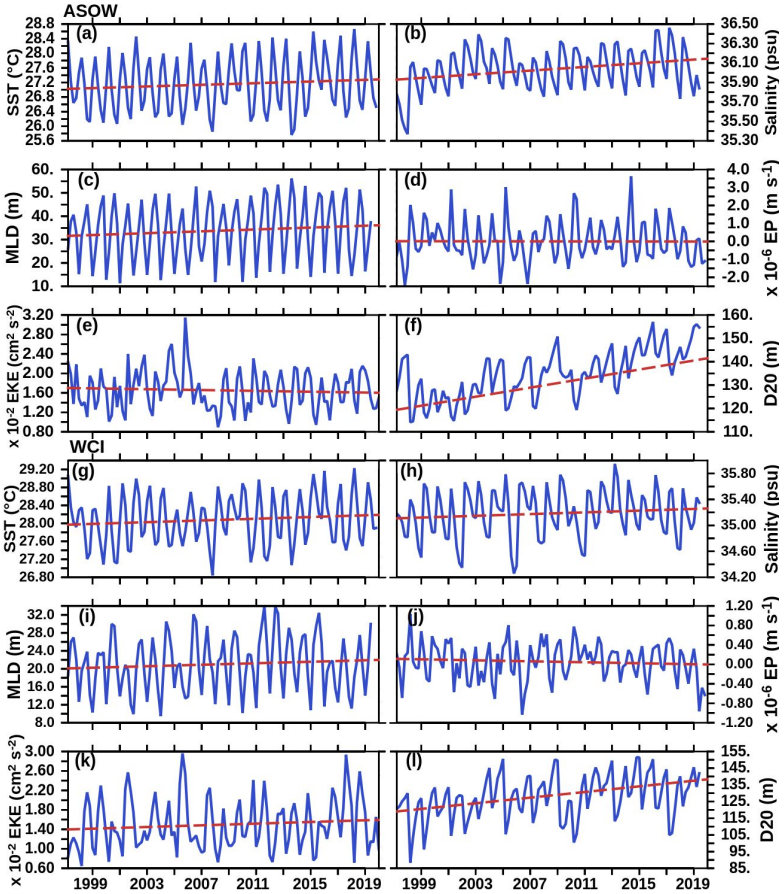


GA:

- Warming (**0.009° C yr $^{-1}$**)
- Decline in the coastal upwelling (**– 1.1 × 10^{-8} m s^{-1} yr^{-1}**)
- Eddy activity (**– 1.19 × 10^{-4} cm^{2} s^{-1} yr^{-1}**)

GO:

- Despite the cooling (**– 0.0053 ° C yr^{-1}**)
- Deepening of MLD (**0.22 m yr^{-1}**)
- Variability in Chl-a follows EKE (- **3.95 × 10^{-4} cm^{2} s^{-1} yr^{-1}**) and D20 (**0.22 m yr^{-1}**)



ASOW:

- Deepening of MLD (**0.14 m yr^{-1}**)
- D20 (**0.92 m yr^{-1}**)

WCI:

- Strong warming (**0.011 °C yr^{-1}**)