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What drives the biological productivity of the northern Indian Ocean?

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The northern Indian Ocean comprises of two tropical basins, the Arabian Sea to its western side and the Bay of Bengal in the eastern side separated by the Indian peninsula. Northern Indian Ocean houses one of the highest biologically productive regions of the world – the Arabian Sea. The high biological productivity of the Arabian Sea is driven by a series of physical forcing which changes seasonally in accordance with the semi-annual switching of the atmospheric forcing between the strong (~15m/s) southwesterly summer monsoon (June-September) winds and comparatively weak (~5m/s) northeasterly winter monsoon (November-February) winds. In winter the high biological productivity is triggered and sustained by winter convection and nutrient injection into the euphotic zone, where as the summer blooms are triggered by the coastal and open ocean upwelling and advection of nutrient-rich waters into the euphotic zone. Though situated in similar latitude and subjected to similar atmospheric forcing, the biological productivity of the Bay of Bengal is regulated by a set of different mechanism compared to the Arabian Sea. The large river-run off during summer monsoon introduces nutrients to the surface waters especially near the river mouths as well as the northern Bay where Ganges-Brhamaputra river system empties. While this could potentially support high biological productivity, the associated sediment load could curtail the light penetration and limit carbon fixation. In addition, the large fresh-water flux introduces strong stratification, which in turn could inhibit wind-driven mixing of upper ocean waters, which is one of the mechanisms of nutrient supply to euphotic zone. The measurements in recent years suggest the role of sub-surface cold-core eddies in the biological productivity of the Bay of Bengal and we are beginning to understand it. Tropical cyclone, which occur regularly during spring and fall Intermonsoons are yet another mechanism which is capable of fertilizing the Bay and we are yet to understand this.