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PROPERTIES OF TRICHODESMIUM: nitrogen-fixing bacteria

- * Gas vacuoles: highly reflective
- * Blue-rich reflectance (Subramanian et al. in press)
- * Requires extra iron to synthesize nitrogenase (e.g. Reuter et al. 1992; Lenos et al. in press)
- * Most excess iron provided to the outer continental shelves of the Gulf of Mexico comes from Saharan dust
- * TRICHODESMIUM provides nitrogen to phosphorus-rich, silica-poor Gulf waters to support *G. breve* red tides (Walsh and Steidinger, submitted)
- * Two found in 2000: Texas shelf and West Florida shelf

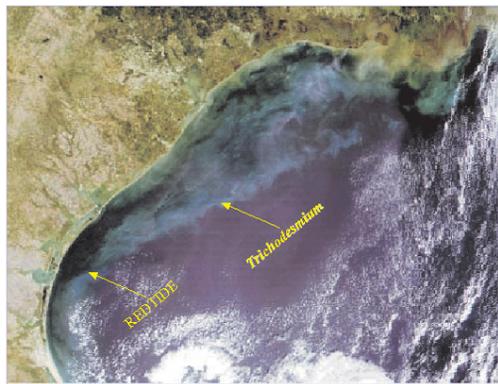


Figure 1 Red tide (black) and Trichodesmium (aqua), 29 September 2000

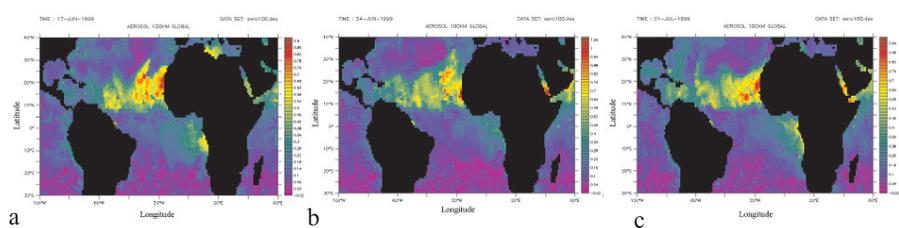


Figure 3 AVHRR imagery of the 1999 aerosol optical thickness of the atmosphere, adjacent the Sahara Desert and above the Gulf of Mexico, during a) 17 June, b) 24 June, and c) 1 July – from the Satellite Active Archive at PMEL (Lenos et al. 2001)

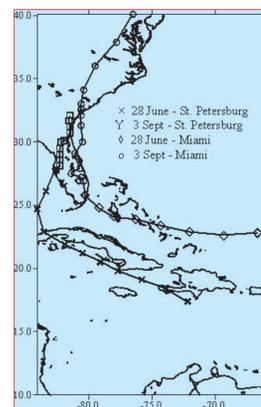


Figure 4 The daily backward trajectories, computed with HYSPLIT, representative of air mass flow at 500, 1000, and 3000m above ground/sea level over a 90-h period ending at 1800 h on 28 June 1999 and on 3 September 1999 from St. Petersburg and Miami

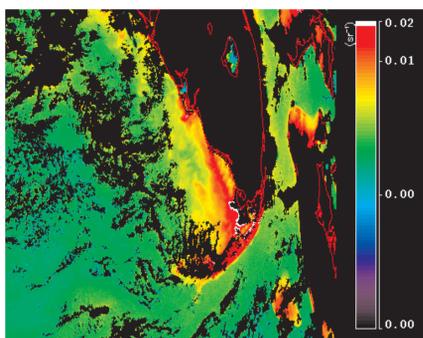


Figure 5 rrs555 from SeaWiFS: note the bottom-reflected radiance that perturbs algorithms

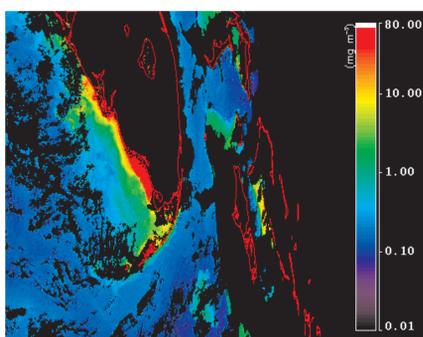


Figure 6 Chla: note high values correspond to high rrs(555) values

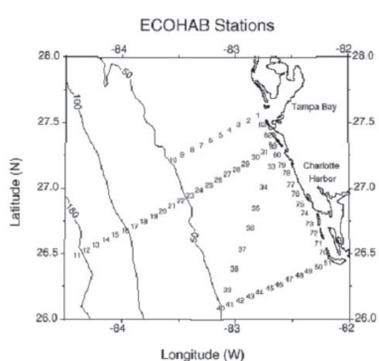


Figure 7 ECOHAB cruise track of monthly surveys on the central West Florida shelf, between Tampa Bay and Charlotte Harbor

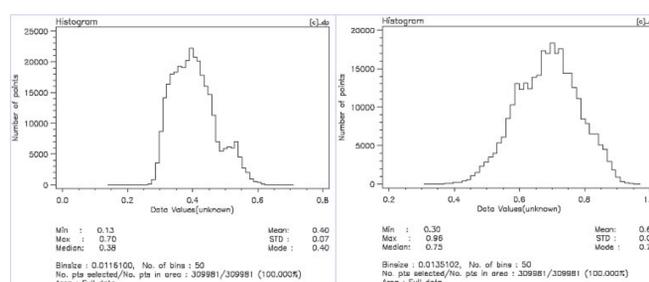
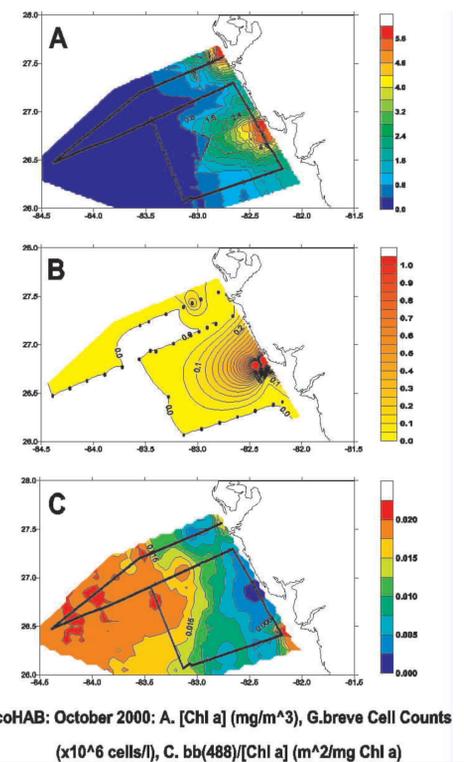


Figure 9 Histograms of corrected (a: left) and uncorrected (b: right) chlorophyll-a concentrations retrieved from AVIRIS-simulated MODIS data for the image in Figure 8



EcoHAB: October 2000: A. [Chl a] (mg/m³), G.breve Cell Counts (x10⁶ cells/l), C. bb(488)/[Chl a] (m²/mg Chl a)

Figure 2 *G. breve* has a very low chlorophyll a specific backscattering, producing very dark patches where red tides predominate

Conclusions

- * For the first time a major red-tide bloom (low chlorophyll-specific backscatter) is seen in satellite imagery juxtaposed with a gigantic nitrogen-fixing Trichodesmium bloom (high, blue-rich backscatter)!
- * Imagery from MODIS confirms! Coincidence???
- * Walsh and Steidinger say No!!!
- * “Iron-rich Saharan dust stimulates Trichodesmium blooms in phosphorus-replete and nitrogen- and silica-poor regions of the Gulf of Mexico”
- * Nitrogen from Trichodesmium blooms fuels red-tide blooms of *Gymnodinium breve* as demonstrated in 1999.
- * Quantification of optical properties of phytoplankton in optically shallow waters using MODIS channels now possible for earlier detection of red-tide blooms!!

References:

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