Seasonal Variability of surface chlorophyll concentrations in the NW African upwelling region

Yaswant Pradhan and Dr Samantha Lavender

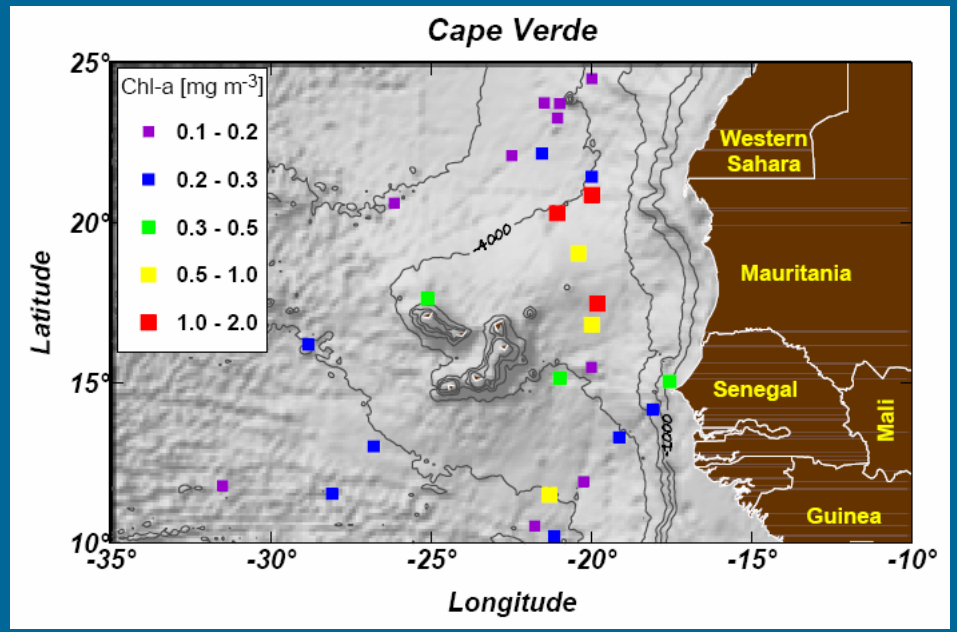
University of Plymouth

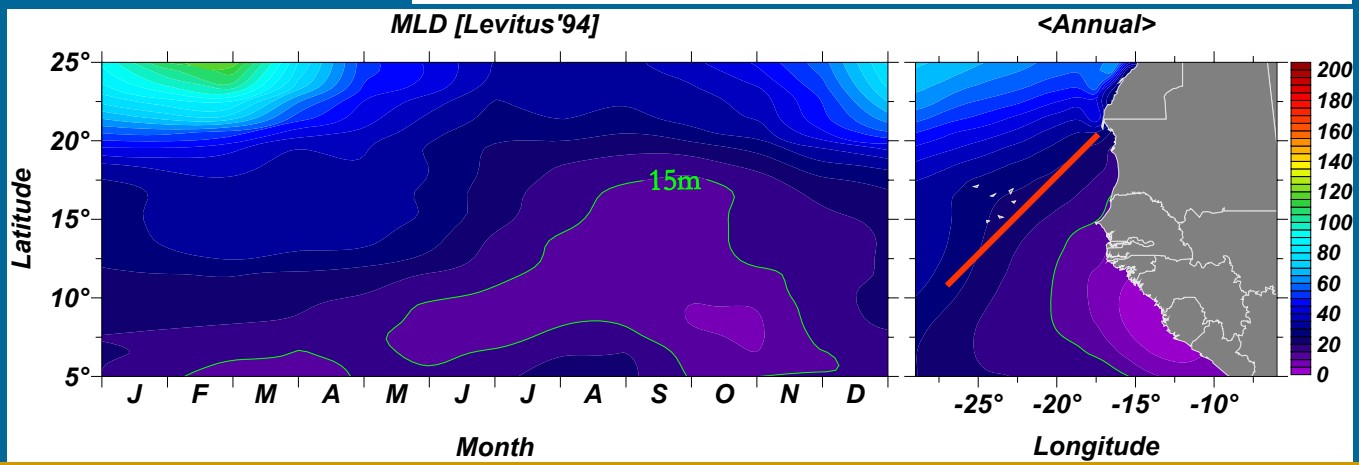
Sensing and Mapping the Marine Environment 2, Institute of Physics, London , 5/4/2005

The Mauritanian upwelling system

Top:
Bottom topography and
Surface Chl-*a* concentration

Bottom:
L- Monthly mixed layer depth
R- Annual mean climatology





Data: NASA-SeaBASS, NGDC-ETOPO5, IRI-LDEO

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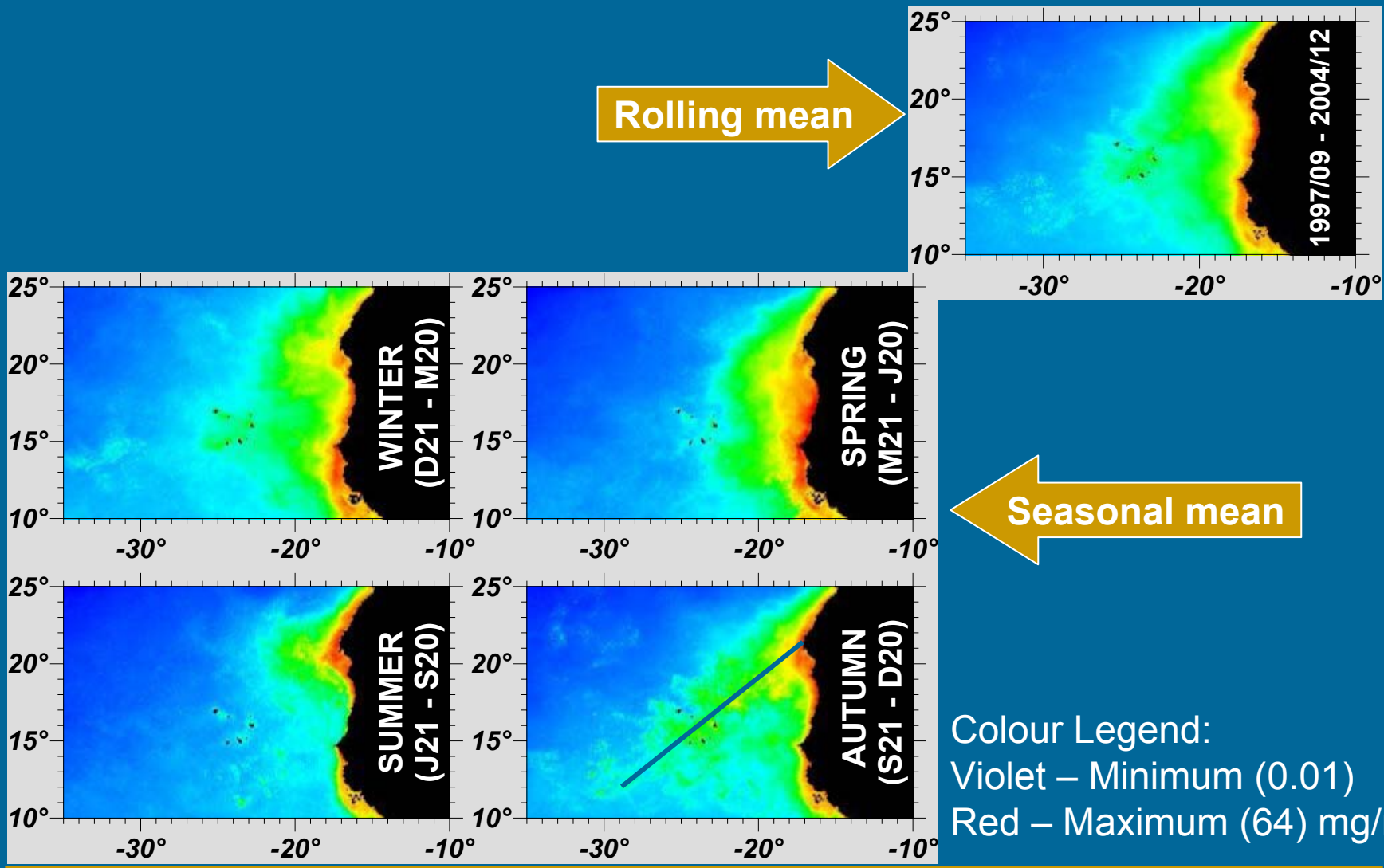
SeaWiFS Chl-*a* - Seasonal climatology



Colour Legend:
Violet – Minimum (0.01)
Red – Maximum (64) mg/m^3

Data: NASA-SeaWiFS v4

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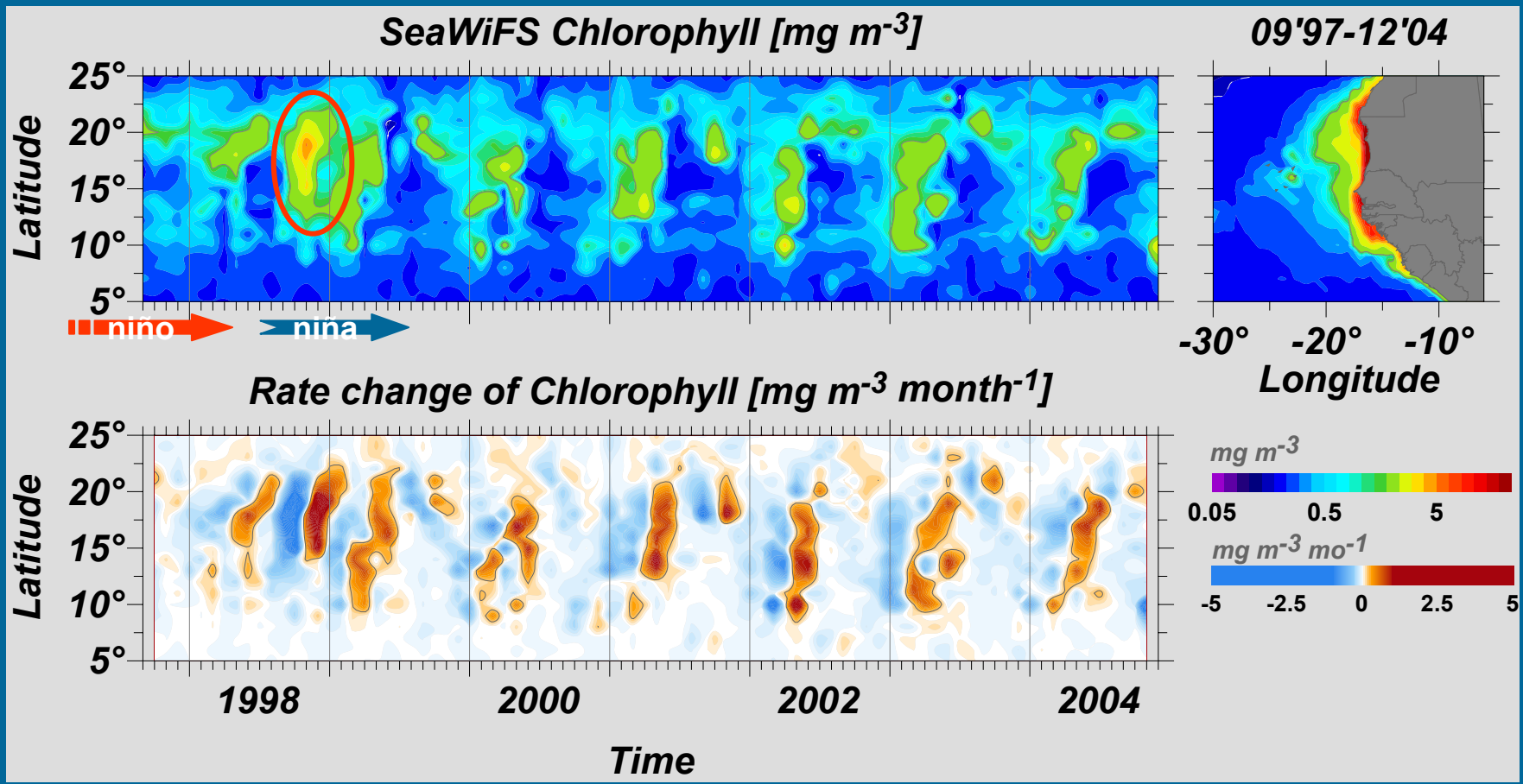
Time evolution of meridional Chl-*a*



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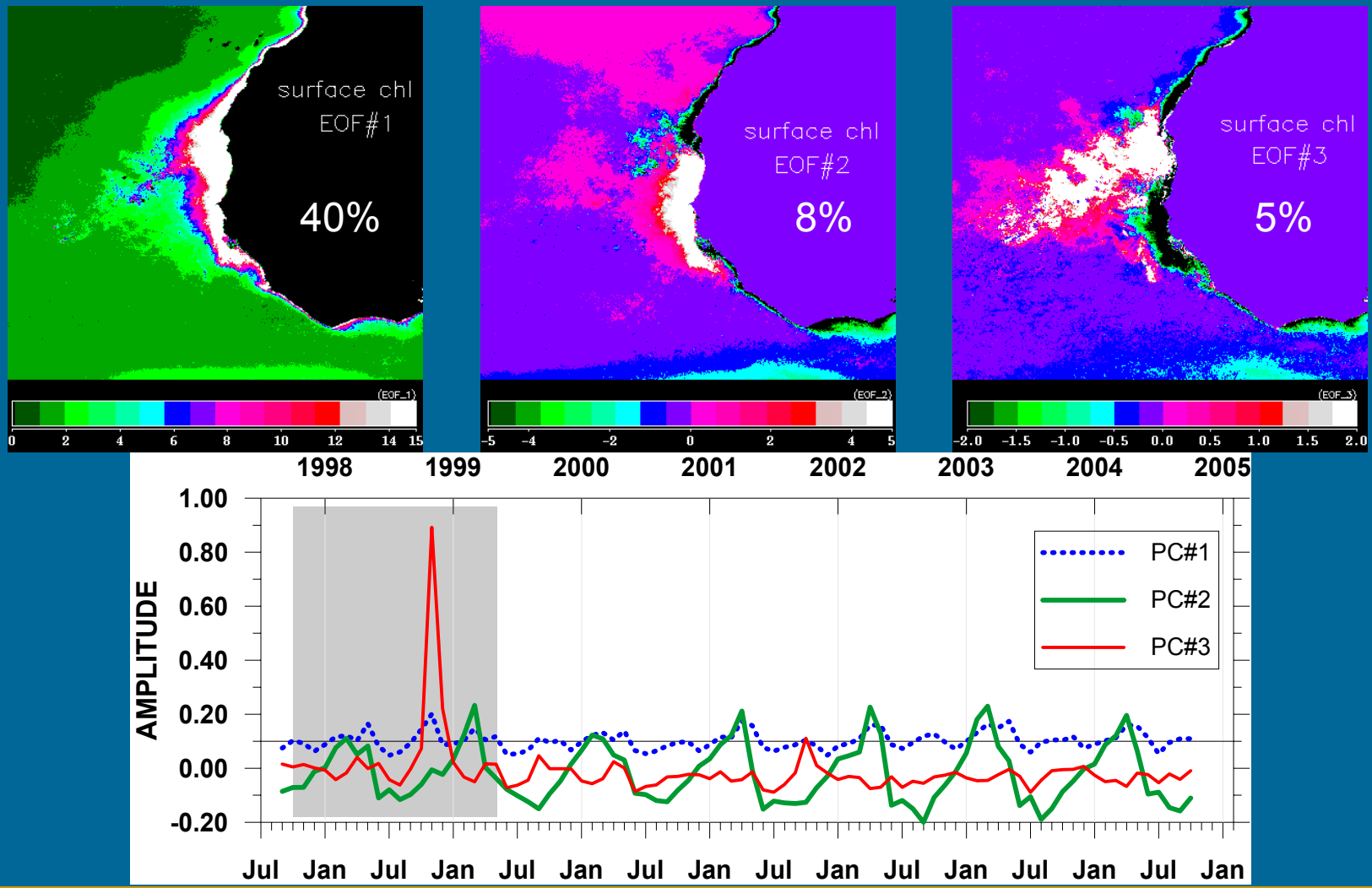
Data: NASA-SeaWiFS v4

Principal modes of Chl-*a* variability



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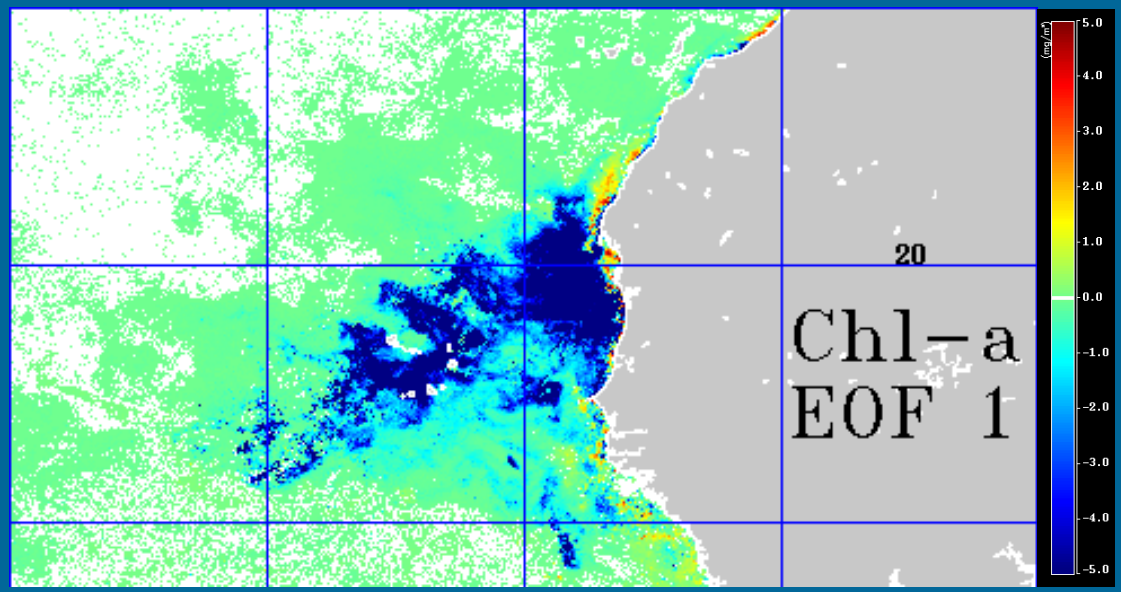
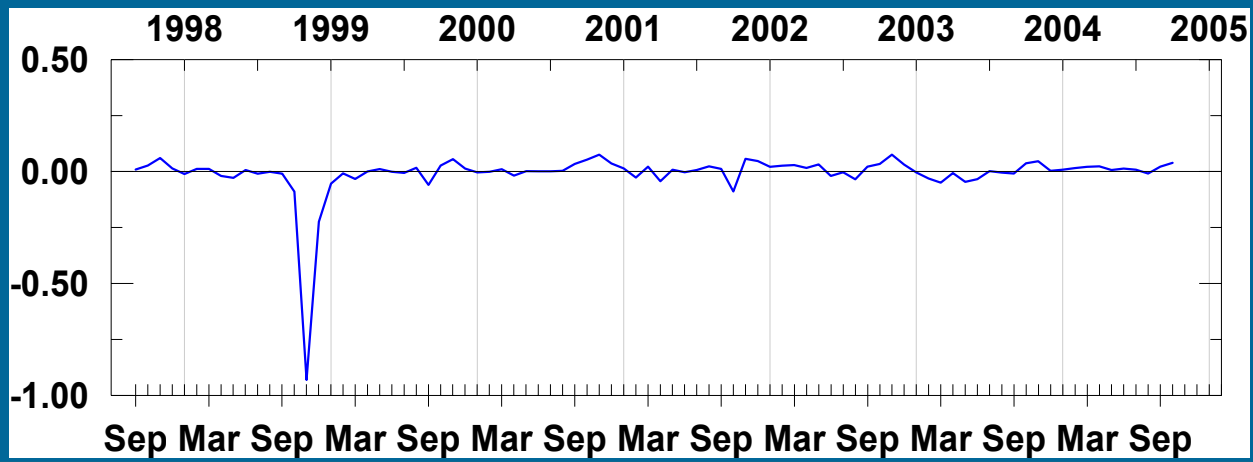
Data: NASA-SeaWiFS v4_L3m

PCA on de-seasoned Chl-*a*





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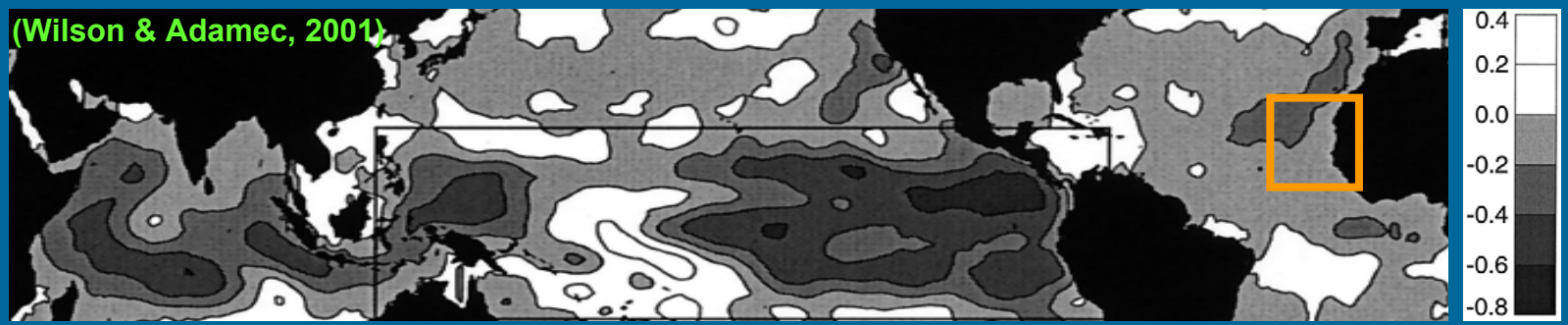
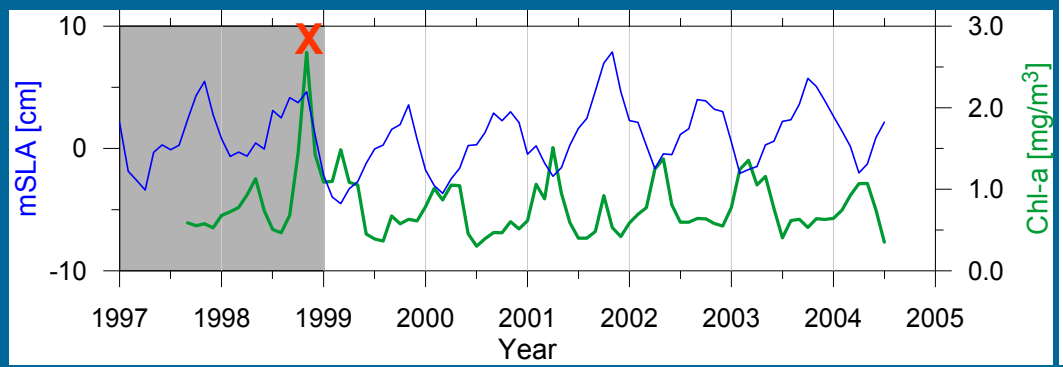
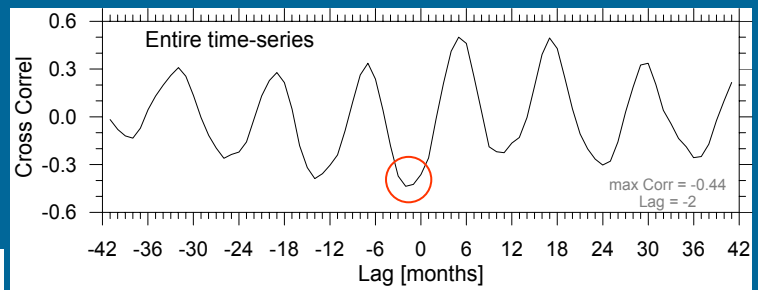
Data: NASA-SeaWiFS v4

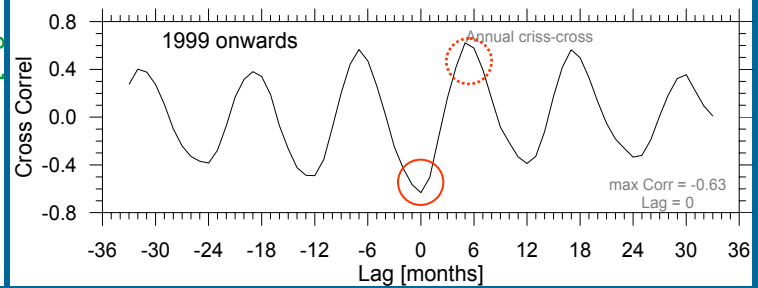
Chl-*a* V SSH - Spatial & Temporal correlation



Spatially averaged [10°-25°N/30°-10°W] time-series







Data: CLS-AVISO/CNES

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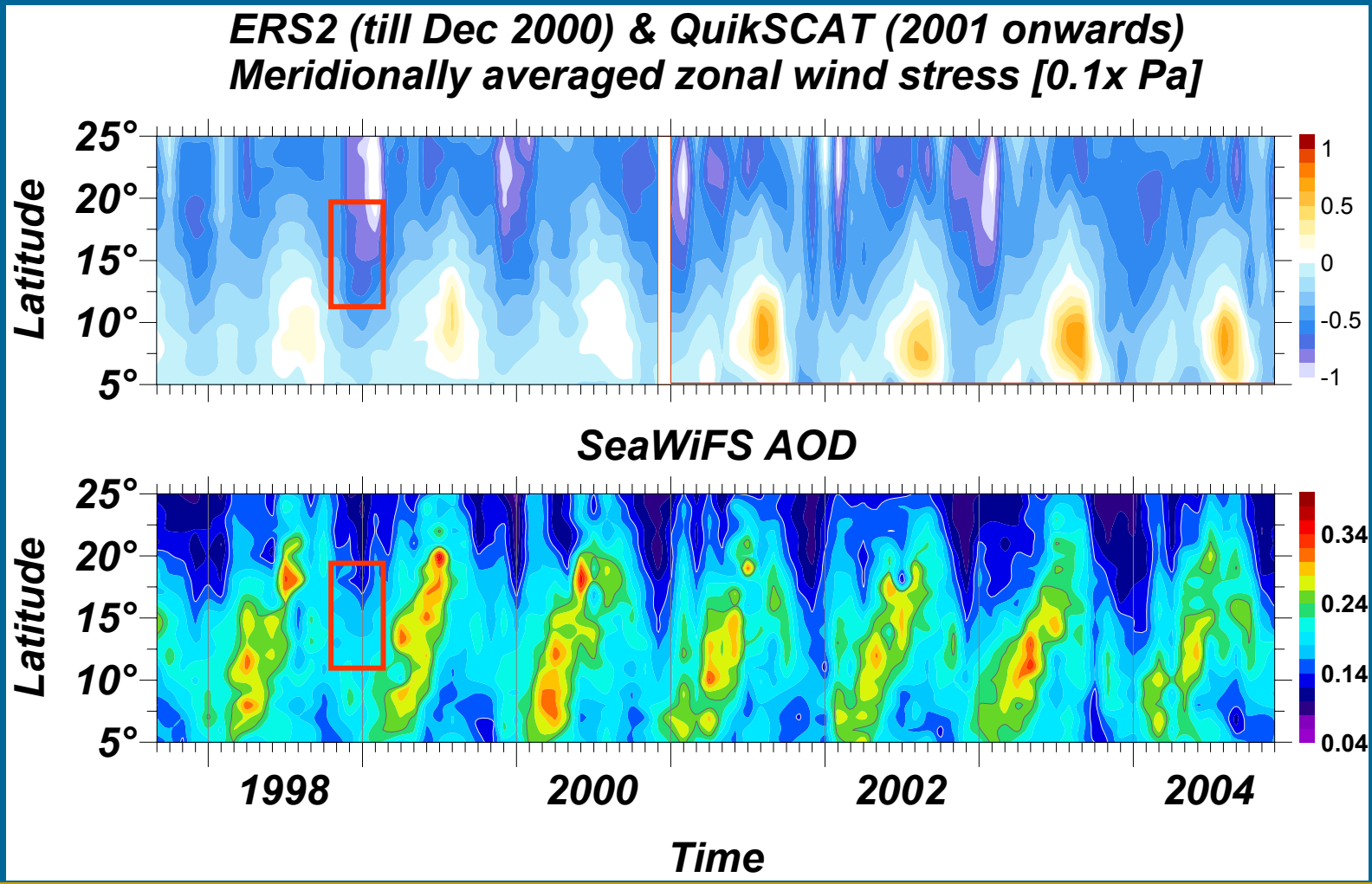
Zonal wind-stress and Aerosol loads



Data: CERSAT-IFREMER; NASA-SeaWifS v4

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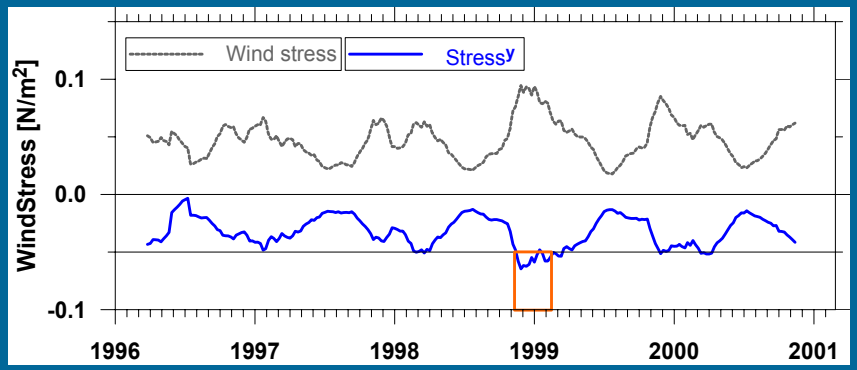
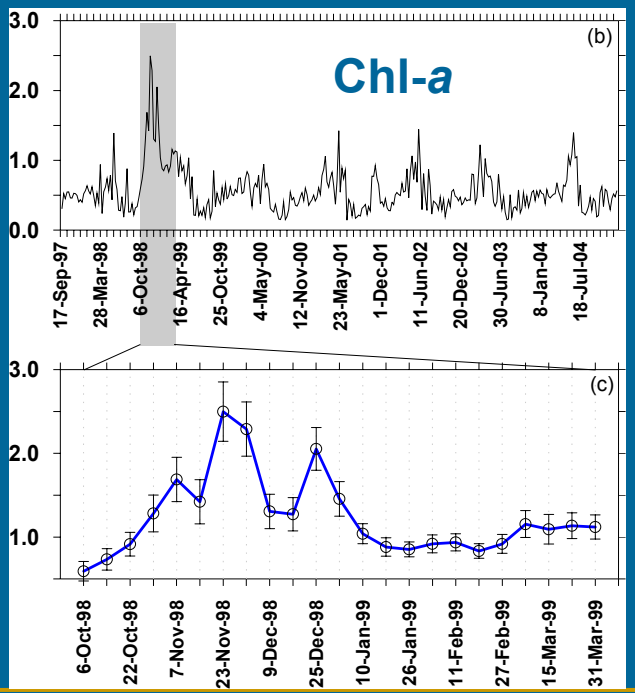
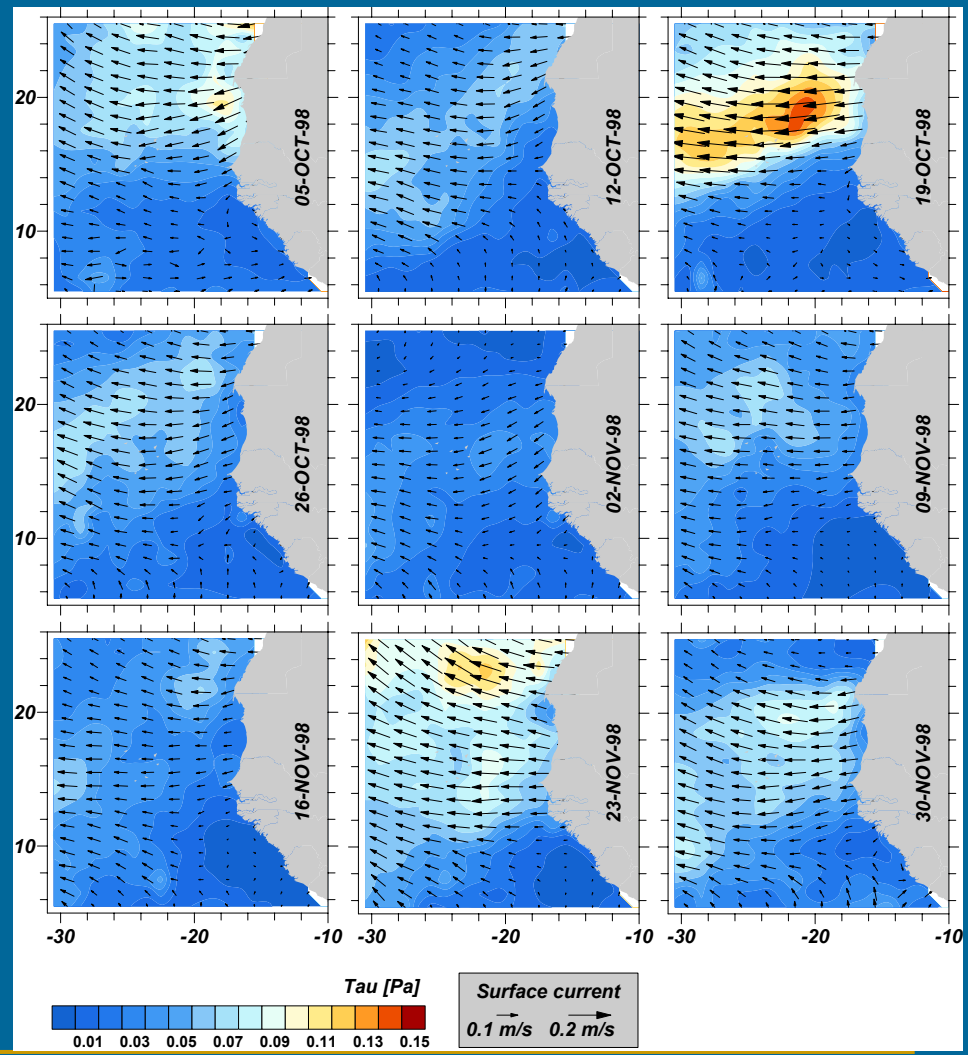
Wind-stress^{y} and sporadic upwelling…







Data: CERSAT-IFREMER; NASA-SeaWifS v4

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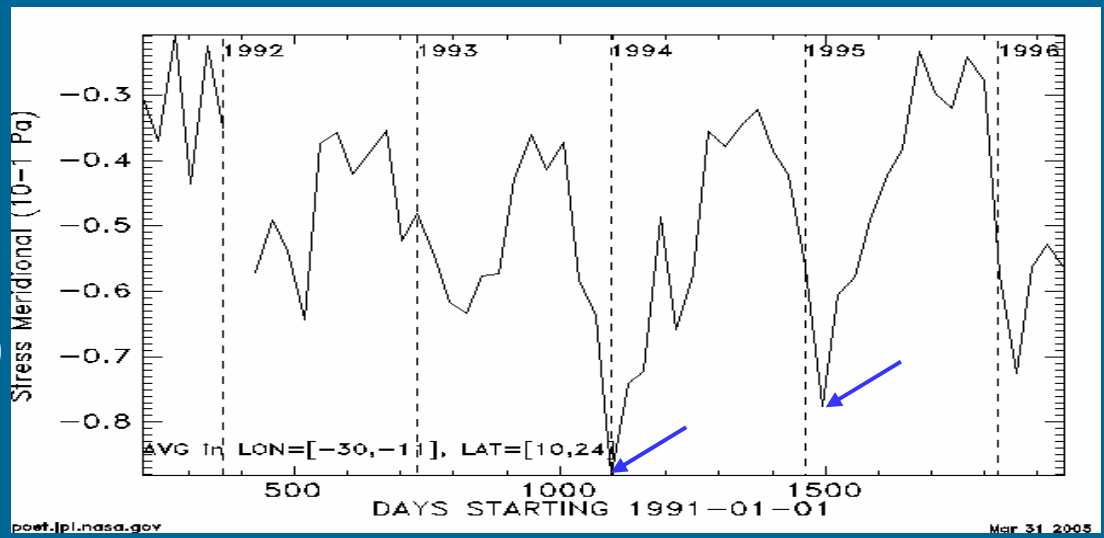
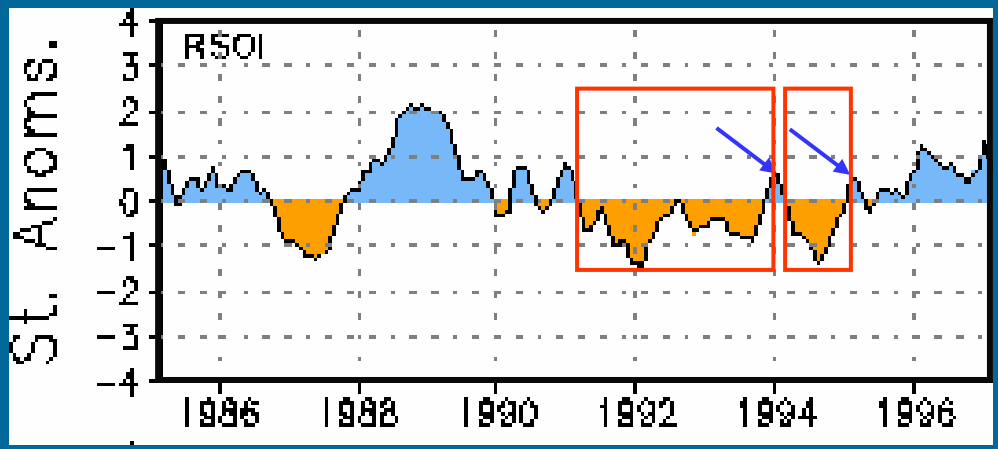
Tele-connection between ENSO and Mauritanian τ^y

Meridional wind stress
(Mauritanian domain, Atlantic)





Southern Oscillation Index
(Pacific)

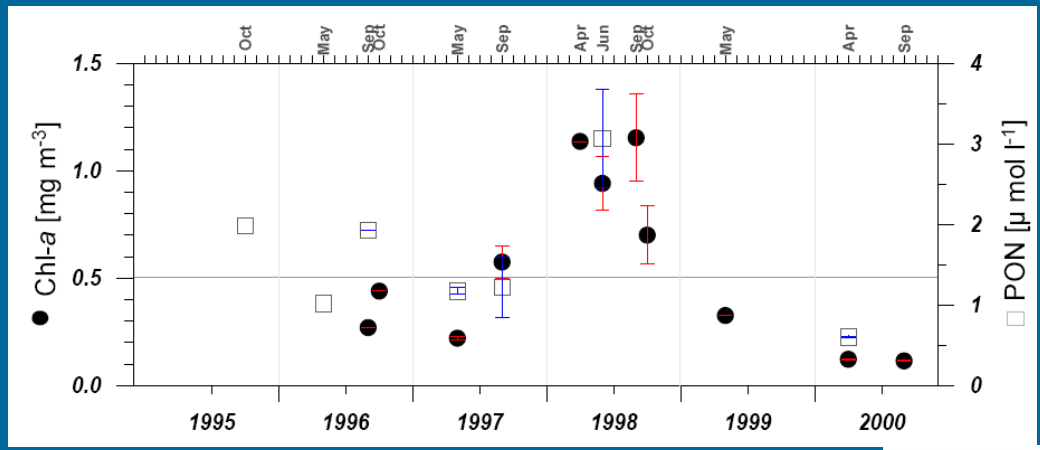
Source: PO.DAAC/IFREMER; CPC-NCEP

Correlation between Chl-a and physical parameters

	SST	τ^y	τ	$\nabla\times\tau$	SLA	τ^x	SSTA	r, R (1)	r, R (2)
Chl-a								0.193#	0.727#
								0.325	0.737
								0.297	0.642
								0.305	0.538
								0.300#	0.630#
								0.230	0.432
								0.006#	0.274#
								0.33	0.76
								0.29	0.76
								0.33	0.79
								0.39	0.81
								0.39	0.82

(1) Including year 1997-98; (2) Excluding year 1997-98
(#) Anti-correlation

Chl-*a* conc. at different time-scales



From AMT:

☞Response of Chl-*a* to nutrients is apparent from *in situ* measurements

From SeaWiFS:

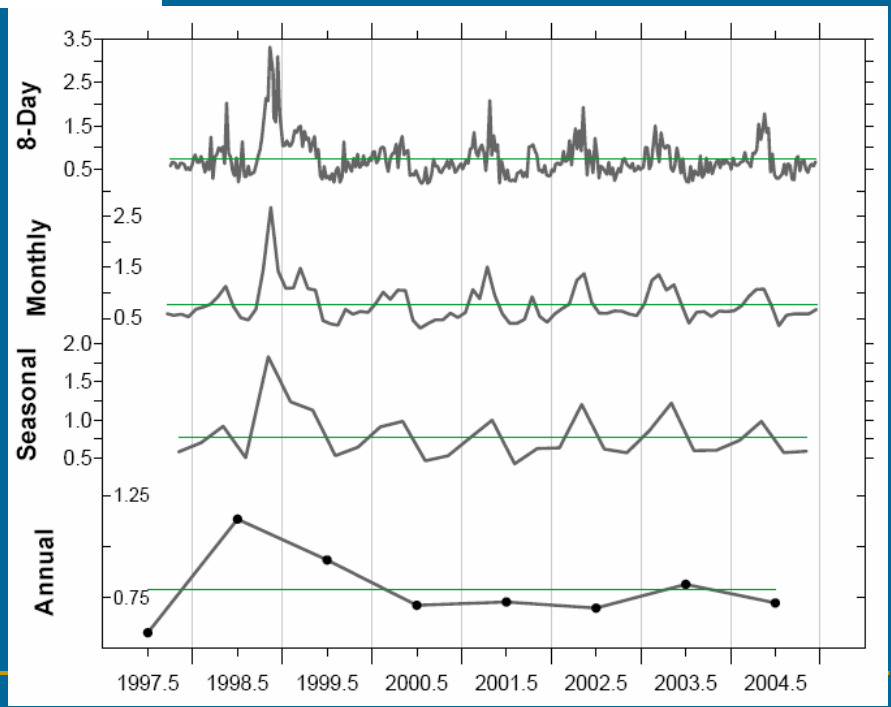
☞1998

☞Autumn

☞November

☞Oct week#2 Nov week#4

Signorini *et al* (1999) observed an Equatorial (25W-5E) summer bloom … cross-equatorial intrusion by NECC?



Data: SeaBASS, AMT/BODC, NASA-SeaWiFSv4

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Conclusions

- 1998 was an unusual year where the surface autumn-winter chl over the Mauritanian upwelling region was exceptionally high;
- Bi-modal chl max (Spring and Autumn-winter) at ~20°N;
- Local meridional wind stress explains max variance of surface chl abundance, which has some immediate response to the end of ENSO events:
  - Iff a prolonged Niño ends in Spring-Summer and Niña kicks-off during Summer-Autumn, then supply of sub-surface nutrients increases since the latter is strongly correlated to τ^y.
- Combination of sub-surface nutrients and surface aerosol inputs (Fe from Saharan dust ?) may further enhance phytoplankton growths in this region.

Acknowledgements

Financial support::

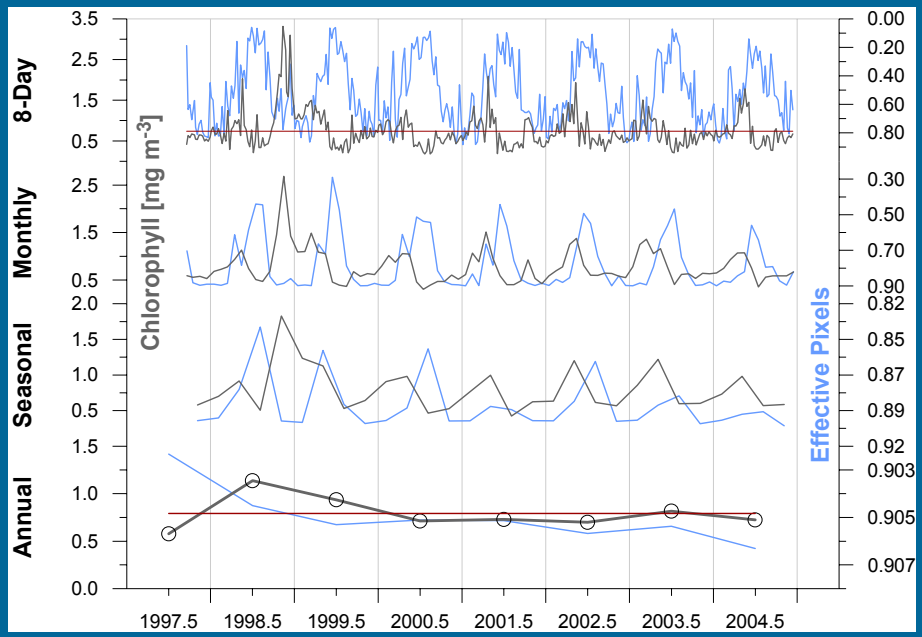
- NERC-CASIX
- NERC-AMT
- COASTCHART

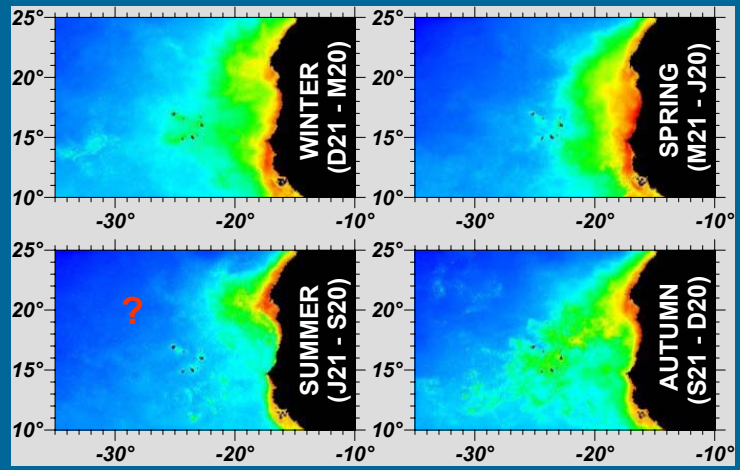
Useful discussions*::

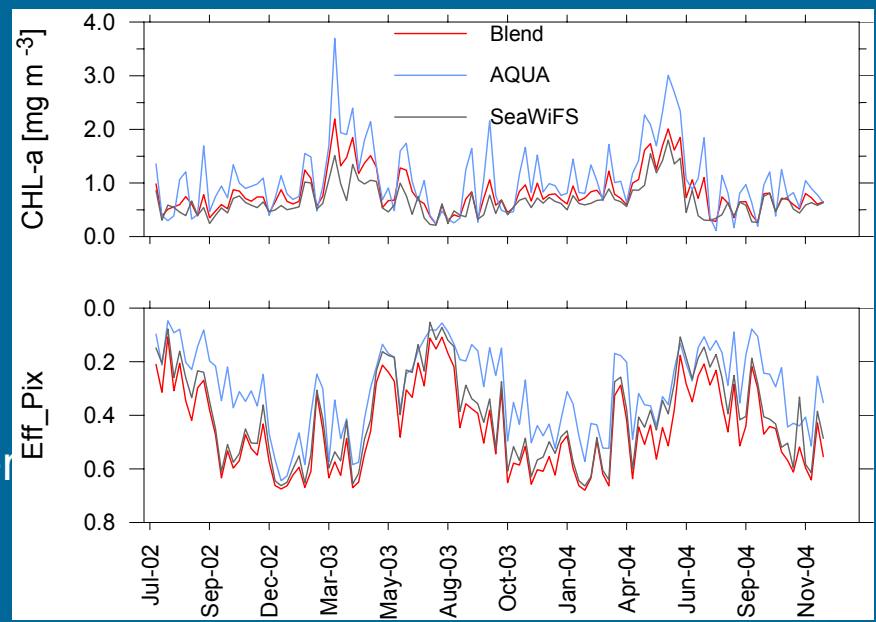
- Prof James Aiken and Dr N Hardman-Mountford

* …But mistakes are mine, if any.

Comments: True picture is unclear during the Summer







Blended product (AQUA/SeaWiFS):
15-35% more Effective pixels during summer
But…
Are the two sources compatible?

Chl-*a* : SeaWiFS V AQUA

Sampling errors can be reduced by using mutli-EO datasets, with appropriate corrections