



Analysis of climate-driven physical-biogeochemical processes in key regions of the tropical and south Atlantic

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1. Goals

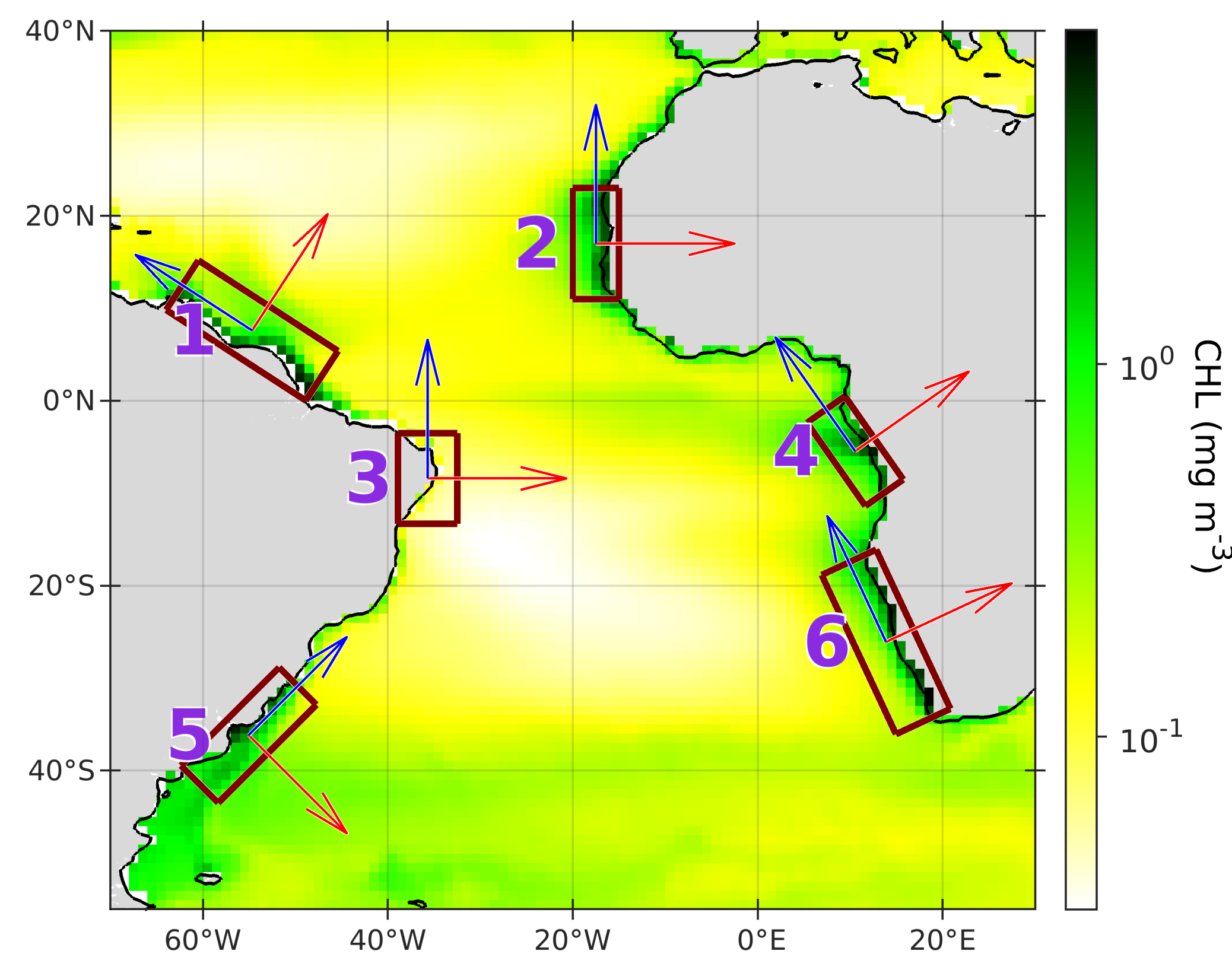
- Analyze the interannual variability of chlorophyll-a (CHL) in key areas of the tropical and south Atlantic.
- Identify the oceanographic processes that drive the CHL in observational data and in the NorCPM outputs.
- Define the common drivers in both datasets and evaluate their predictability.

2. Data

- Reanalysis products: Copernicus, ERA5, NCEP, GODAS.
- Satellite-derived products: MODIS-Aqua, SEAWIFS, AVHRR, AVISO altimetry.
- In-situ data: NODC-NOAA.
- Climate indexes: CPC-NOAA.
- Ensemble mean of 10 members of the NorCPM reanalysis experiment.

3. Processing

1. Monthly composites/means were obtained for diverse oceanographic variables (27) and climatic indexes (15).
2. Anomalies were calculated by removing the climatological-mean seasonal cycle.
3. Six key regions (focus of the analysis) were defined:



4. The anomalies were spatially averaged within each region to obtain time series.
5. In each region, CHL series were correlated with the other variables and climatic indexes.
6. Both observational and model data were similarly processed.

4. Phytoplankton stoichiometry: In-situ data

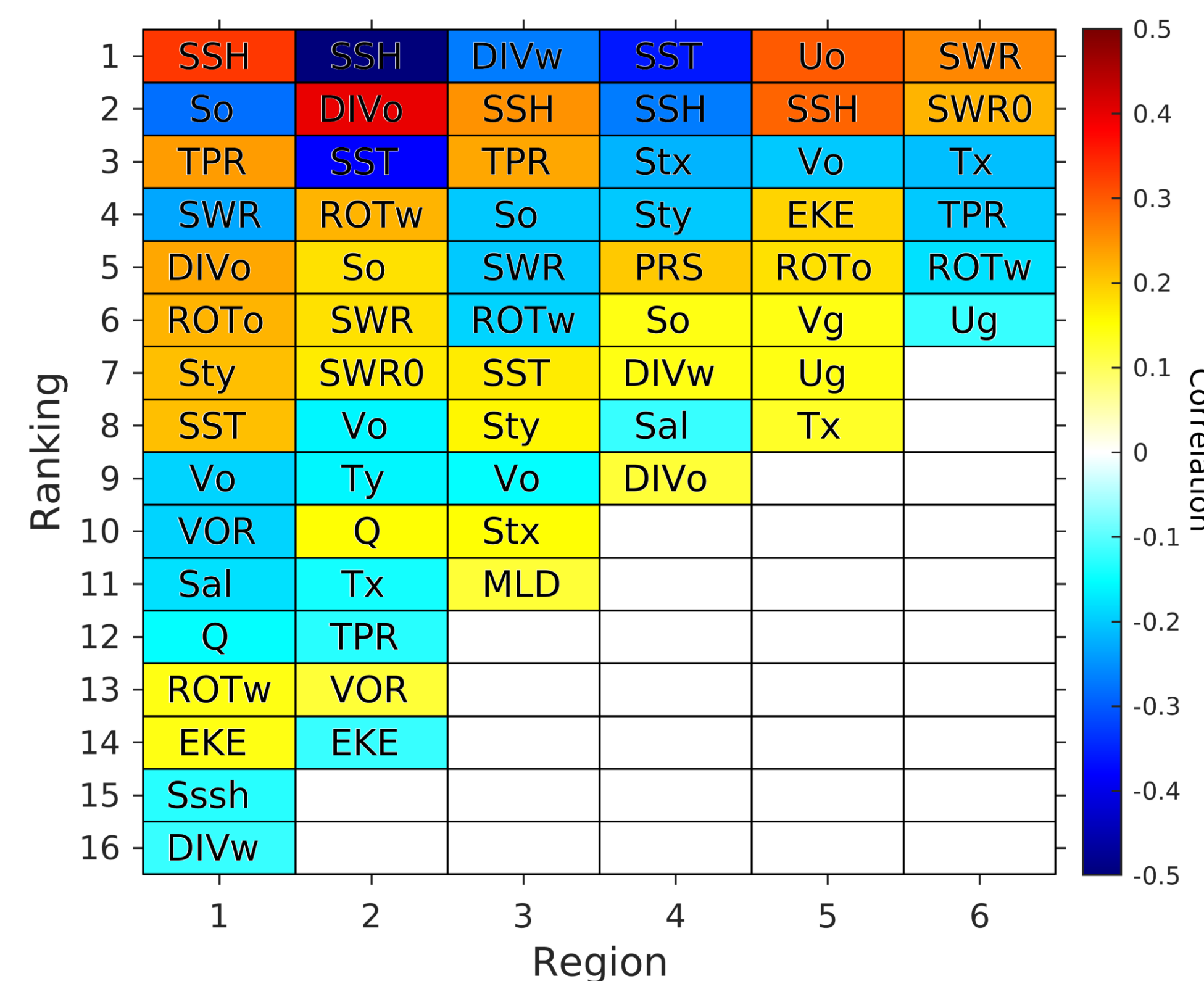
- In-situ sampled CHL and nutrients were correlated in each region:

Region	PO ₄	SiO ₂	NO ₃	# of samplings
1	0.72	---	---	558
2	0.25	0.98	0.25	143
3	---	0.34	---	19
4	0.21	0.98	0.13	13
5	---	---	0.47	34
6	---	0.02	---	7283

- Regions 3-5 are sub-sampled.
- Uncorrelated nutrient (“---”, $p \geq 0.05$) suggests non-limitation by such a nutrient.
- SiO₂ limitation associated with variable riverine input.

6. Correlations: Reanalysis/satellite data

- Satellite (L4) CHL series were correlated with diverse oceanographic variables in each region:



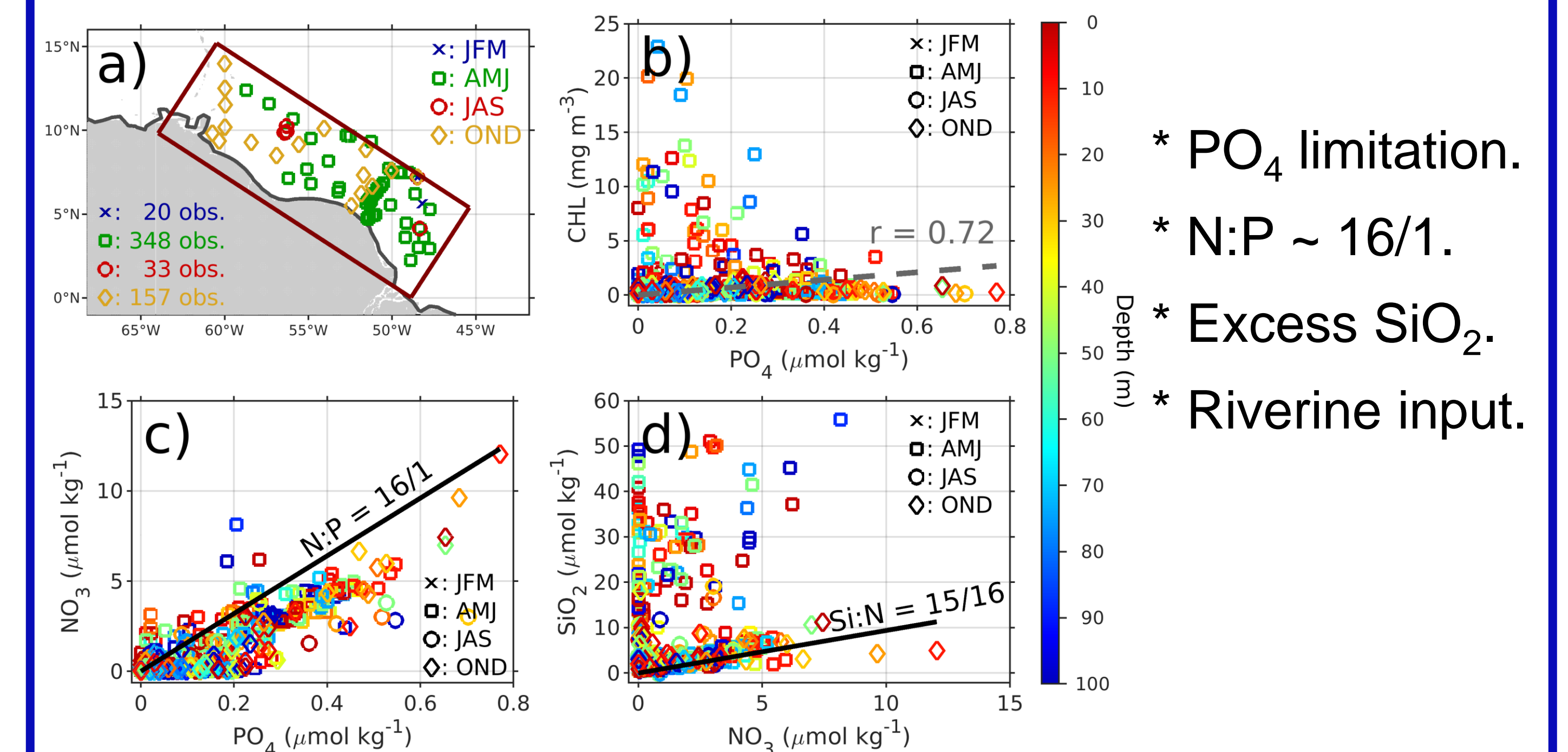
* MLD: Mixed-layer depth; Sal: Salinity; SST: Sea surface temperature; SWR0: Net shortwave irradiance; So: Salinity; Uo: Cross-shore water velocity; Vo: Long-shore water velocity; ROTo: Water curl; DIVo: Water divergence; SWR: Net shortwave irradiance; PRS: Surface pressure; TPR: Total precipitation rate; Tx: Cross-shore wind stress; Ty: Long-shore wind stress; Stx: Cross-shore-wind-stress SD; Sty: Long-shore-wind-stress SD; ROTw: Wind-stress curl; DIVw: Wind-stress divergence; SSH: Sea surface height; Sssh: Sea-surface-height SD; Ug: Cross-shore geostrophic water-velocity; Vg: Long-shore geostrophic water-velocity; VOR: Water vorticity (geostrophic); EKE: Eddy kinetic energy (geostrophic); Q: Okubo-Weiss parameter (geostrophic).

8. What's next...

- Identify the main driving variables and indexes.
- Elucidate the dynamical factors that support the statistical results.
- Cross-compare the results between observational data and NorCPM outputs.
- Evaluate the predictability of the dynamical factors that drive the CHL using the NorCPM.

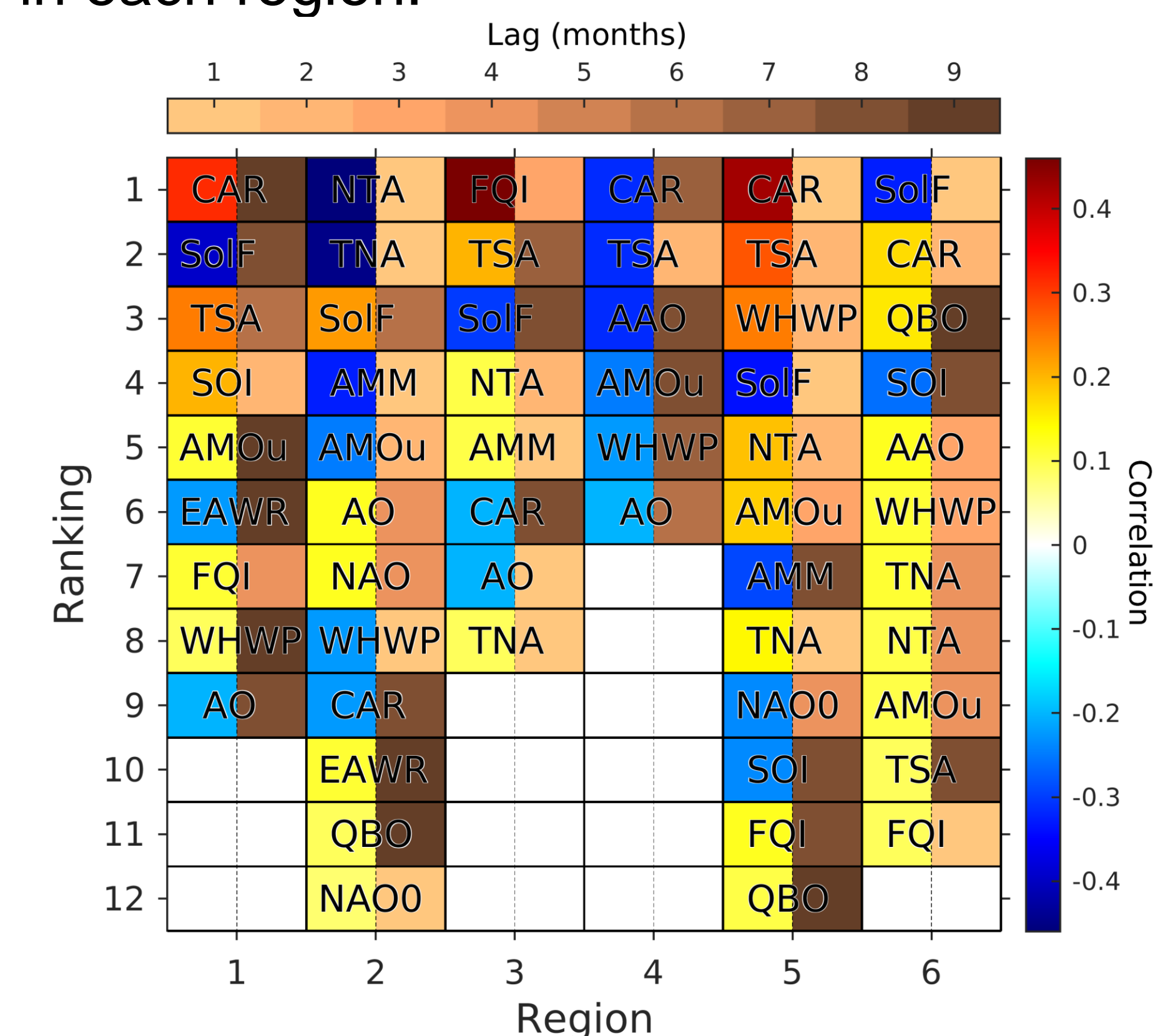
5. Phyt. Stoichiom. (example): Region 1

- Samplings focused on spring (AMJ) and fall (OND):



7. Correlations: Climatic indexes

- Satellite (L4) CHL series were correlated with diverse climatic indexes in each region:



* AAO: Antarctic Oscillation; EAWR: Eastern Atlantic/Western Russia; QBO: Quasi-Biennial Oscillation; AMM: Atlantic Meridional Mode; SOI: Southern Oscillation Index; NAO0: North Atlantic Oscillation; SoF: 10.7 cm Solar Flux; AMOu: Atlantic Multidecadal Oscillation (unsmoothed); NAO: North Atlantic Oscillation (Jones); TNA: Tropical Northern Atlantic; AO: Arctic Oscillation; TSA: Tropical Southern Atlantic Index; CAR: Caribbean Index; NTA: North Tropical Atlantic Index; WHWP: Western Hemisphere Warm Pool; FQI: Northeast Brazil rainfall index.

Acknowledgements

- This research is supported by TRIATLAS project (EU Horizon 2020 programme, grant No. 817578).
- The NorCPM analysis (next stage) is carried out in collaboration with Filippa Fransner and Shunya Koseki (GFI-UiB).