Pelagic Seascape Ecology and CMIP5:

Characterizing the trajectory of dynamic ocean habitats

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MAREMIP

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Seascape ecology: concept transfer from landscape ecology

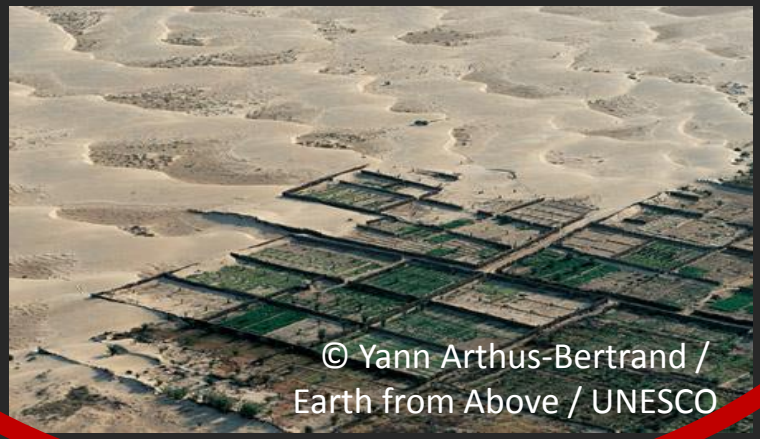
Grain

Extent

Seascape ecology: reciprocal interaction between ecology and *spatiotemporal* pattern, characterizing a process of interest.

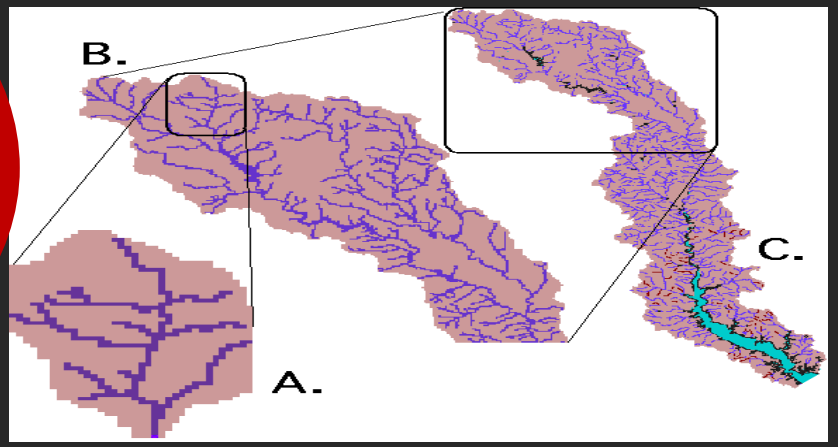
Edge

Patch



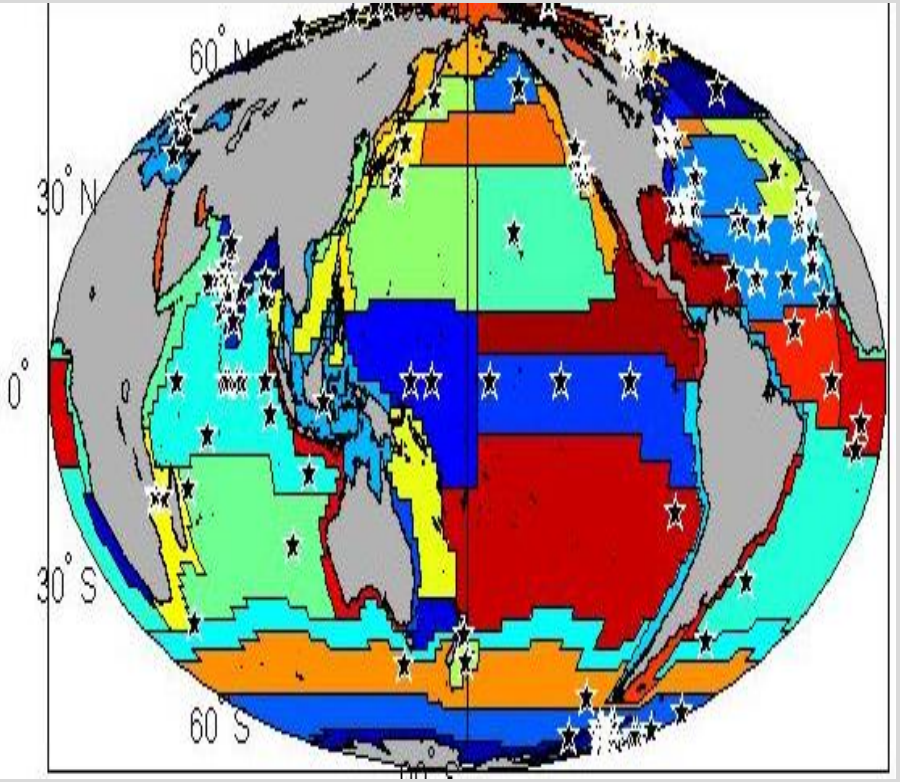
Scale

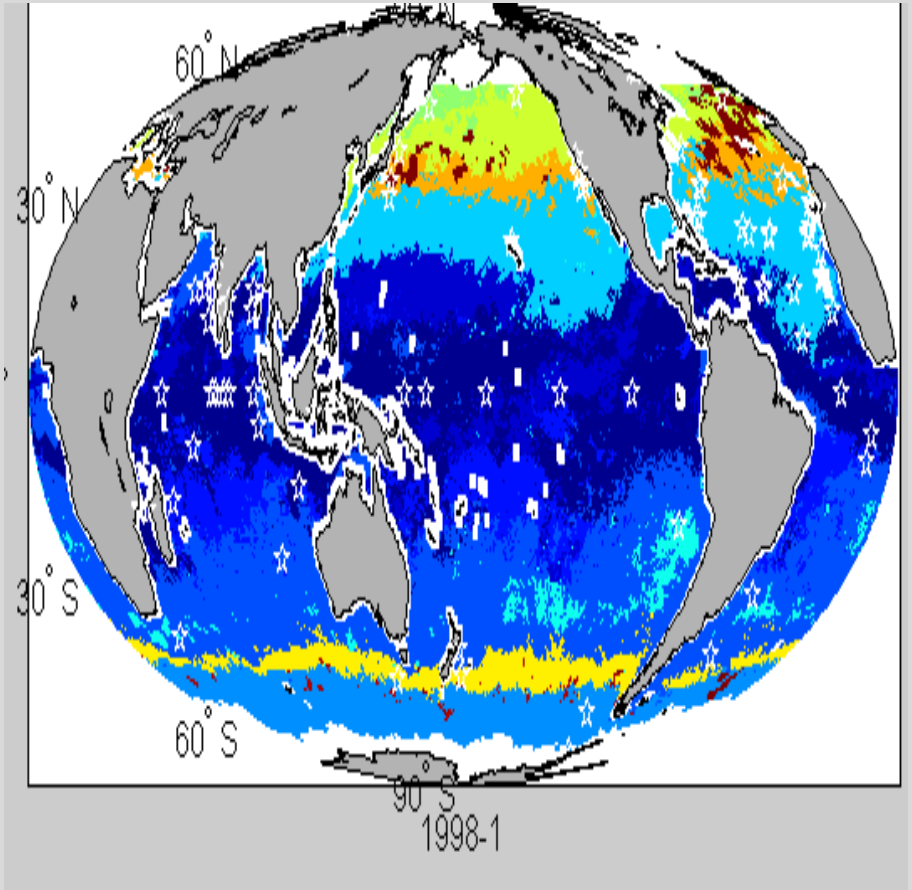
Organization



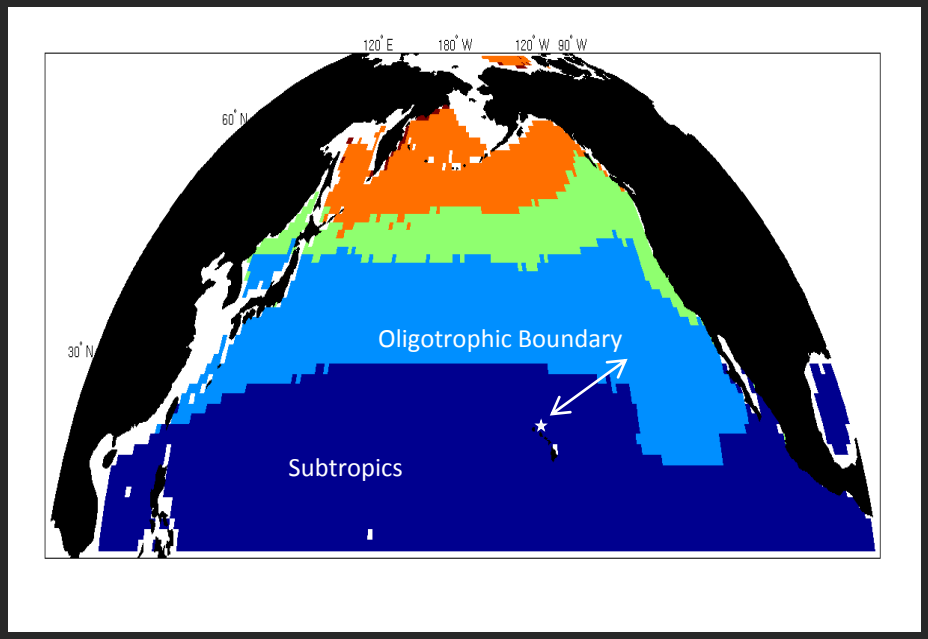
Static & subjective or dynamic & objective

Observational context and tracking systems through time





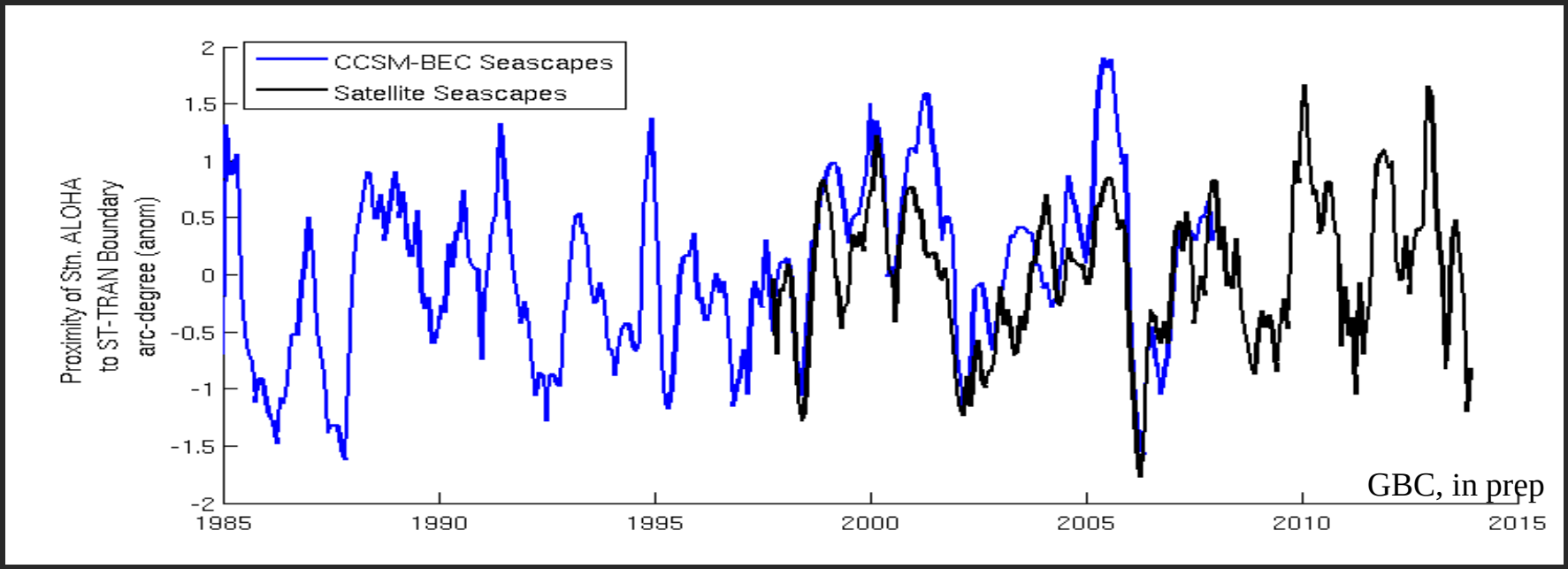
Ocean SITES: Eulerian observatories- stations and moorings



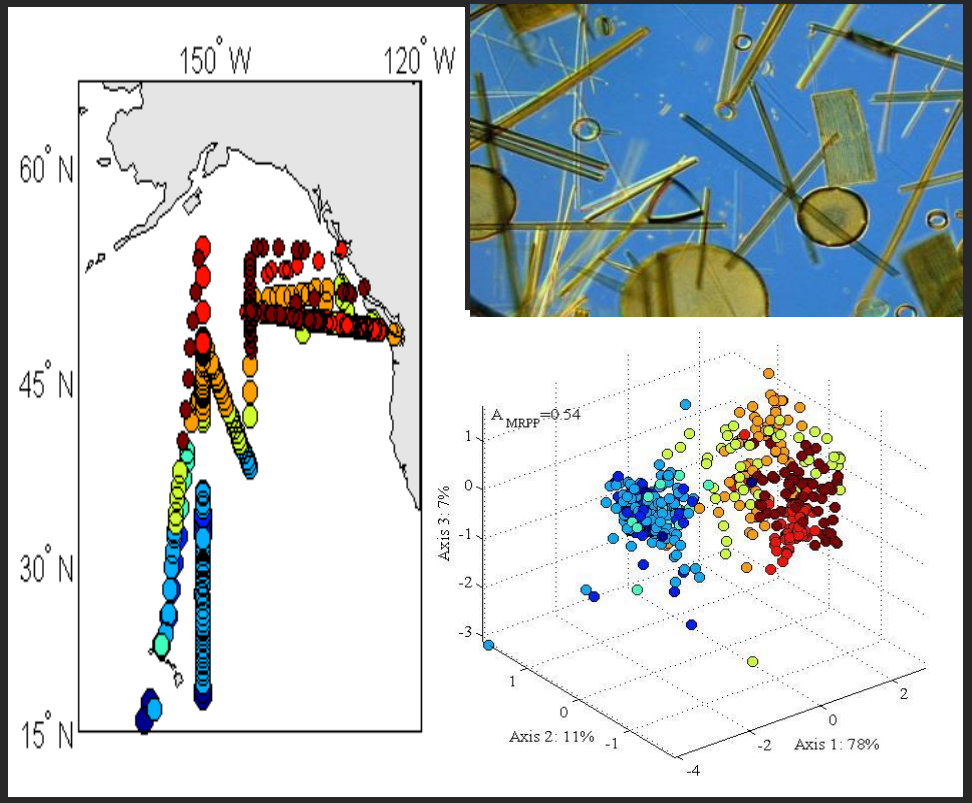
Seascapes and CMIP5

Effect of water mass or geographical context on observations.

Good agreement allows better characterization of underlying climate forcing

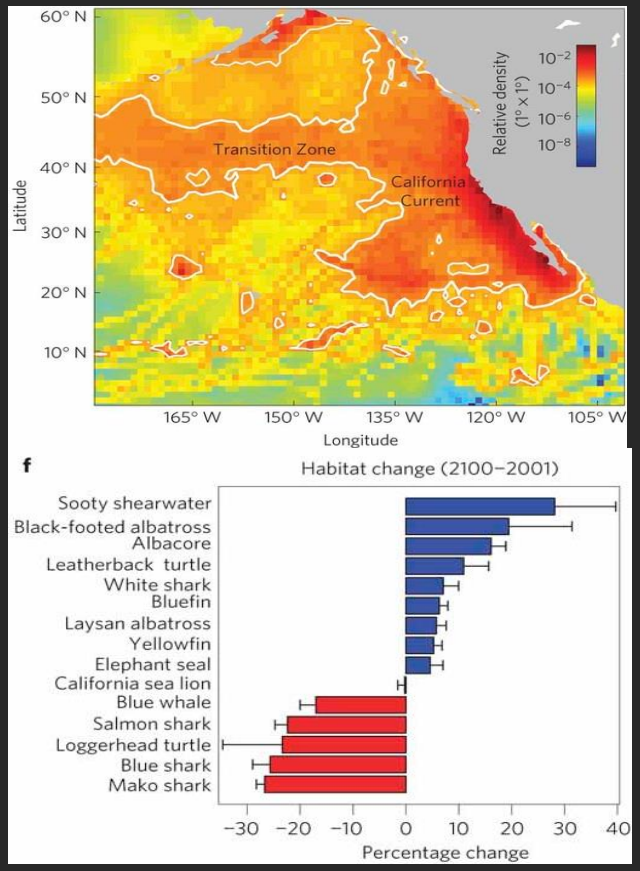


CMIP 5: Predictions of species distributions based on habitat



Multivariate seascapes predict planktonic assemblages, biophysical forcing, niche etc.

Kavanaugh et al. (flow cytometry), but also Gomez-Pereira (genetics)

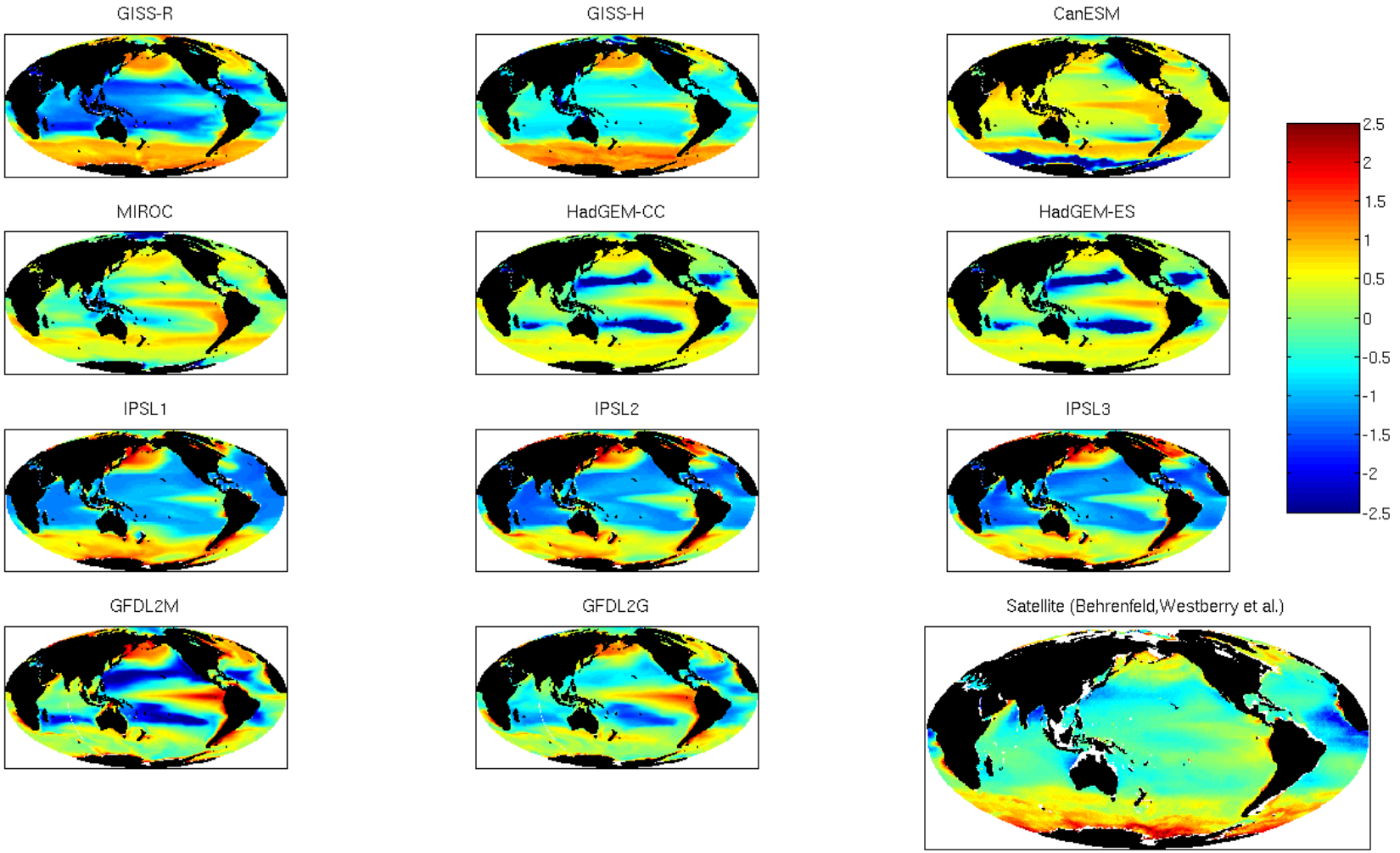


Projection (GFDL) of habitat based on occupancy, SST, chl-a.

Hazen et al. 2013

Classify seascapes in CMIP 5

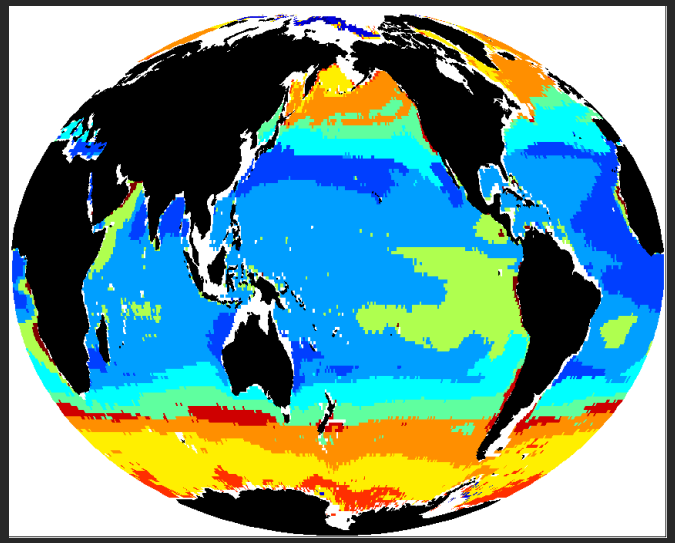
Phytoplankton Carbon Climatology (1998-2005, N=11, historical)

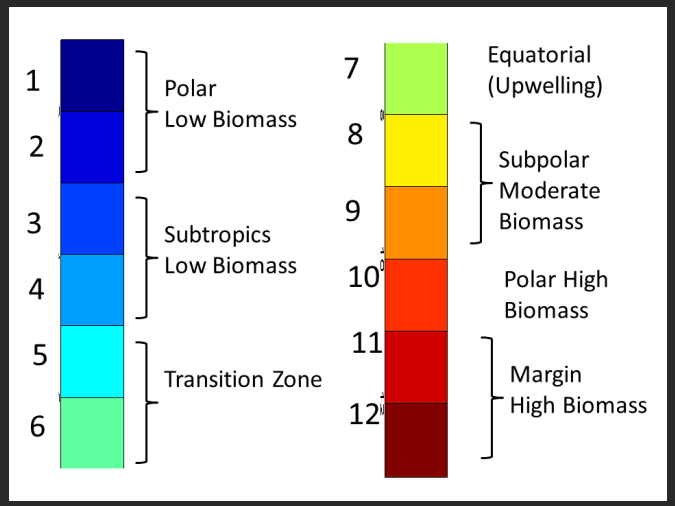


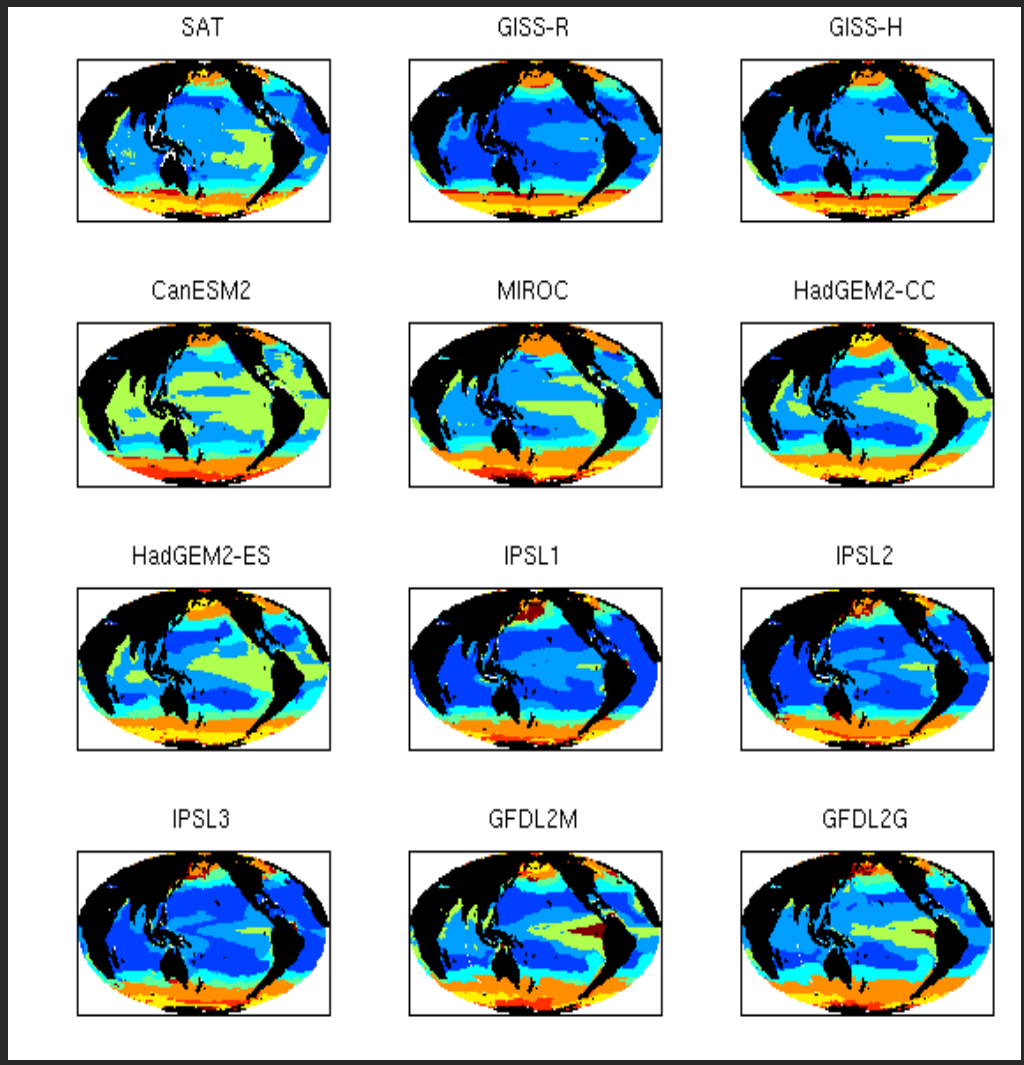
Classification uses phytoplankton carbon, SST, and PAR. Sea ice is used as a mask.

CMIP 5 (historical): satellite and model feature (seascape) match

Satellite seascapes → mixed multivariate Gaussian model + Model environmental variables → Model seascapes

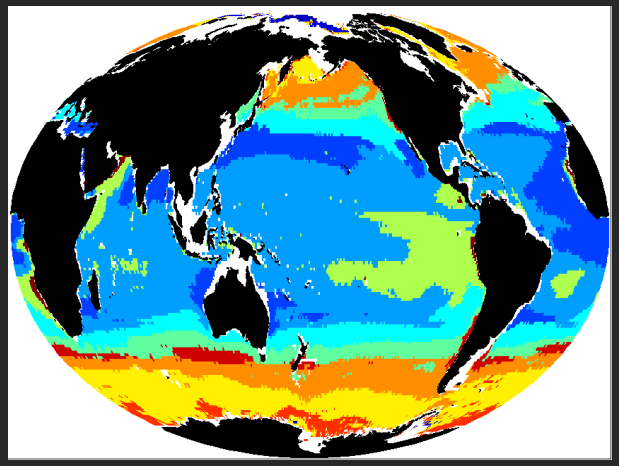




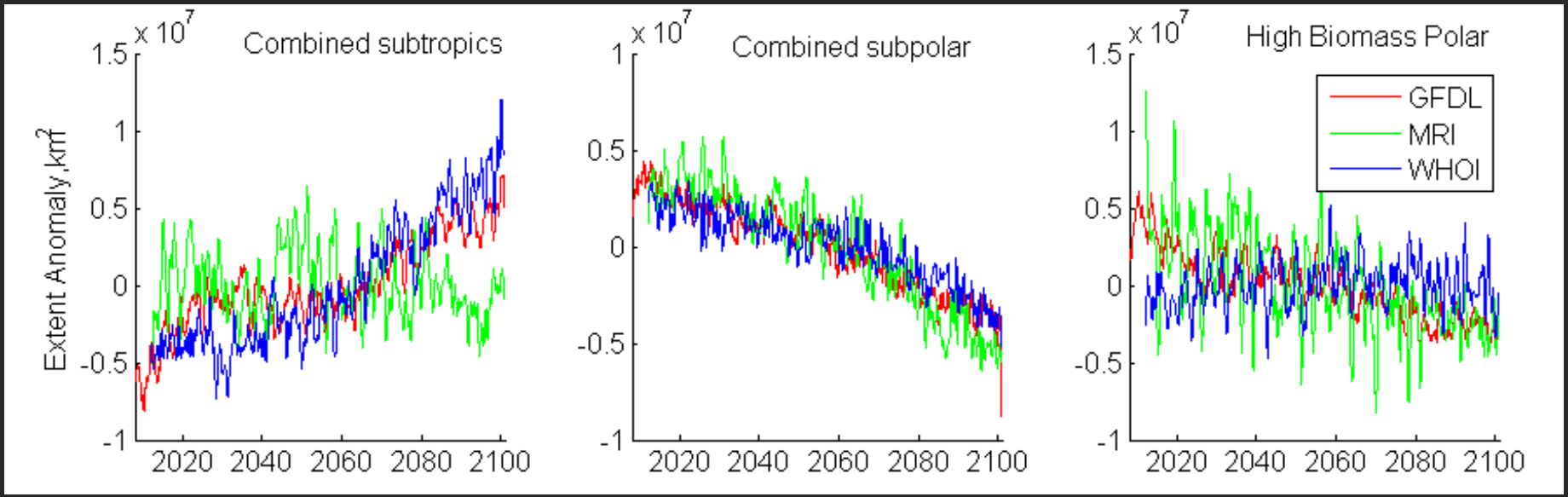


Color= spatial match up of analogous distribution in model space

CMIP5+MAREMIP (MARine Ecosystem Model Intercomparison Project): How will global change affect pelagic habitat?



1) Classify CMIP and MAREMIP model features based on satellite data distributions
2) Classify future scenarios (currently only RCP 8.5); quantify feature extent and location.
3) Quantify patterns of habitat expansion, contraction, and loss across all models.



CMIP5 and Seascapes: lessons learned

Oceanic habitats are both internally and geographically dynamic

- Model output can provide context, e.g. dominant climate forcing.
- Model output can illuminate potential shifts in habitat quality and location of boundaries. Important for biogeochemical cycles, higher trophic levels, and potentially mitigation (adaptive management

Ongoing challenges: variables, resolution, uniformity