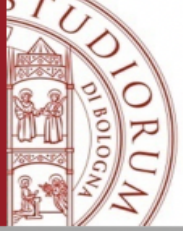


Global Ocean Climatologies

Seadatacloud WP11 Meeting
30 October 2020

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Prof. Nadia Pinardi



Global Products to be delivered

Monthly Global Temperature and Salinity climatologies

1. SDC_GLO_CLIM_TS_V1 (first version)
2. SDC_GLO_CLIM_TS_V2 (Improvement of V1)

Monthly Global Density climatologies

SDC_GLO_CLIM_Dens

Averaged Brunt Vaisala frequency profiles

SDC_GLO_CLIM_DP1

Seasonal Apparent Oxygen Utilization climatologies

SDC_GLO_CLIM_DP2

Global Temperature and Salinity Climatologies

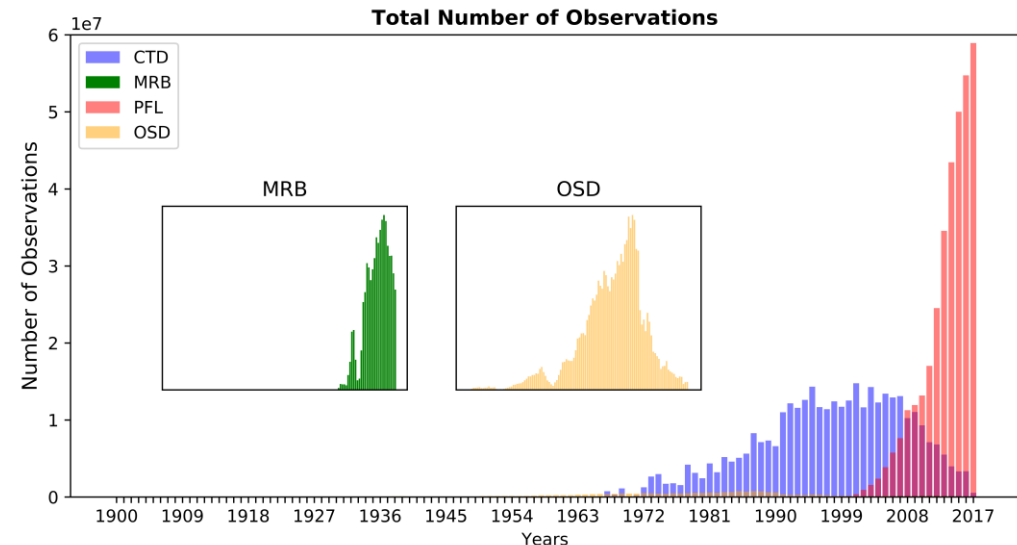
Two estimates, based on two datasets from World Ocean database (WOD18):

Dataset1: longest time mean product, 1900-2017, surface to 6000m

- Profiling floats(PFL)
- Ocean station data(OSD)
- Conductivity Temperature depth (CTD)
- Moored Buoy (MRB)

Dataset2: last 15 years data, 2003-2017, surface to 2000m

- Profiling floats(PFL)



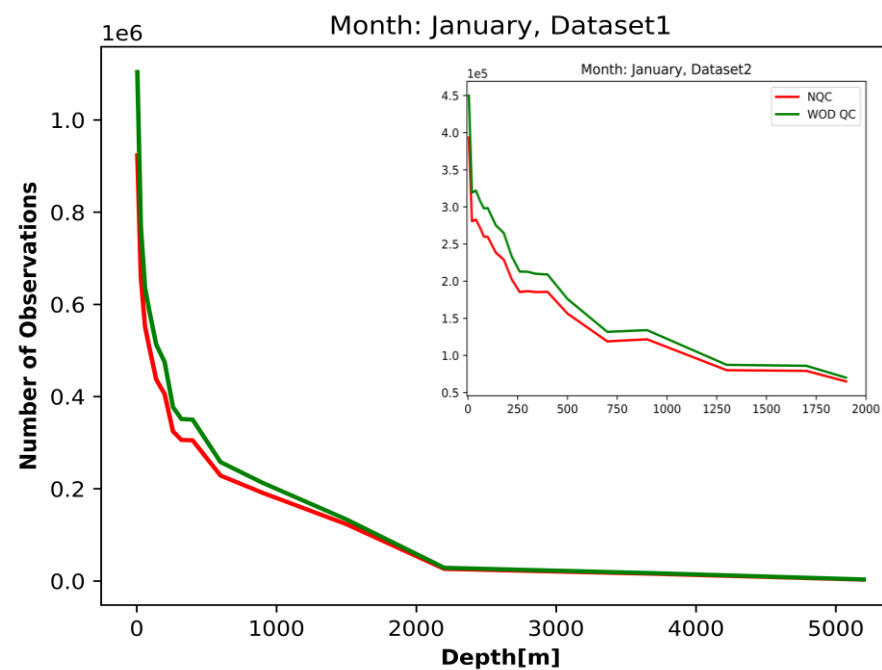
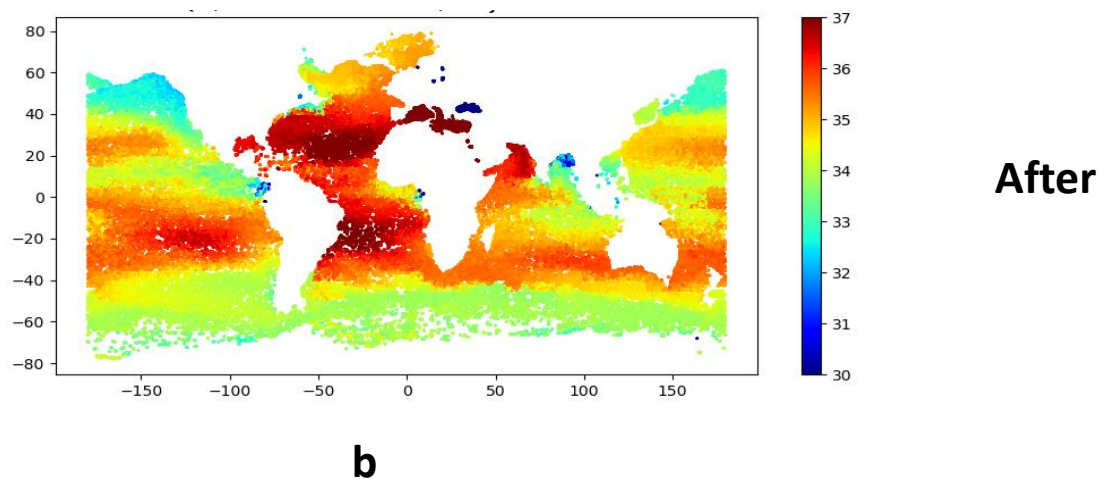
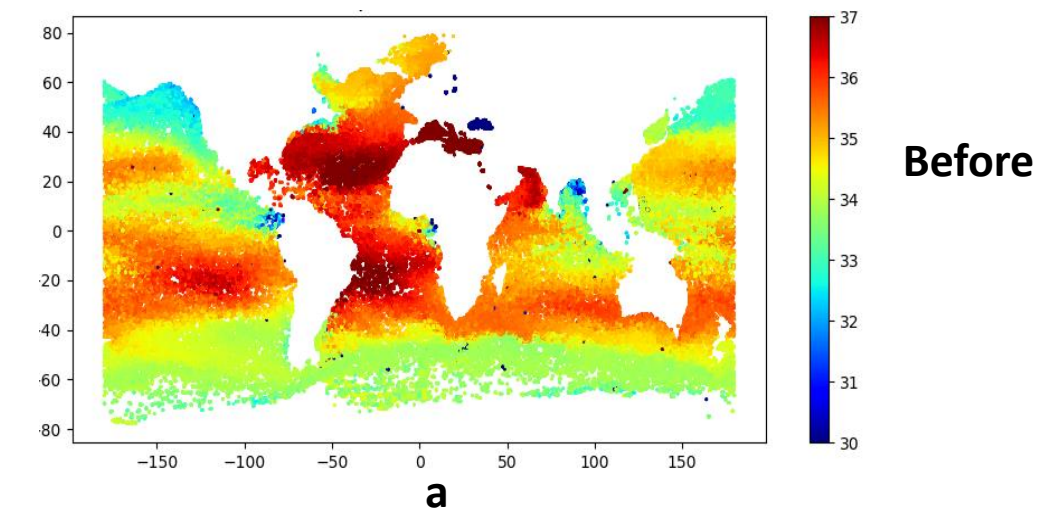
V1 versus V2

- ✓ Revise the depth layers
- ✓ WOD18 instead of WOD 13 with available Quality flags
- ✓ Additional quality control data named as Nonlinear Quality

Layers	Depth (m)	Layers	Depth (m)	Layers	Depth (m)	Layers	Depth (m)
1	0-10	12	125-150	23	400-425	34	1400-1600
2	10-20	13	150-175	24	425-450	35	1600-1800
3	20-30	14	175-200	25	450-475	36	1800-2000
4	30-40	15	200-225	26	475-500	37	2000-2500
5	40-50	16	225-250	27	500-600	38	2500-3000
6	50-60	17	250-275	28	600-700	39	3000-3500
7	60-70	18	275-300	29	700-800	40	3500-4000
8	70-80	19	300-325	30	800-900	41	4000-4500
9	80-90	20	325-350	31	900-1000	42	4500-5000
10	90-100	21	350-375	32	1000-1200	43	5000-5500
11	100-125	22	375-400	33	1200-1400	44	5500-6000

Layers	Depth (m)	Layers	Depth (m)	Layers	Depth (m)	Layers	Depth (m)
1. (5m)	0-10	12. 120m	115-125	23. 340m	335-345	34. 1500	1495-1505
2. (10m)	5-15	13. 140m	135-145	24. 370m	365-375	35. 1700	1695-1705
3. 20m	15-25	14. 160m	155-165	25. 400m	395-405	36. 1900	1895-1905
4. 30m	25-35	15. 180m	175-185	26. 450m	445-455	37. 2200	2195-2205
5. 40m	35-45	16. 200m	195-205	27. 500m	495-505	38. 2700	2695-2705
6. 50m	45-55	17. 220m	215-225	28. 600m	595-605	39. 3200	3195-3205
7. 60m	55-65	18. 240m	235-245	29. 700m	695-705	40. 3700	3695-3705
8. 70m	65-75	19. 260m	255-265	30. 800m	795-805	41. 4200	4195-4205
9. 80m	75-85	20. 280m	275-285	31. 900m	895-905	42. 4700	4695-4705
10. 100m	85-95	21. 300m	295-305	32. 1100	1095-1105	43. 5200	5195-5205
11. 110m	95-105	22. 320m	315-325	33. 1300	1295-1305	44. 5700	5695-5705
						45. 6000	5995-6005

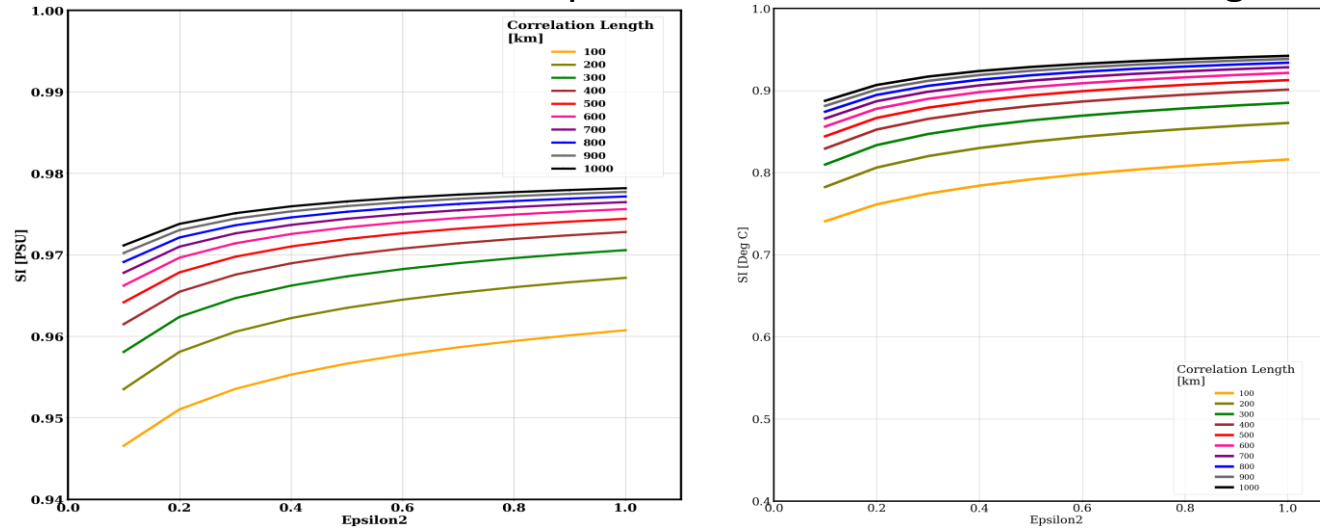
Quality Control



Salinity observations, (January, Dataset V2_2) at nominal depth 5m, before (a) and after (b) application of NQC with 13% data elimination.

DIVA Implementation

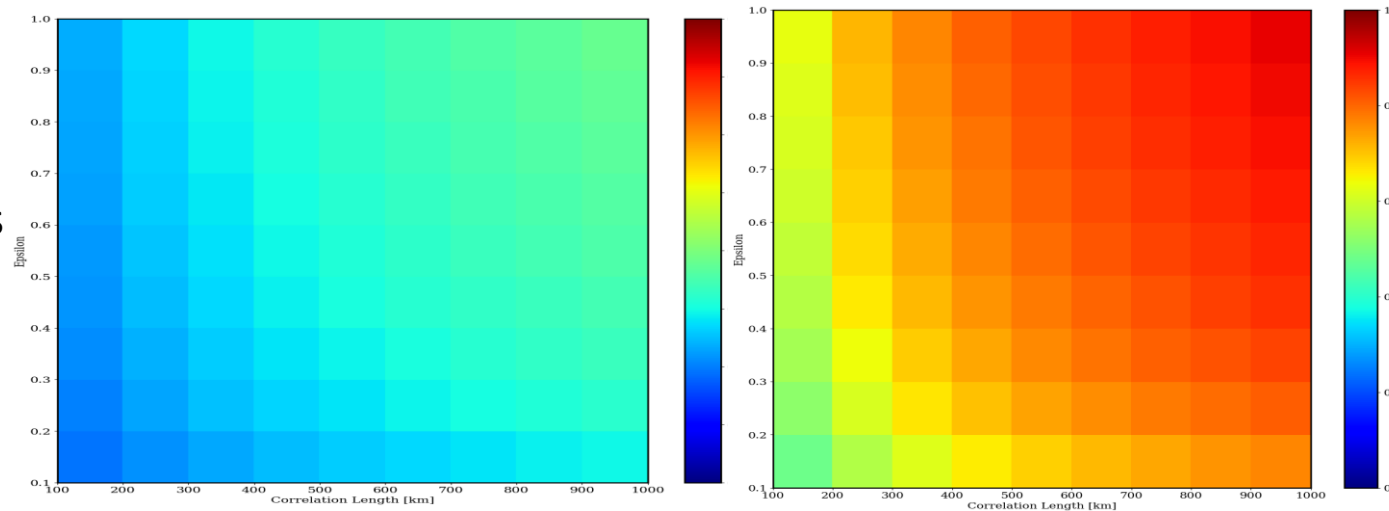
SI Index and RMS of Residuals are computed for different correlation length and epsilon2



$$SI = \frac{1}{N} \sum_{n=1}^N \sqrt{(\Delta_x f)^2 + (\Delta_y f)^2}$$

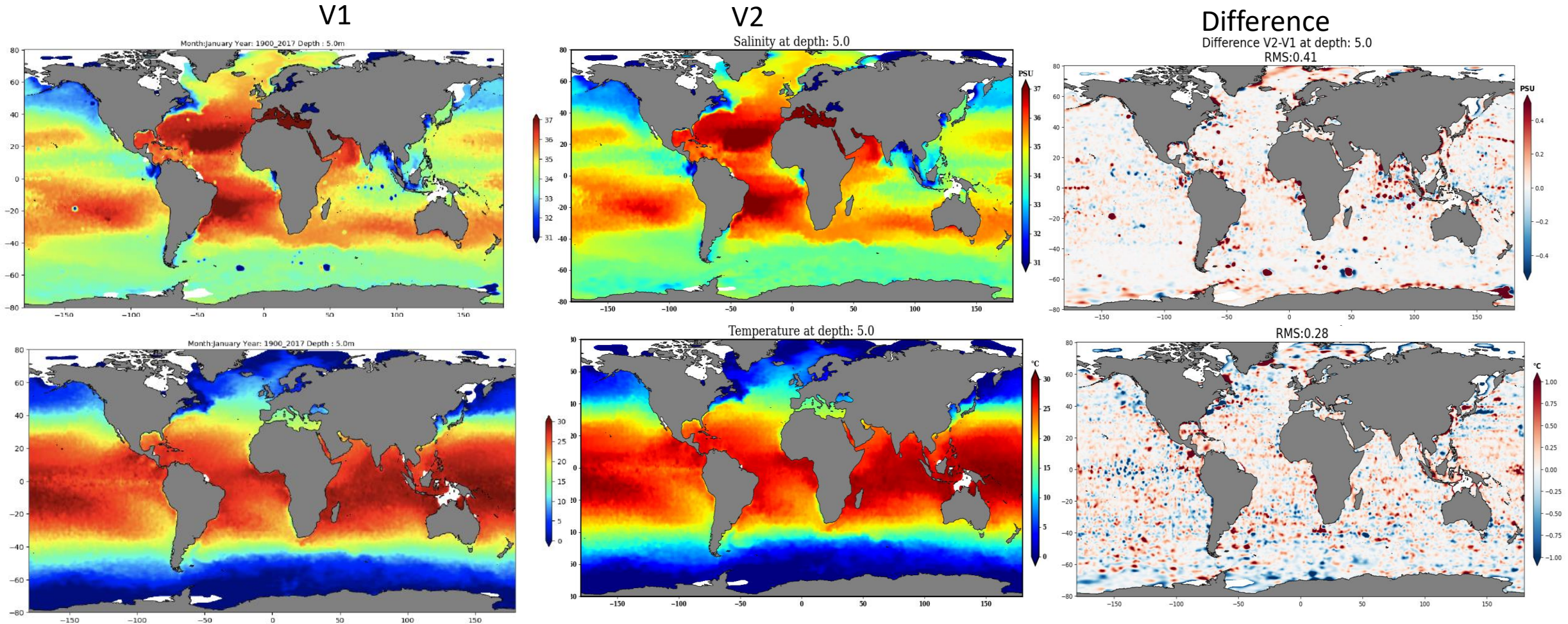
“SI and RMS of Residuals were used in order to choose the parameter to be used for DIVA”

RMS
of
Residuals



With the help of these two quantities, we have selected
Epsilon2: 0.6
Correlation length: 300km

Results

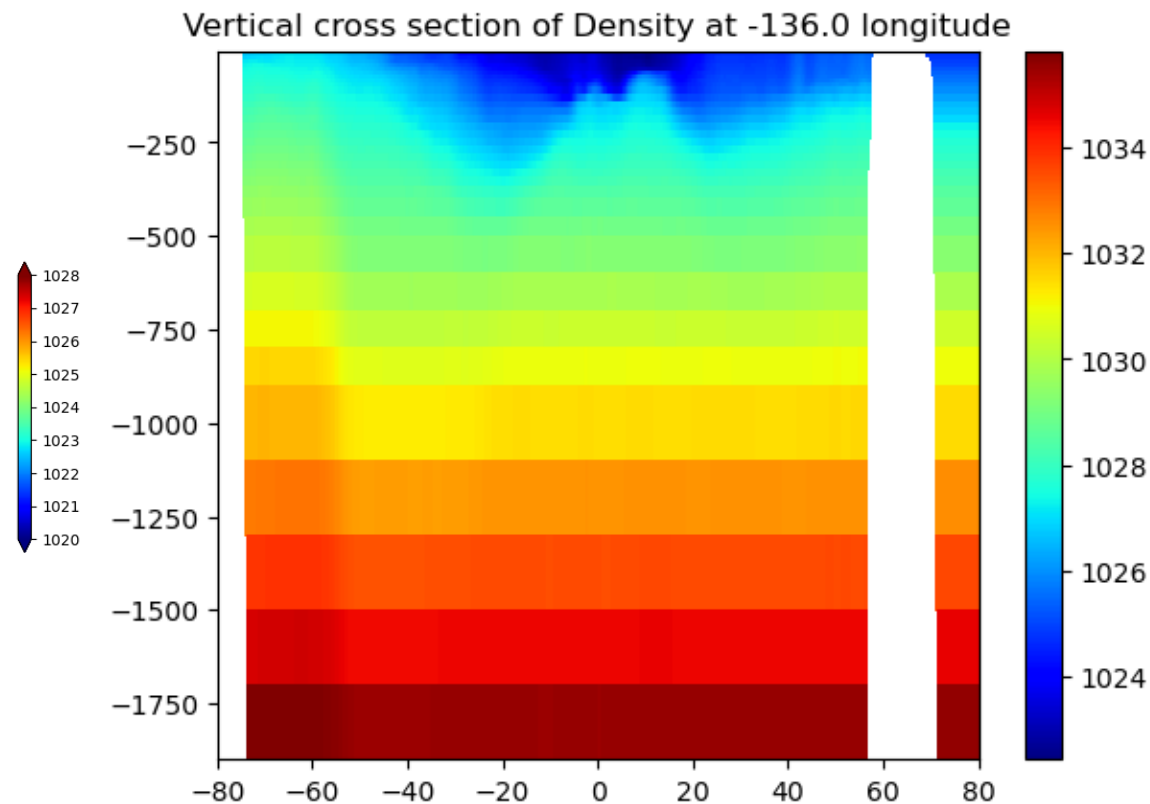
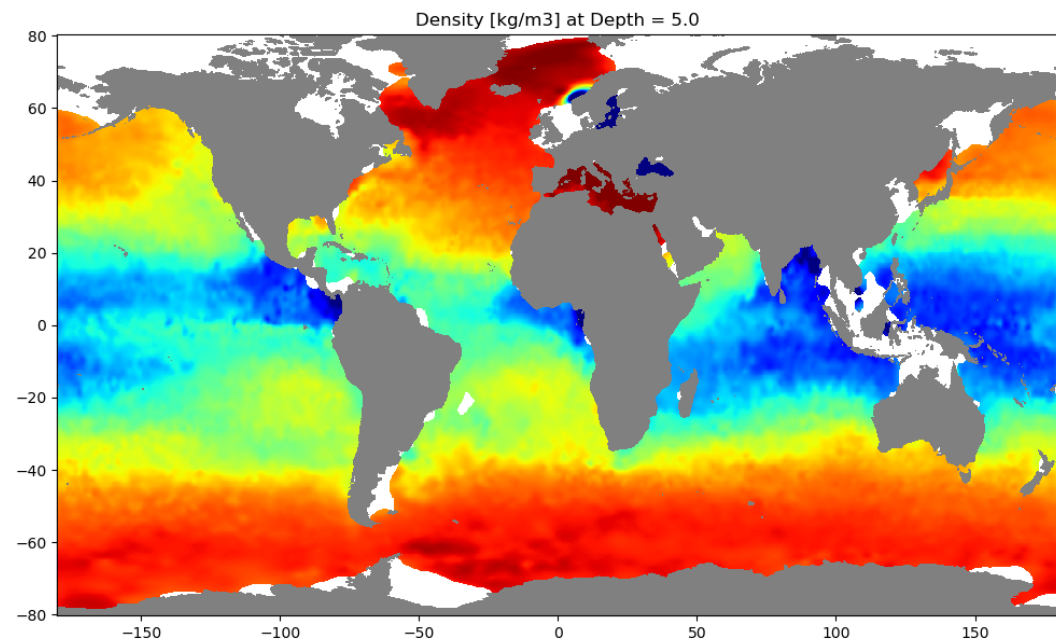


V2 is an improved version of V1 because of additional Quality Control and Improved depth definition. Analysis are carried out using varying Background that is DIVA field with large correlation length but differences are minimum therefore it is decided to use mean vertical profile as a background.

Global Density Climatologies

Dataset2: PFL 2003-2017

NQC processed Temperature and Salinity profiles together

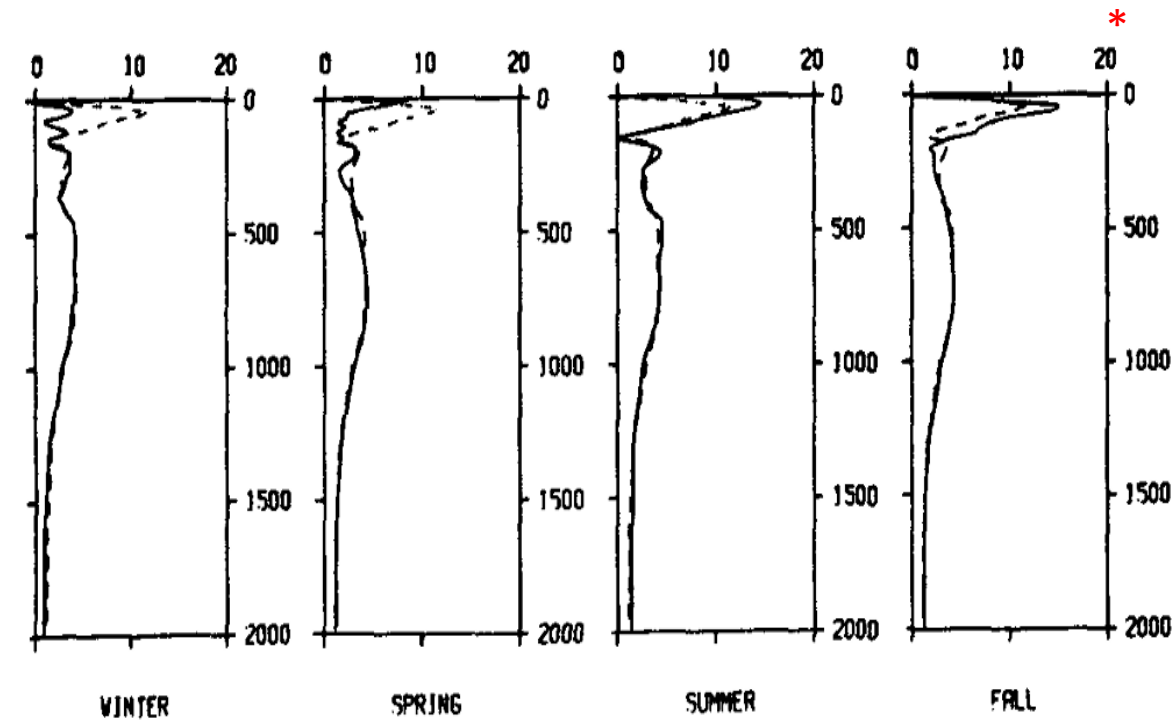
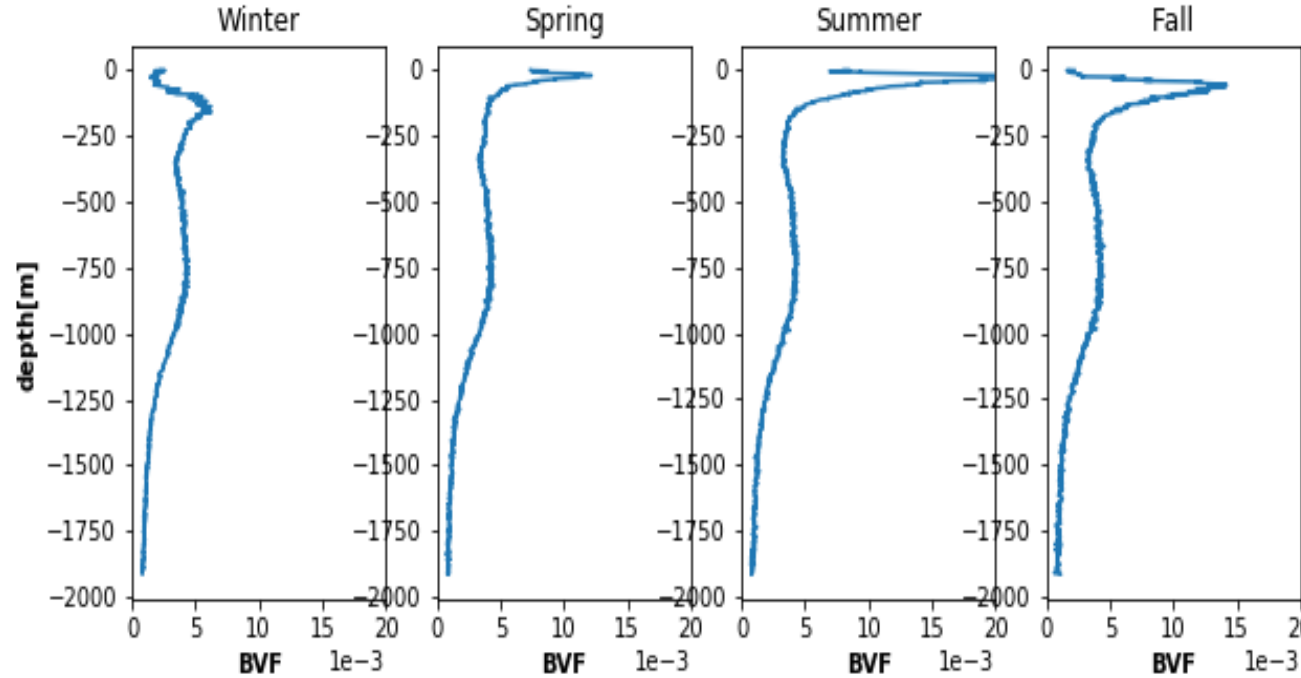
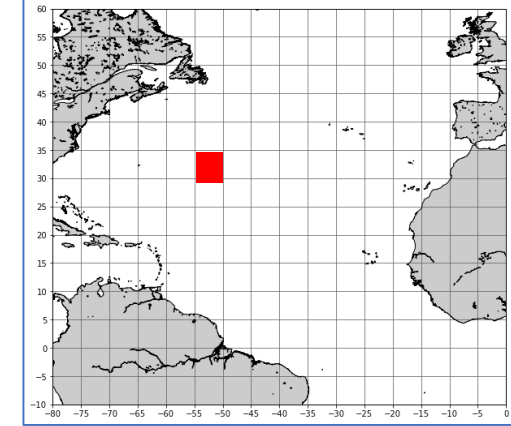


Averaged Brunt Vaisala frequency profiles

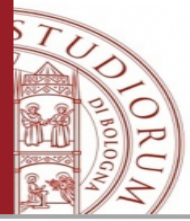
- Temperature and Salinity profiles together
- Computed the Density and BVF profiles

$$N = \sqrt{-\frac{g}{\rho} \frac{d\rho}{dz}}$$

Box averaged seasonal profiles of Brunt Vaisala Frequency



* W. J. Emery, W. G. et al, *Geographic and Seasonal Distributions of Brunt-Vaisala Frequency and Rosby Radii in the North Pacific and North Atlantic*, 1983



Apparent Oxygen Utilization

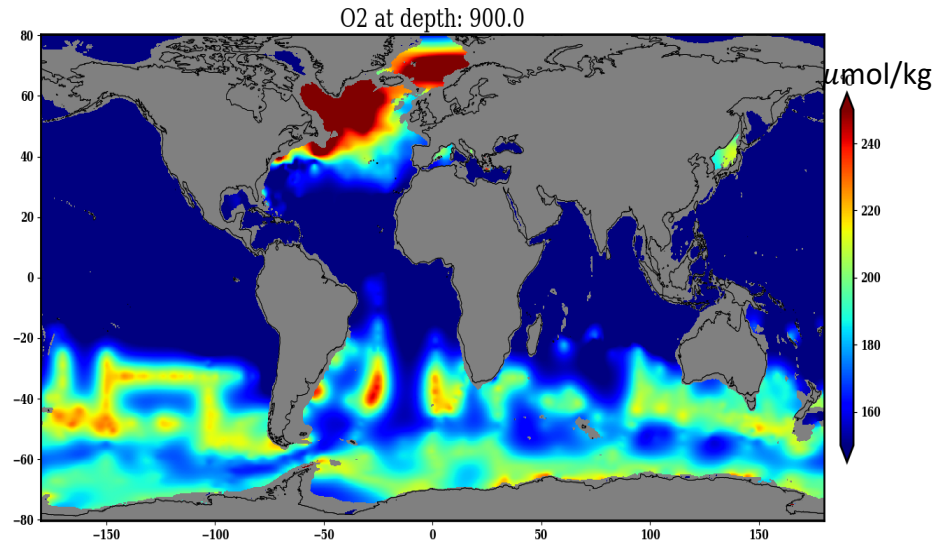
Provide information about the ocean oxygenation state

DIVA parameters

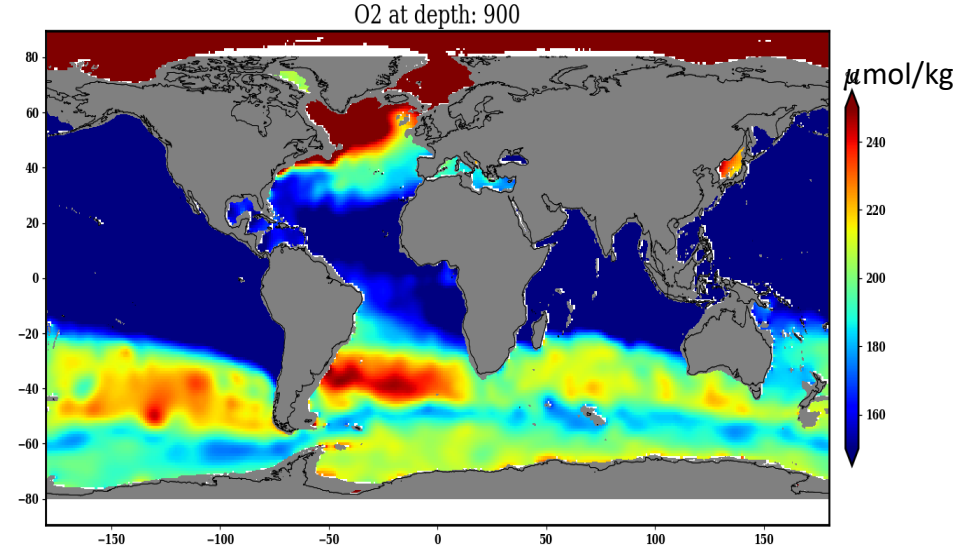
- Epsilon2: 0.6
- Correlation length: 300km
- Grid size = 0.25degree

Dataset: WOD18 (OSD, CTD and PFL (2003-2017)), surface to 2000m

First, we mapped the O₂ and compared it with WOA 18



DIVA



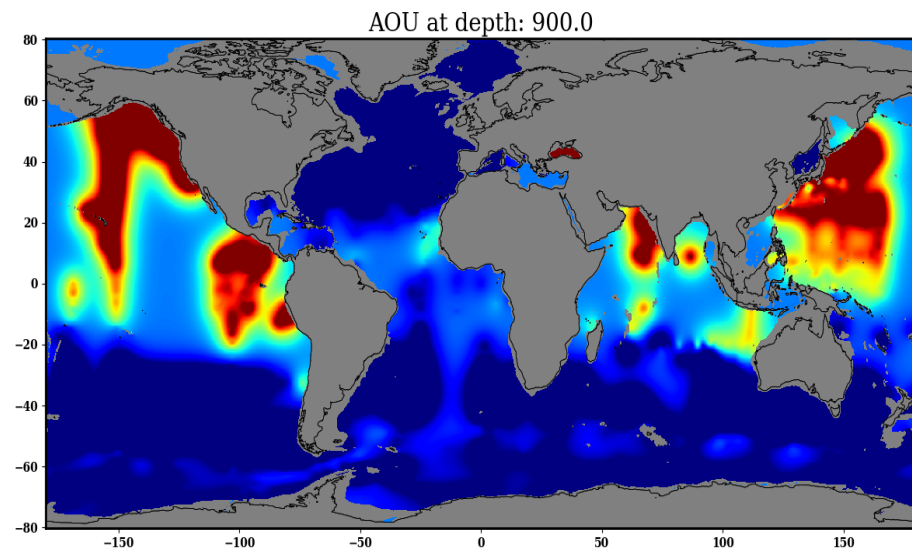
WOA

In-situ Dissolved Oxygen (O₂)

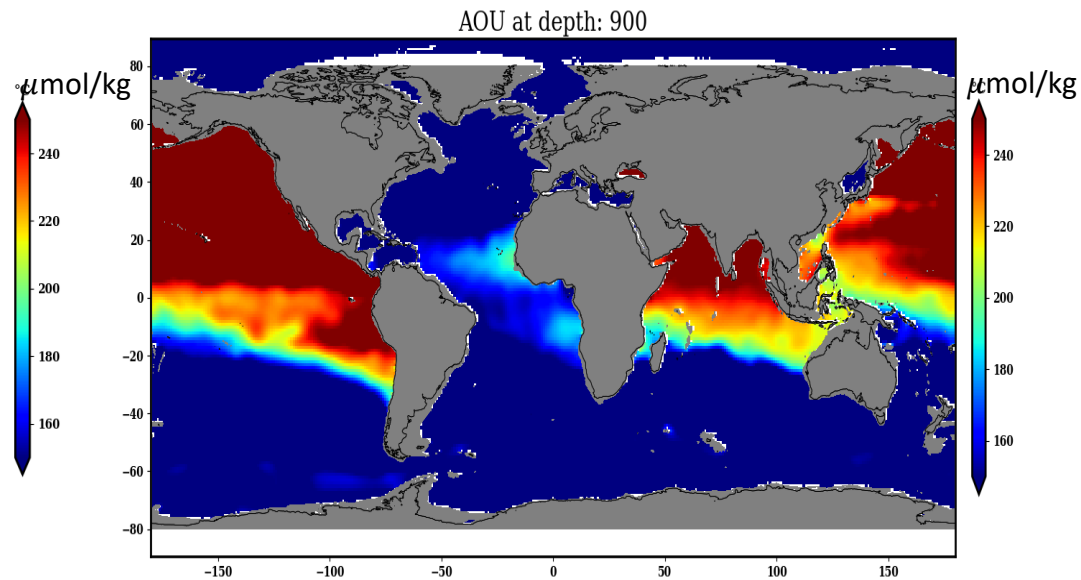
Mapping for Apparent Oxygen Utilization

$\text{AOU} = \text{In situ Dissolved oxygen} - \text{Oxygen Saturation}$

Oxygen Saturation is calculated by using the equation Garcia and Gordon (1993) that uses the solubility coefficients derived from the data of Benson and Krause(1984).



DIVA



WOA

Conclusion

An updated version of Temperature and Salinity climatologies is provided with the following improvements:

- Depth layers are revised as compared to previous version, constant layer thickness of 10 m is used for whole water column for both Dataset1 and Dataset2.
- An additional quality control procedure NQC is applied that will remove the outliers and non representative data not suitable for large scale global ocean climatologies.
- **Global density climatologies is computed from NQC processed TS profiles.**
- **An average of Brunt Vaisala frequency profiles in 5x5 degree boxes.**
- **Global climatologies for apparent oxygen utilization.**

Thank you for your attention!

