Fine scale structures of the Abrolhos Bank circulation from SWOT first results

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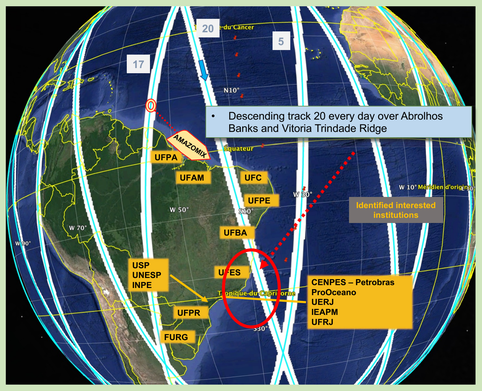
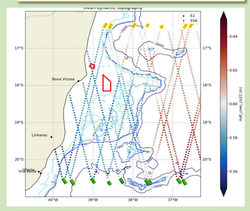
New insight on SSH Scales between 10 and 50 km :

- Partnership with Brazil on satellite altimetry
- Fine scales in a Western Boundary dynamics
- Internal Waves along the Brazilian shelf
- SWOT-ABROLHOS 2023: Cal/Val SWOT

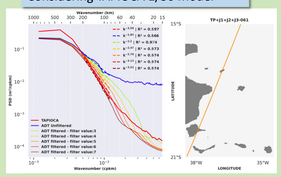
Contribution to the SWOT Cal/Val effort over a Brazilian-French partnership



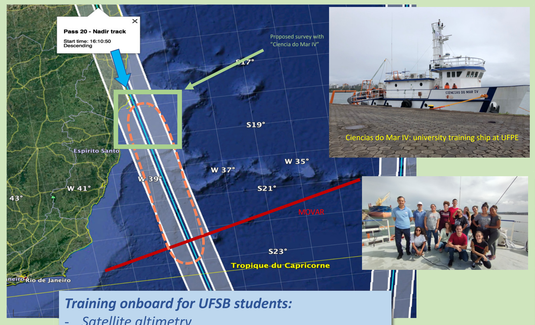
Preliminary analysis at LEGOS of reprocessed XTRACK nadir altimetry



Considering TAPIOCA 1/36 Model



SWOT-Abrolhos (May & September 2023)



Training onboard for UFSB students:

- *Satellite altimetry*
- *SWOT mission*
- *Field work*

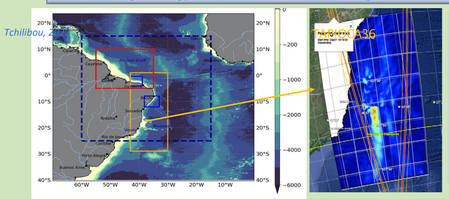
Objectives of SWOT-Abrolhos:

- *Brazil Current dynamics and mesoscale over the shelf, on the Banks:*
- *Banks of Abrolhos: rich ecosystem and MPA*
- *SSH on coastal areas*
- *Wave, tidal influence over the Banks*
- *Biogeochemistry (for Ocean Colour)*

SWOT-Abrolhos Field Campaign:

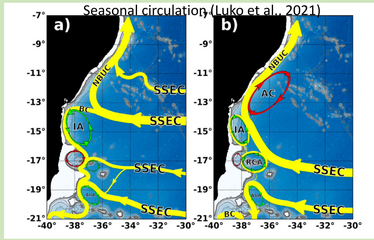
- *R/V Ciencias do Mar IV – 2 Legs : VM-ADCP, TSG*
- *CTD casts*
- *Biology, biogeochemistry, water sample*
- *2 shallow water moorings (ADCP, wave)*

Modelling strategy: dedicated simulations at high resolution with and without tides

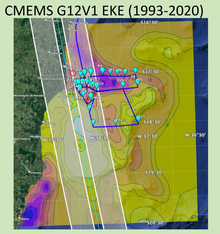


- *3 km resolution with tides*
- *Zones of internal tide generation, propagation, dissipation*
- *Interaction with shelf break*
- *Interaction IW-mesoscale-largescale*
- *Impact of IW on surface (SST cooling)*
- *Coupling with BGC and ecosystem models*

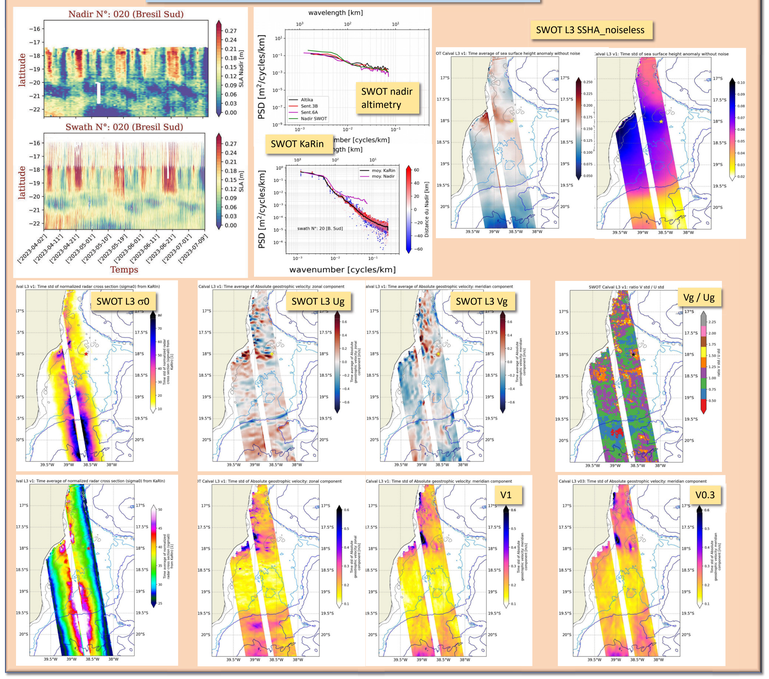
Seasonal circulation (Luko et al., 2021)



CMEMS G12V1 EKE (1993-2020)



First analysis at LEGOS of SWOT CalVal Pass 20 (L3 v0.3 & v1)

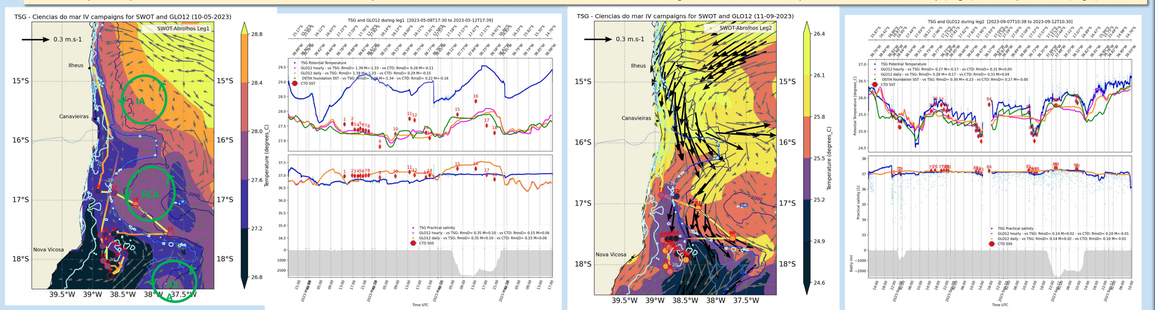


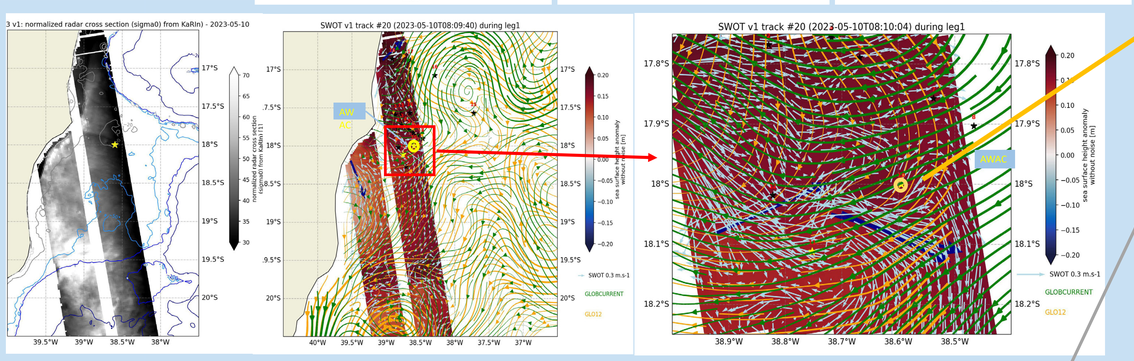
- First cal/val campaign of the Ciencias do Mar IV: difficulties at the first leg with TSG temperature measurements, ship-mounted ADCP data not yet processed
- Contribution to the SWOT ST AdAC projects (thank for their help during the cruises)
- Good agreement between CTD casts and CMEMS GLO12 and OSTIA products
- Sampling of the expected mesoscale features along the Brazil Current shelf and over the Banks

1-day repeat analyses:

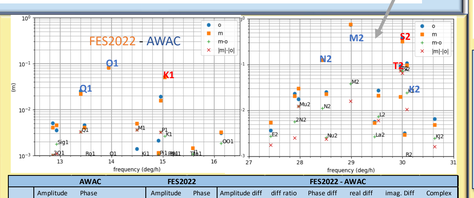
- SWOT L3 SSH and SSH noiseless very similar in the area
- Larger SSH variability closer to the coast need further analysis
- Mean SWOT SSH, sigma0_std , velocities reveal possible contamination by bathymetry (MSS corrections)
- Mean sigma0 : unexpected large cross-track slopes (mean and std)
- SWOT L3 v1 less noisy than v0.3, in particular on U/V std
- Variability of zonal/meridional currents need further analysis, although very high. Current pattern due to « real » dynamics on this shallow area need to be infered against other sources (satellite SST, color, ocean models)

Preliminary description of the water masses and circulation dynamics from Ciencias do Mar IV TSG and CTD casts, together with CMEMS operational forecasts: May (leg1) and September (leg2) 2023



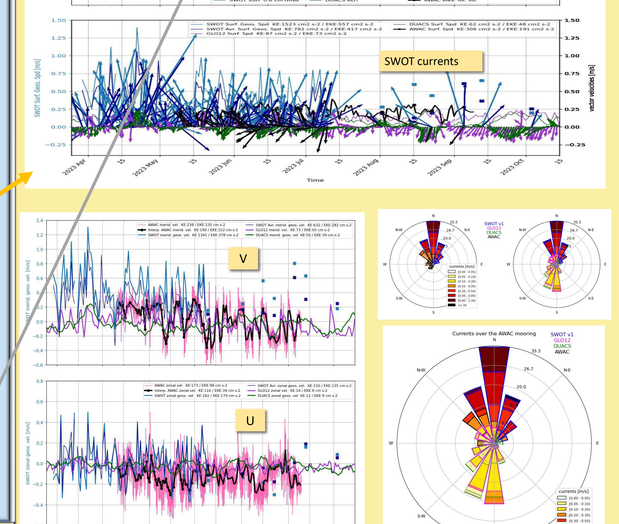


- Only one shallow water mooring correctly operating from May to September 2023, equiped with AWAC ADCP (Pressure → Sea level / Currents at the surface)
- Evaluation of SWH, SSH, currents from the AWAC, and compared against SWOT L3, CMEMS GLO12 and DUACS data over the period on coastal dynamics
- Good agreement between AWAC SLP and SWOT L3 SSH (no differences with noiseless) and GLO12_SSH. DUACS_ADT too low frequencies
- Good agreement between AWAC and SWOT SWH (wave spectrum under evaluation)
- Local dynamics: weaker and non consistent currents of CMEMS GLO12 and DUACS compared to AWAC
- **SWOT currents too large and noisy** in particular V (impact of tidal, MDT and MSSH errors under investigations)
- AWAC currents at 6-m depth, below influence of surface are not better matching SWOT geostrophic currents (although better comparison with GLO12)
- Comparison of sea level (from AWAC pressure) to FES2022 : very good agreement of major tidal constituent (S2 might be polluted by atmospheric tides)



	AWAC			FES2022		AWAC - FES2022				
Waves	Amplitude (cm)	Phase (deg)	Error (%)	Amplitude (cm)	Phase (deg)	Amplitude diff (cm)	diff ratio (%)	Phase diff (deg)	real diff (cm)	imag. Diff (cm)	Complex diff
M2	73,58	182,45	0,5	75,19	185,15	1,62	2,20%	2,70	1,38	3,60	3,86
S2	38,85	205,58	1,5	32,28	200,90	-6,57	16,92%	-4,68	4,89	5,26	7,18
N2	12,72	177,81	8,9	12,75	182,84	0,03	0,24%	5,03	0,02	1,12	1,12
K2	10,71	207,83	5,3	9,66	195,33	-1,05	9,78%	-12,50	0,15	2,45	2,45
T2	9,41	219,71	10,5	2,01	197,24	-7,40	78,63%	-22,48	5,32	5,41	7,59
O1	8,22	154,96	9,2	8,18	155,46	-0,03	0,39%	0,50	0,00	0,08	0,08
Sa	5,56	93,71	18,0	0,47	227,72	-5,10	91,60%	134,02	0,05	5,90	5,90
K1	5,18	224,97	16,0	5,08	107,13	-0,09	1,79%	-117,84	2,16	8,52	8,79
Q1	2,52	125,44	24,6	2,20	126,44	-0,33	12,90%	0,99	0,16	0,29	0,33
2N2	2,32	198,34	21,5	2,06	185,00	-0,26	11,01%	-13,34	0,15	0,55	0,57
Mu2	1,78	180,91	72,0	3,02	178,44	1,24	69,87%	-2,47	1,24	0,11	1,25
Nu2	2,54	177,98	35,7	2,30	180,34	-0,24	9,36%	2,35	0,24	0,10	0,26
L2	2,75	193,96	48,2	2,14	184,31	-0,61	22,20%	-9,65	0,53	0,50	0,73
M4	2,06	26,94	54,5	1,82	48,06	-0,23	11,36%	21,12	0,62	0,42	0,75

Comparison of SWOT L3 (v0.3) against GLO12, DUACS and Moored ADCP (20 m-depth)



Velocity comparison at AWAC location

Sea Level	DUACS daily		GLO12 daily		AWAC filtered	
	cc	RMSD	cc	RMSD	cc	RMSD
SWOT	0,71	7,16	0,86	5,04	0,91	4,54
DUACS			0,75	6,67	0,82	5,79
GLO12					0,96	2,89
Zonal Component	**DUACS geostrophic**		**GLO12 total**		**AWAC 6m total detided**	
SWOT geostrophic	-0,05	13,52	-0,08	14,02	0,00	23,75
DUACS geostrophic			0,04	6,18	-0,19	14,37
GLO12 total					0,26	12,57
Meridional component	**DUACS geostrophic**		**GLO12 total**		**AWAC 6m total detided**	
SWOT geostrophic	0,26	34,36	0,22	34,33	0,07	29,65
DUACS geostrophic			0,22	12,77	0,44	23,37
GLO12 total					0,69	15,06

Sea Level	AWAC filtered	
	cc	RMSD
SWOT	0,91	4,54
DUACS	0,82	5,79
GLO12	0,96	2,89
Zonal Component	**AWAC 6m total detided**	
SWOT geostrophic	-0,13	16,03
DUACS geostrophic	-0,14	5,59
GLO12 total	0,49	5,33
Meridional component	**AWAC 6m total detided**	
SWOT geostrophic	0,14	29,98
DUACS geostrophic	0,19	11,21
GLO12 total	0,85	6,84