Homogeneous multi-mission 20 Hz sea level anomaly (20 Hz L2P) products available

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Context

Since the launch of TOPEX/Poseidon and ERS-1 in the early 90's more than 10 other Altimetry missions were launched and operated by different agencies. The level 2 data (destinated to expert users) are distributed using different file formats (binary, netcdf) and contain different geophysical standards used to compute the sea level anomaly.

In the frame of the SALP (Service d'Altimétrie et de Localisation Précise) project supported by CNES (Centre National d'Etudes Spatiales) and of the Sentinel-3 Marine Altimetry L2P-L3 Service (operated under an EUMETSAT contract in the frame of the Copernicus Programme funded by the European Union) level 2P data are available to users for all the altimeter missions (TOPEX/Poseidon, Jason-1/2/3, ERS-1/2, Envisat, Saral/AltiKa, Sentinel-3A/B, GFO, Cryosat-2, HY-2A, HY-2B) in 1 Hz delayed time on AVISO+ and for Sentinel-3A, Sentinel-3B and Sentinel-6A (SAR) also in NRT/STC timeliness.

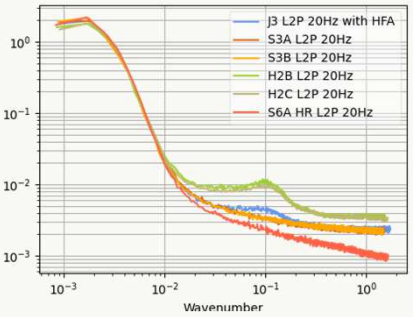
Since mid-2021 level 2P 20 Hz data are also available on AVISO+ for Sentinel-3A, Sentinel-3B and Jason-3 for near-real-time and short-time-critical timeliness. Other missions (Sentinel-6A and HY-2B) will be added soon. Hereafter the value-added sea level anomaly L2P 20 Hz products are presented.

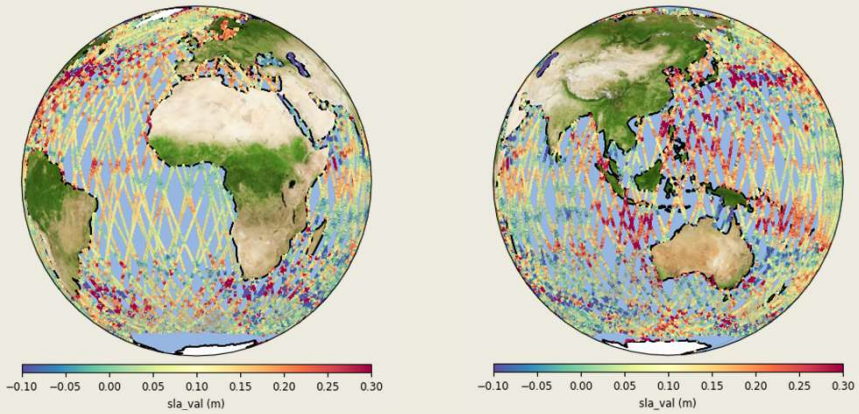
L2P 20Hz products

- Are easy to use (netcdf format)
- Are homogenous along-track mono-mission products
- Provide the same updated corrections and models
- Contain the sea level anomaly and all the corrections used to compute it and a validity flag
- An inter-mission bias is applied in order to have consistent time series since TOPEX/Poseidon
- Are input to the CMEMS L3 5Hz regional system

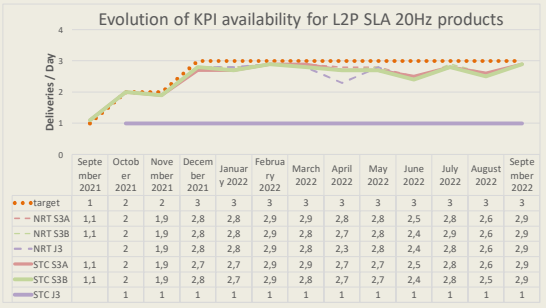
Spectral content

Power density spectrum of L2P 20 Hz SLA shows good agreement for the long wavelengths (steep oceanic slope). The LRM missions (Jason-3 and HY-B/C) have 20Hz and 1Hz plateau, as well as spectral hump. For Jason-3 HFA (Tran 2019) was applied which reduces the noise and the spectral hump. SAR missions show a spectral slope (« red noise » for scales lower than 50 km, likely linked to swell occurrences.





Sea level anomaly (sea_level_anomaly applying validation_flag) from L2P 20Hz products for Sentinel-3A/B, Jason-3 and Sentinel-6A over 2 days



	September 2021	October 2021	November 2021	December 2021	January 2022	February 2022	March 2022	April 2022	May 2022	June 2022	July 2022	August 2022	September 2022
target	1	2	2	3	3	3	3	3	3	3	3	3	3
NRT S3A	1,1	2	1,9	2,8	2,8	2,9	2,9	2,8	2,8	2,5	2,8	2,6	2,9
NRT S3B	1,1	2	1,9	2,8	2,8	2,9	2,8	2,7	2,8	2,4	2,9	2,6	2,9
NRT J3		2	1,9	2,8	2,8	2,9	2,8	2,3	2,8	2,4	2,8	2,6	2,9
STC S3A	1,1	2	1,9	2,7	2,7	2,9	2,9	2,7	2,7	2,5	2,8	2,6	2,9
STC S3B	1,1	2	1,9	2,8	2,7	2,9	2,8	2,7	2,7	2,4	2,8	2,5	2,9
STC J3		1	1	1	1	1	1	1	1	1	1	1	1

Average of number of daily deliveries of L2P 20 Hz products over a month

L2P 20 Hz products are produced on a best effort basis and delivered 3 times per day since December 2021 (except for Jason-3 STC, as L2 input products are only distributed once per day).

L2P 20 Hz 2021 standards	J3	S3A	S3B	S6A (soon to come)	HY-2B (2023)
L2 used	Official OGDR/IGDR (MLE4 retracking)	Official NRT/STC PDGS (SAR)	Official NRT/STC PDGS (SAR)	Official NRT/STC PDAP (SAR)	Official SDR NSOA
Orbit	CNES MOE-F (from L2)	CNES MOE-F (from L2)	CNES MOE-F (from L2)	CNES MOE-F (from L2)	CNES MOE-F (updated)
Sea State Bias	Non parametric SSB [same as L2]	Non parametric SSB [same as L2]	Non parametric SSB [same as L2]	Non parametric SSB [same as L2]	From L2
Ionosphere	Filtered (from L2)	Filtered (from L2)	Filtered (from L2)	Filtered (from L2)	Along-track GIM data
Wet troposphere	From J3-AMR radiometer	From S3A-MWR radiometer	From S3B-MWR radiometer	From S6A-MWR radiometer	Model computed from ECMWF Gaussian grids
Dry troposphere	Model computed from ECMWF Gaussian grids from L2 (except for HY-2B and HY-2C)				
Combined atmospheric correction	MOG2D High frequencies forced with analysed+predicted ECMWF pressure and wind field [Carrere and Lyard, 2003; operational version used, current version is 3.2.0] + inverse barometer low frequencies				
Ocean tide	FES2014B [Carrère et al., 2016]				
Solid Earth tide	Elastic response to tidal potential [Cartwright and Tayler, 1971], [Cartwright and Edden, 1973]				
Pole tide	[Desai et al., 2015 + mean pole location 2017 (Ries et al., 2017)]				
Internal tide	Internal tide [Zaron, 2019] HRET v8.1				
MSS	Combined (SCRIPPS,CNES/CLS15,DTU15)				
High frequency adjustment	High frequency adjustment [Tran et al., 2019]				

Access to L2P products:

L2P SLA 20 Hz Nrt/Stc products are available for Sentinel-3A, Sentinel-3B and Jason-3 on AVISO+: https://www.aviso.altimetry.fr/en/data/products/sea-surface-height-products/global/along-track-sea-level-anomalies-l2p.html

The following other L2P products are also available on AVISO+ :

- 1Hz S3A/S3B/S6A Near-Real-Time sea level anomaly (L2P data are available on AVISO+ generally less than 4h after the sensing start time of the product)
- 1Hz S3A/S3B/S6A Short-Time-Critical sea level anomaly (L2P data are available on AVISO+ generally less than 2 days after sensing start time of the product)
- 1Hz delayed time L2P sea level anomaly products (TP,ERS-1, ERS-2,EN, SARAL/AltiKA, J1, J2, J3, HY-2A, HY-2B, C2). S6A will be added very soon
- 1Hz S3A/S3B/S6A Near-Real-Time significant wave height and wind speed products

Perspectives:

When using new retracking, errors at short wavelengths will be reduced, as already demonstrated in "Toward Higher resolution Level-3 altimeter Sea Level products" (Pujol et al., Poster SC32022_007)

In November 2022 the Sea-Level TAC plans to introduce in the service catalogue a new along-track European 5Hz L3 product with a higher resolution than the historical 1Hz products. This requires operational upstream altimeter L2p products available with a 20Hz resolution over the global area.

OST/ST meeting, 31st October - 4th November, 2022