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# Change Record

When the quality of the products changes, the QuID is updated and the SQO is updated. A line is added to this table and the version of the SQO document is the same than that of the REFERENCE QUID. The third column specifies which sections or sub-sections have been updated.

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| Issue | Date | § | Description of Change | Authors | Validated By |
| 2.0 | 28/05/20 | All | Creation of the document for the 3 datasets (radar\_total, drifter,drifter\_filt) | L. Corgnati,  C. Mantovani, E. Reyes, A Rubio,  M. Chifflet,  J. Mader, N. Verbrugge, H Etienne, T. Carval | Validated by PQ leader |

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# Executive summary

The quality of the INSITU\_GLO\_UV\_NRT\_OBSERVATIONS\_013\_048 product from the CMEMS distribution is assessed through the horizontal data coverage along time for the following variables/datasets:

* **SURFACE WATER VELOCITY From High Frequency Radars (“radar\_total” and radar\_radial datasets)**

In the case of the radar\_radial and radar\_total data set, the SURFACE WATER VELOCITY consists in maps of NRT near-surface zonal and meridional velocities measured by High Frequency radars (HF radars, as acronym HFR). These variables are distributed along with standard deviation of near-surface zonal and meridional velocities, Geometrical Dilution of Precision (GDOP), quality flags and metadata.

To control both spatial and temporal availability of the surface water velocity maps, we use the 80/80 coverage annual metric as suggested by Roarty, et al. 2012**.** To compute this metric, we define a spatial area of reference which consists in all the grid points with at least one-time step of available good data (i.e. QCflag=1) for the target period. Then the % of time steps where the spatial coverage is equal or higher than 80% of the reference area is computed, considering only good (i.e. QCflag=1) and probably good data (i.e. QCflag=2). This metric allows to check if the system has reached the goal of providing surface currents over the 80% of the area during 80% of the time. This computation is done for each HF radar system separately and, when available, for each calendar year of available surface current maps.

For more information on the quality of the different HF radar system, you can refer to specific system reports to be found in the following links:

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| **HFR System** | **Link to system reports and figures** |
| **HFR-COSYNA** | <http://dspace.azti.es/handle/24689/888> |
| **HFR-MATROOS** | http://dspace.azti.es/handle/24689/903 |
| **HFR-EUSKOOS** | http://dspace.azti.es/handle/24689/898 |
| **HFR-Galicia** | http://dspace.azti.es/handle/24689/899 |
| **HFR-Lisboa** | http://dspace.azti.es/handle/24689/902 |
| **HFR-South** | http://dspace.azti.es/handle/24689/904 |
| **HFR-Gibraltar** | http://dspace.azti.es/handle/24689/900 |
| **HFR-Ibiza** | http://dspace.azti.es/handle/24689/901 |
| **HFR-DeltaEbro** | http://dspace.azti.es/handle/24689/897 |
| **HFR-TirLig** | http://dspace.azti.es/handle/24689/905 |

Table : http addresses to access the different HFR systems reports

* **NEAR\_SURFACE WATER VELOCITY From “drifter” dataset**

The Coriolis data Centre delivers every Monday **1-hour (3-hours before the 25th of March 2018)** 15 m depth velocities measurements from drifters.

Most of the drifters are of SVP type (or derived) and are part of the DBCP’s Global Drifter Program which transmits the data in real-time to the (Global Telecommunication system- GTS). Their drogue is centred at 15 meters depth (note: a small number of buoys, not SVP type, can measure other depths: 0 and 50m). These data are first collected on the GTS, then analysed and pre-processed (estimations of the velocities, outliers detection, position on land, drogue loss,… ) by the Marine meteorological Center of Météo-France (CMM) in the frame of the French project Coriolis, dedicated to operational oceanography in situ observation management. Only the drifters that have kept their drogue are distributed.

Other operational qualification is also done by Coriolis in a second stage (position, date, spike, … Real Time Quality Control (RTQC): EuroGOOS DATA-MEQ working group (2010). Recommendations for in-situ data Near Real Time Quality Control. https://doi.org/10.13155/36230) before the final dissemination of the data to CMEMS project in CMEMS file.

SVP drifter’s velocity is not the perfect measurement of the water column averaged over the drogue depth. The water can sink, or the drifter can slip due to wind influence on the surface float. Hence the resulting drifter velocity is the addition of the 15 meters depth large-scale current, the upper-ocean wind-driven flow, the influence of tides and Stokes Drift and other forces on the drogue and the surface body of the drifter, and the slip.

* **SEA WATER VELOCITY at 15m from “drifter\_filt” dataset**

This dataset is based on the “drifter dataset” described above. Each Tuesday, the data for the latest 30 days of the “drifter dataset” are downloaded and a 3-day low-pass filtering is applied along each drifter’s trajectory to remove inertial oscillation, tidal and high frequencies. Validation consists of monitoring the number of platforms and verifying the energy density spectrum before and after the application of the filter.

🡺 **For additional information regarding the in-depth validation of this product, the calculation of the assessment metrics presented in this product and other detailed information in quality and noticeable events please refer to the reference Quality Information Document (QuID) CMEMS-INS-QUID-013-048**

**Important notice:**

The contents of this document are an assessment based on the best set of observations available for evaluation at the time the operational system was validated. The validation methodology was defined and agreed within CMEMS, inheriting the long experience of MyOcean and MERSEA series of projects (Hernandez et al., 2018) but also the HFR EU node and the HFR-related activities in the CMEMS-INCREASE and H2020 – JERICO-Next research projects (HFR data). The estimated accuracy numbers (EAN) given in this document mainly come from literature. Other results illustrate the data coverages in time and space. The reader is invited to use complementary information from reference QUID (error maps for instance, when available).

# Variable/dataset SURFACE WATER VELOCITY from High Frequency Radars (“radar\_radial” and “radial\_total” datasets)

Coverage area and spatial resolution depend respectively on HFR operating frequency and available bandwidth (Rubio et al. 2017). Moreover, data coverage is not always regular. Spatial and temporal data gaps may occur at the outer edge, as well as inside the measurement domain due to several environmental and electromagnetic causes: (e.g. lack of Bragg scattering ocean waves or severe ocean wave conditions, low salinity environments, the occurrence of radio interference). Table 2 and Figure 1 shows the results of the 80/80 metrics for each of the systems along their temporal coverage (in the case of Figure 1, a map of temporal availability is showcased for different periods).

The temporal and horizontal coverage for the different available systems is by means of the 80/80 metrics in shown in Table 2.

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| **HFR-COSYNA** | TOTALS |  |  |  |  |
|  | 42.41 |  |  |  |  |
| **HFR-MATROOS** | TOTALS |  |  |  |  |
|  | 81.6 |  |  |  |  |
| **HFR-EUSKOOS** | TOTALS | HIGE | MATXI |  |  |
|  | 41.63 |  |  |  |  |
| **HFR-Galicia** | TOTALS |  |  |  |  |
|  | 49.26 |  |  |  |  |
| **HFR-Lisboa** | TOTALS |  |  |  |  |
|  | 97.46 |  |  |  |  |
| **HFR-South** | TOTALS |  |  |  |  |
|  | 0 |  |  |  |  |
| **HFR-Gibraltar** | TOTALS |  |  |  |  |
|  | 54.63 |  |  |  |  |
| **HFR-Ibiza** | TOTALS |  |  |  |  |
| **HFR-DeltaEbro** | TOTALS |  |  |  | 75.31 |
|  | 50.38 |  |  |  |  |
| **HFR-TirLig** | TOTALS |  |  |  |  |
|  | 41.35 |  |  |  |  |

Table 2: Summary of QA/QC analysis of NRT radial and total datasets. Results of the 80/80 metrics. Percent of spatial coverage available for each of the system in the last XX months is displayed. In green systems achieving or approaching the 80/80 goal, in orange systems with spatial coverage between 40 and 70%, in red systems with spatial coverage under 40% a 80% percent of the time.

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|  | Figure 1: Map of the % of availability of data in each grid point and contour showing the area of temporal availability >80%. The maps are computed following Roarty et al., 2012, for each system independently and for last XX months. | |

Figure 2: Map of the % of availability of data in each grid point and contour showing the area of temporal availability >80%. The maps are computed following Roarty et al., 2012, for each radial station independenty and for the corresponding periods as specified in the title of the subplots.

# Variable NEAR SURFACE SEA WATER VELOCITY from “drifter” dataset

Table 3 summarizes the accuracy of the measurements that can be expected from the drifters. This is the best accuracy that a user can expect for the data:

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| **Dataset** | **Reference** | **Current (m/s)** |
| drifter | Poulain et al. (2012, doi:10.1175/JPO-D-11-0159.1) | 0,01 |

Table 3: Accuracy of the drifter measurements expected from literature

In some regions and time periods, the number of measurements can be critically low due to the drifter launch time schedule (Figure 2) and their geographical locations (as in high latitudes) (Figure 3). The number of drifters has continuously increased from 2003 and reaches a number around 1200 in the last 4 years. The spatial repartition of the measurement is sparse or null in high latitudes. Less data is also available in the Mediterranean Sea and particularly in coastal areas.

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|  | | Figure : Count of transmitting drifters per month from 01/2003 to 12/2018. | |
|  | Figure 3: 5°x5° bins mean number of measurements over a 3-month period from 2019 October to December. |

# Variable SEA WATER VELOCITY at 15m from “drifter\_filt” dataset

We first check that the temporal distribution of the data is identical to the one of the “drifter dataset” (§2). We compare the number of drifters at 15m depth before (black) and after (red) the filtering to check that we are not missing too many drifters because of too short drifters’ trajectories or because of issue with the application of the filter.

|  |  |
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| Une image contenant carte  Description générée automatiquement | Figure : Number of SVP drifter (15m depth) before (black) and after(red) the filtering - April 2018 to April 2020. |

The density energy spectra were calculated before (blue) and after (red) the 3-days filtering was applied along the drifter trajectories to validate its effect on the signal.

The calculation is done from April 2018 to April 2020, on the 1h drifters’ database. The energy strongly decreases below 3 days, but we also see a decrease in energy for up to 6 days.

The spectrum is computed for anticyclonic and cyclonic trajectories. The dissymmetry comes from the fact that we have more energy in the anticyclonic gyres (wind forcing, western boundary currents, …). On the raw dataset, tides peaks are visible at 6, 9, 12h, … The 24h frequency of the tide is not visible. The signature of the inertial frequency is also observed (around 1d) but spread because spectrum is calculated on the entire global domain. It is anticyclonic.

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| Une image contenant carte, texte  Description générée automatiquement | Figure : Energy density spectrum for uv before (blue) and after (red) filtering and for cyclonic (solid) and anticyclonic trajectories (dashed). April 2018 to April 2020 |

# References

**Hernandez, F., et al., 2018**: Measuring performances, skill and accuracy in operational oceanography: New challenges and approaches. In "New Frontiers in Operational Oceanography", E. Chassignet, A. Pascual, J. Tintoré, and J. Verron, Eds. GODAE OceanView, 759-796, doi:10.17125/gov2018.ch29.

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