

Report on HFR - TirLig Historical data files QA/QC

Data provider information:

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- acknowledgements: The HFR-TirLig network has been established, developed and maintained thanks to the Italian flagship project RITMARE, the EU H2020 Jerico-Next, Jerico-S3 and EuroSea projects, the Interreg Italy-France Maritime IMPACT, Sicomar-Plus and SINAPSI projects, the NextGenerationEU ITINERIS and RAISE Italian projects. The network has been designed, implemented and managed through the efforts of CNR-ISMAR Section of Lerici.

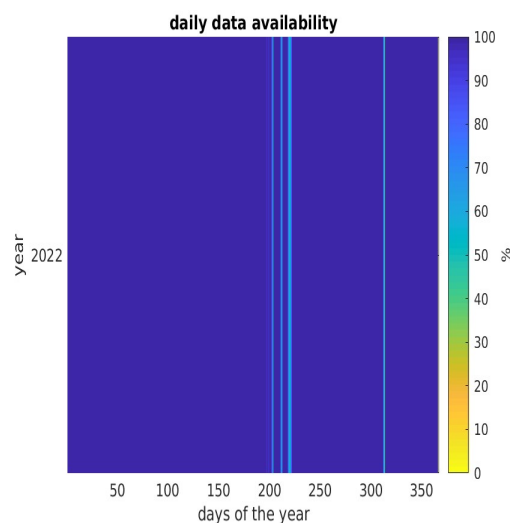
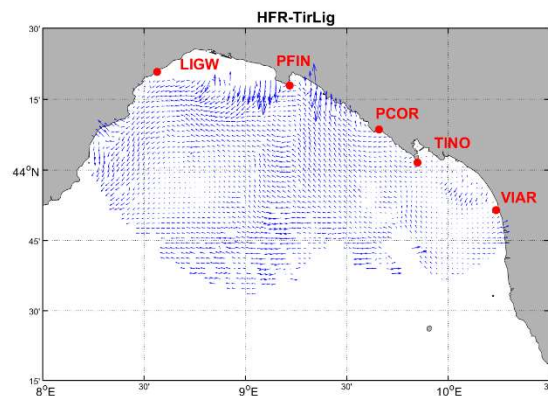
System: **TirLig**

Sites: **PCOR, TINO, MONT, VIAR, PFIN, LIGW**

Data set: **Totals**

Data source: Totals from the radials combination in de EU Node

Period: **2016-Aug-04 - 2022-Dec-31**



Daily data % available during the whole time period

INFO ON QA/QC Settings and Calibration

%%% QC info for all the period 04-Aug-2016 – 23-Jul-2020

OceanSITES quality flagging for GDOP threshold QC test. Threshold set to 2.

OceanSITES quality flagging for Data density threshold QC test. Threshold set to 3 radials.

OceanSITES quality flagging for Velocity threshold QC test. Threshold set to 1.2 m/s.

OceanSITES quality flagging for variance threshold QC test. Test not applicable to Direction Finding systems. The Temporal Derivative test is applied. Threshold set to 1.2 m/s.

%%% Calibration info for 04-Aug-2016 – 23-Jul-2020

MONT: 2016-06-22T00:00:00Z;

TINO: 2018-09-27T00:00:00Z ; TINO: 2021-07-21T00:00:00Z;

PCOR: 2018-04-18T00:00:00Z ;

VIAR: 2018-09-14T00:00:00Z ; VIAR: 2020-07-15T00:00:00Z

PFIN: 2020-07-14T00:00:00Z;

LIGW: 2018-12-06T00:00:00Z;

RESULTS OF HIST DATA INSPECTION

General comments:

This system is composed by 6 radar stations (MONT, PCOR, TINO, VIAR,, PFIN, LIGW). They all have not been operating since the beginning and this fact helps to understand the differences in the number of data availability figures, presented later in this report.

MONT: operational since Jun-2016 to Apr-2028

TINO: operational since Aug-2016

PCOR: operational since Apr-2018

VIAR: operational since Sep-2018

PFIN: operational since Feb-2020

LIGW: operational since Dec-2021

We have noticed 2 periods to be controlled and/or reflagged, occurring in 2018 and 2020

year	General comment	Periods to be reflagged	Reason for new fagging	Sugg. Flag
2018		29-Oct-2018 – 31-Dec-2019	variability of number of data available	2
2020		11-Feb – 23-Jul-2020	low number and variable data availability	2

The different installation and removal periods of the different antennas, explain the differences of the Spatial Coverage vs. temporal coverage of the different years in figures E. The addition of new HF radar stations during the existence of this network, creates a bigger reference coverage are for the whole study period, which suggest bad functioning periods. But the standard computation of the 80/80 metric for this case needs be analysed taking in consideration this characteristics instead of considering bad functioning periods.

The lower performances for 2019, are expected since PCOR station was out of service for 2 months. Surface current average:

- 2016: anticyclonic circulation; north-westward current at the east of the covered zone
- 2017: anticyclonic circulation

- 2018: anticyclonic circulation; north-westward current at the east of the covered zone
- 2019: north-westward circulation, except along the coast and south of the covered zone; covered zone distinct to other years
- 2020-22: north-westward current at the north of the HF Radar footprint area

Spatial Coverage vs. Temporal coverage: objective of USCG 80-80% data availability			
Period	General comments	Nb. analysed hours	80%-80% obj.
2016	11.159% spatial availability 80% of the time.	3583	n
2017	10.7278% spatial availability 80% of the time.	8717	n
2018	9.9191% spatial availability 80% of the time.	8163	n
2019	8.7332% spatial availability 80% of the time.	8750	n
2020	6.8464% spatial availability 80% of the time.	8645	n
2021	19.3531% spatial availability 80% of the time.	8282	n
2022	24.2049% spatial availability 80% of the time.	8671	n

Annex I Applied QA/QC tests

QC Flag	Short name	Short description
Variable name		
-	Syntax	Syntax check: this test will ensure the proper formatting and the existence of all the necessary fields within the total NetCDF file. This test is performed on the NetCDF files and it assesses the presence and correctness of all data and attribute fields and the correct syntax throughout the file. This test is performed by the European HFR Node before pushing data to the distribution platforms.
DDNS_QC	Data Density Threshold	Data Density Threshold: this test labels total velocity vectors with a number of contributing radials bigger than the threshold with a “good data” flag and total velocity vectors with a number of contributing radials smaller than the threshold with a “bad data” flag.
CSPD_QC	Velocity Threshold	Velocity Threshold: this test labels total velocity vectors whose module is bigger than a maximum velocity threshold with a “bad data” flag and total vectors whose module is smaller than the threshold with a “good data” flag.
VART_QC	Variance Threshold	Variance Threshold: this test labels total vectors whose temporal variance is bigger than a maximum threshold with a “bad data” flag and total vectors whose temporal variance is smaller than the threshold with a “good data” flag. This test is applicable only to Beam Forming (BF) systems. Data files from Direction Finding (DF) systems will apply instead the “Temporal Derivative” test reporting the explanation “Test not applicable to Direction Finding systems. The Temporal Derivative test is applied.” in the comment attribute.

TIME_QC	Temporal Derivative	Temporal Derivative: for each total bin, the current hour velocity vector is compared with the previous and next hour ones. If the differences are bigger than a threshold (specific for each grid cell and evaluated on the basis of the analysis of one-year-long time series), the present vector is flagged as “bad data”, otherwise it is labelled with a “good data” flag. Since this method implies a one-hour delay in the data provision, the current hour file should have the related QC flag set to 0 (no QC performed) until it is updated to the proper values when the next hour file is generated.
GDOP_QC	GDOP Threshold	GDOP Threshold: this test labels total velocity vectors whose GDOP (Geometrical Dilution Of Precision) is bigger than a maximum threshold with a “bad data” flag and the vectors whose GDOP is smaller than the threshold with a “good data” flag.
QCflag	Overall QC	

Annex II QC Flags

Code	Meaning	Comment
0	No QC was performed	-
1	Good data	All real-time QC tests passed.
2	Probably good data	-*
3	Bad data that are potentially correctable	These data are not to be used without scientific correction.*
4	Bad data	Data have failed one or more of the tests.
5	Value changed	Data may be recovered after transmission error.
6	Not used	-
7	Nominal value	-
8	Interpolated value	Missing data may be interpolated from neighbouring data in space or time.
9	Missing value	-

*These two are to be used after examination of the hist data sets and exchanges with the data provider

Annex III Figures for the QA/QC tests

Fig A – Temporal series of the spatial average of the current velocity module (first panel), its standard deviation (second panel), the grid points of the total coverage (third panel), and monthly data availability. Black dots are the values obtained considering all the data in the domain, in green those considering only data with QC flag =1 (good data).

Fig B - Temporal series of the QC flags for all the grid nodes with data and percentage of data with each flag (0,1,2,3,4).

Fig C - Maps of the mean velocity module and the mean value of QC flags for the target year (left column) and their standard deviations (right column) for the target year.

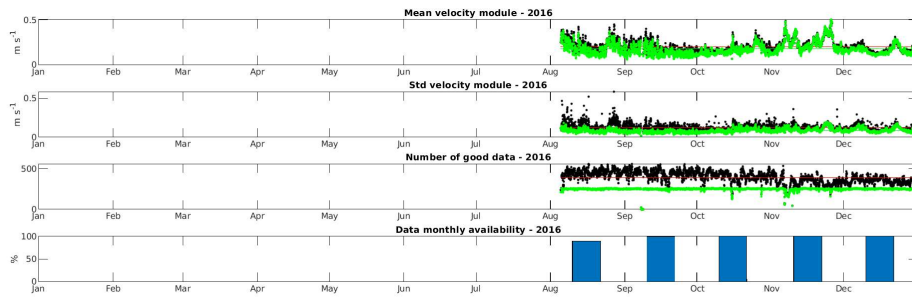
Fig D - Spatial (x-axis) vs. temporal (y-axis) coverage 80/80 annual metric. Allows to check if the system has reached the goal of providing surface currents over the 80% of the area during 80% of the time. The grid points taken in account for the % are the ones inside the GDOP limits defined by the data provider.

Fig E – Map of the % of availability of data in each grid point and contour showing the area of temporal availability >80%

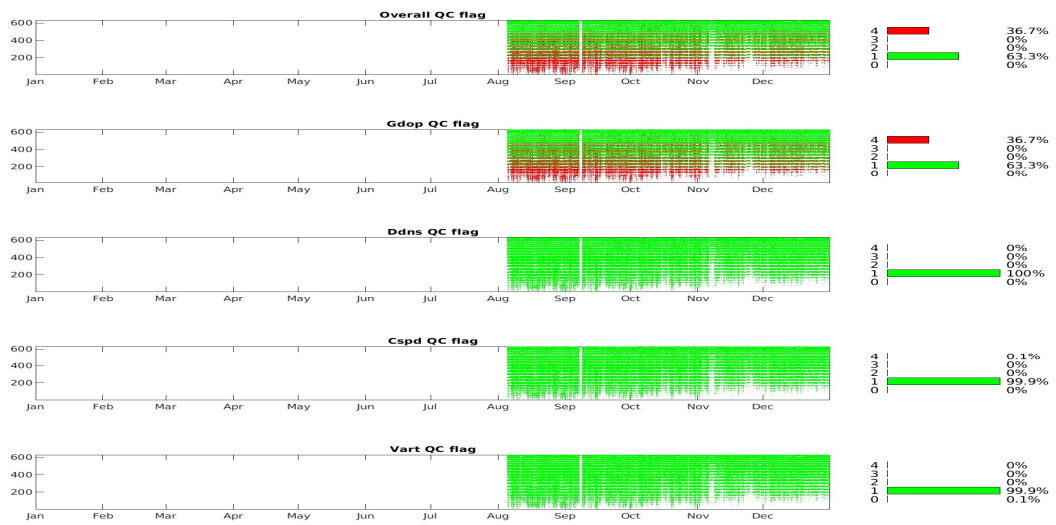
Fig F- Mean surface current maps for the indicated systems and periods. The means are computed in the area of 80% temporal coverage for the target year.

Period: 2016

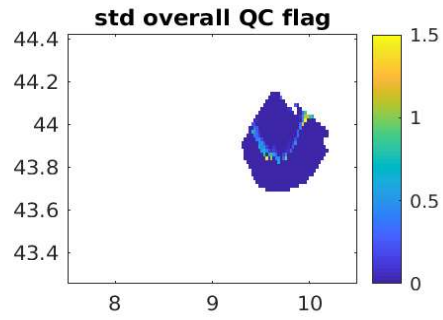
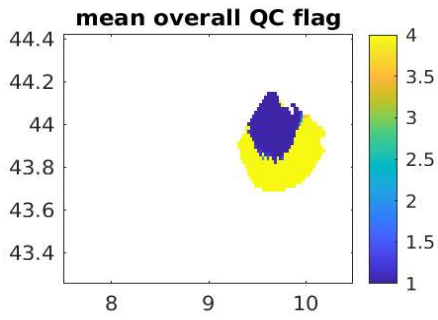
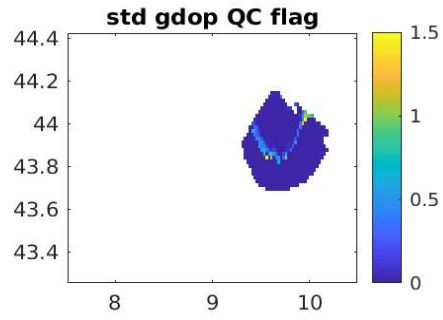
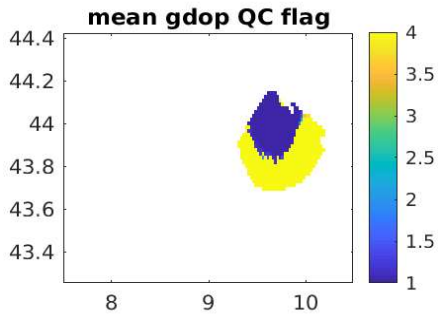
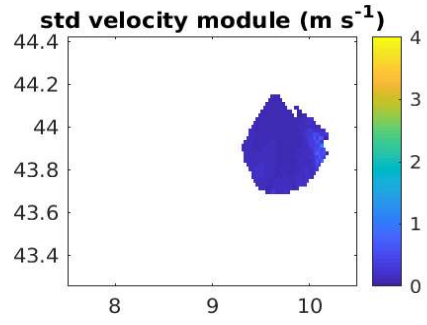
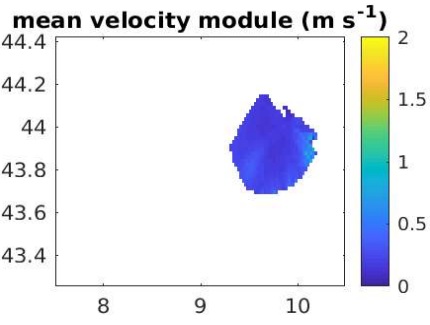
A



B

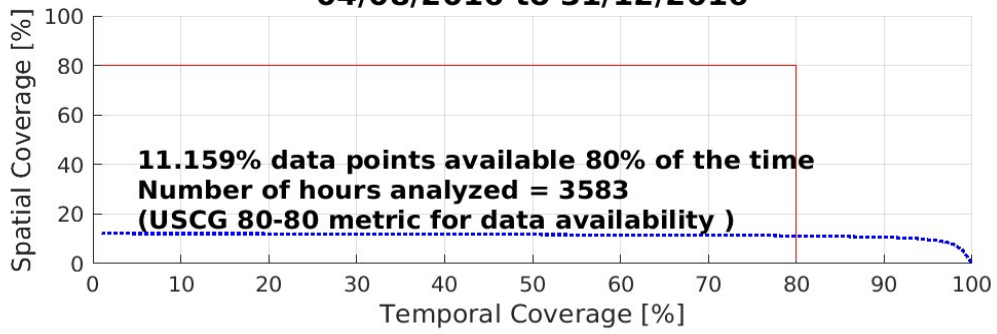


C



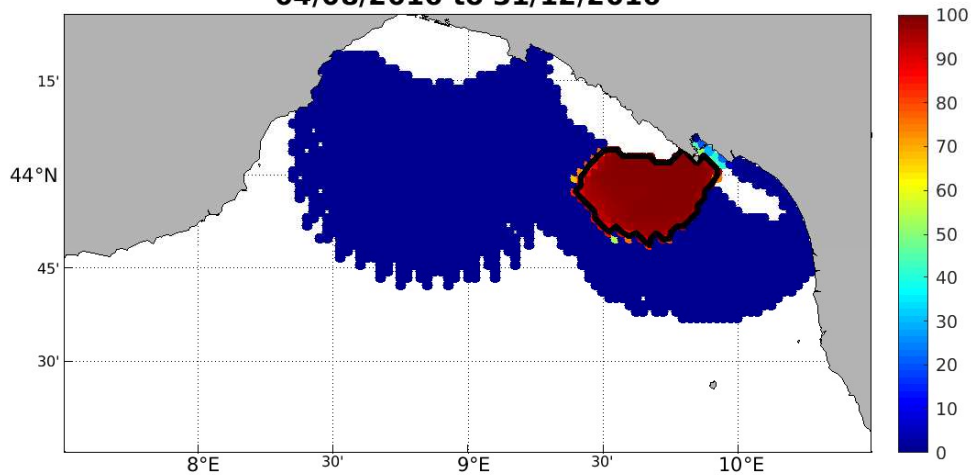
D

HFR-TirLig: Spatial Coverage vs. Temporal Coverage 04/08/2016 to 31/12/2016



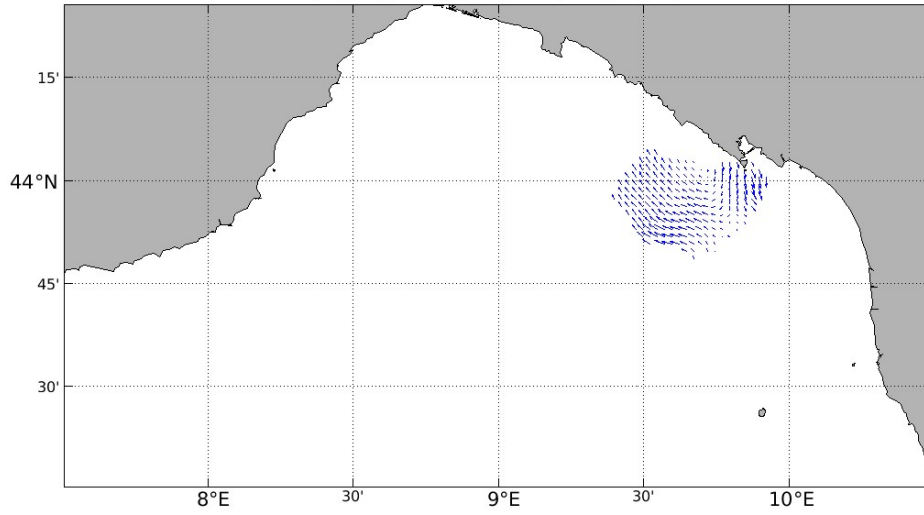
E

HFR-TirLig: Percent Total Vector Coverage (contour showing >80%) 04/08/2016 to 31/12/2016



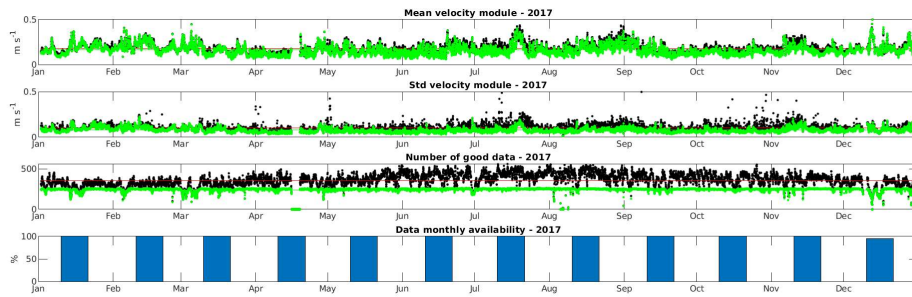
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**HFR-TirLig: HFR Surface current average [m/s]
04/08/2016 to 31/12/2016**

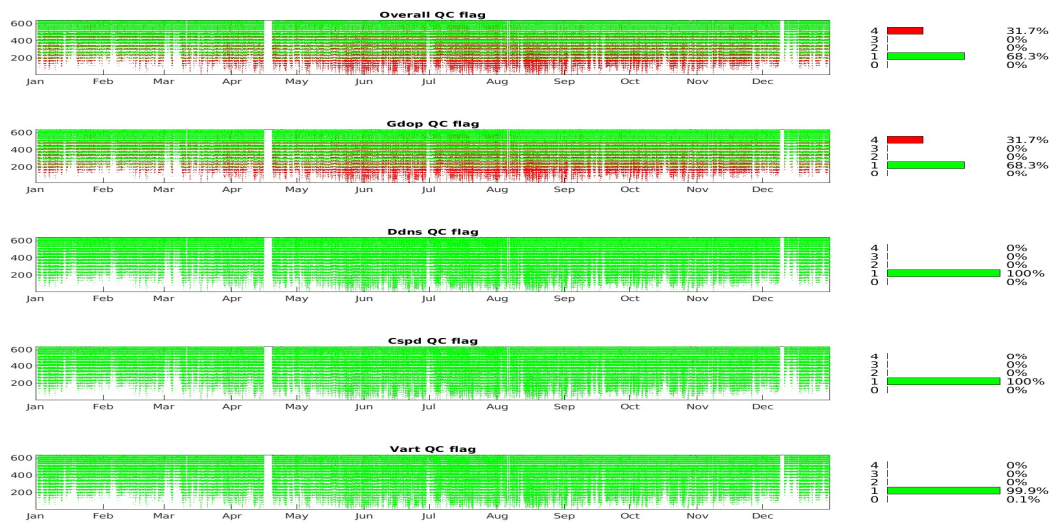


Period: 2017

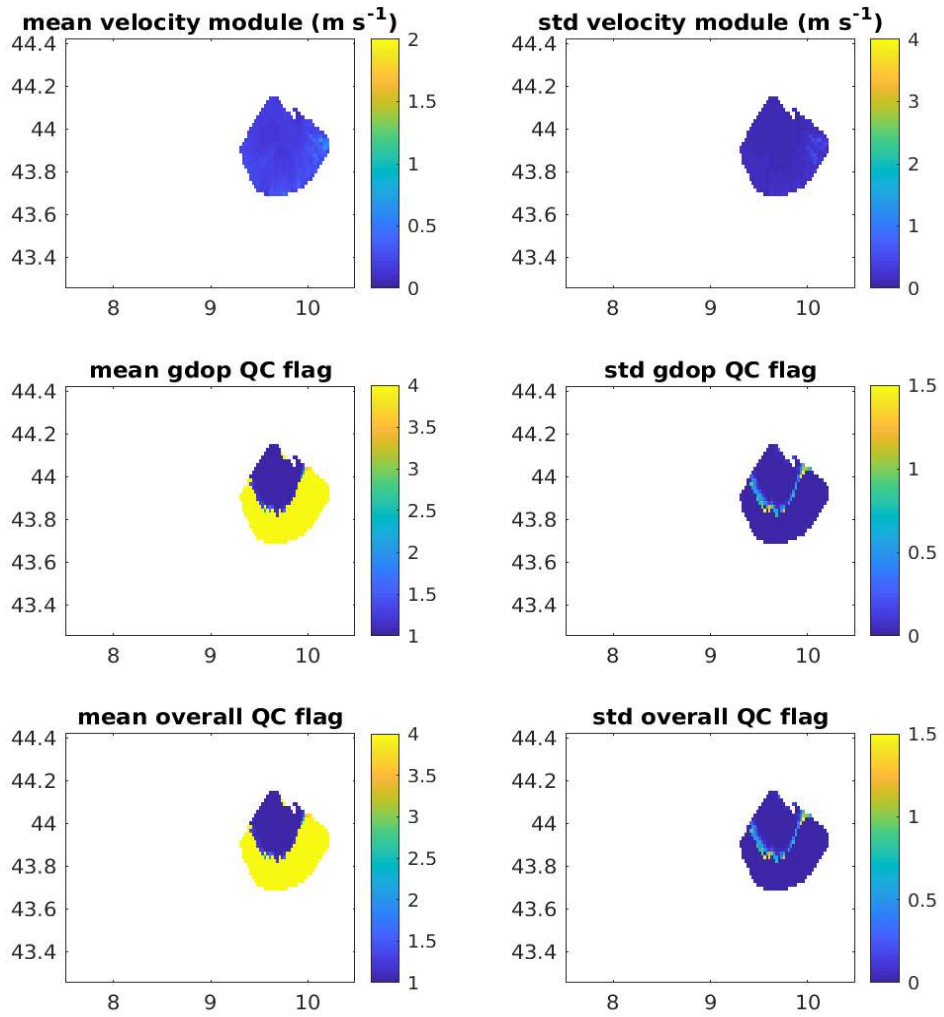
A



B

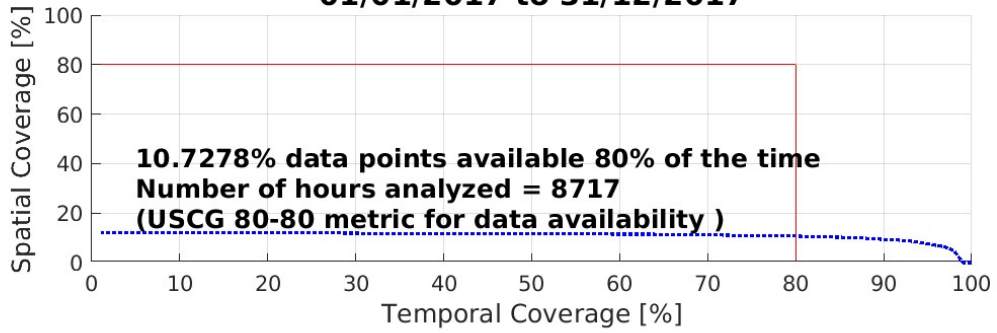


C



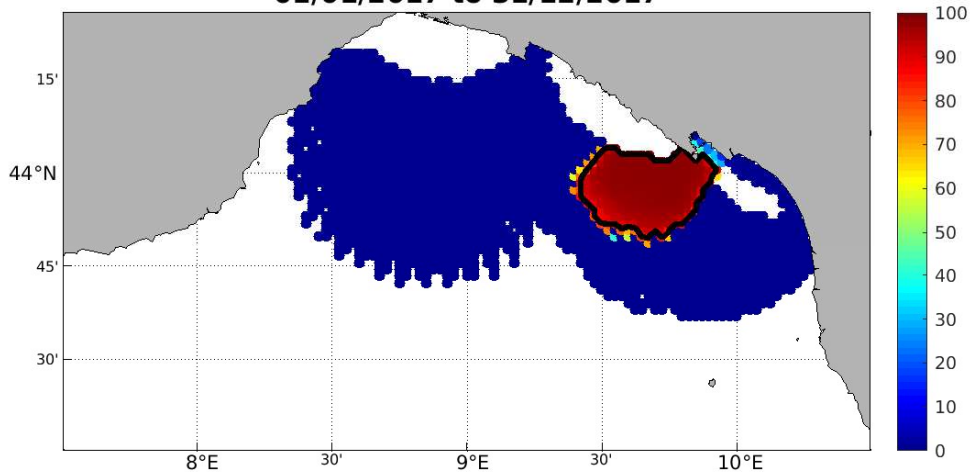
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**HFR-TirLig: Spatial Coverage vs. Temporal Coverage
01/01/2017 to 31/12/2017**



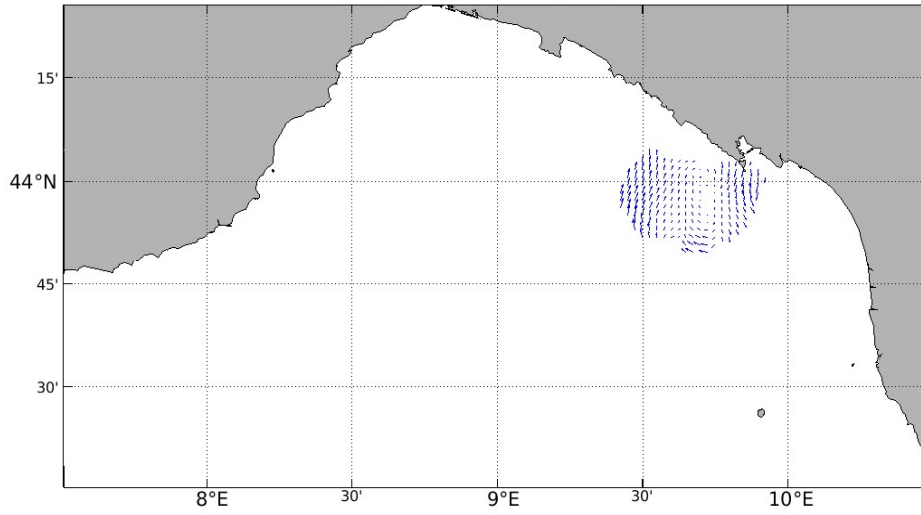
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**HFR-TirLig: Percent Total Vector Coverage (contour showing >80%)
01/01/2017 to 31/12/2017**



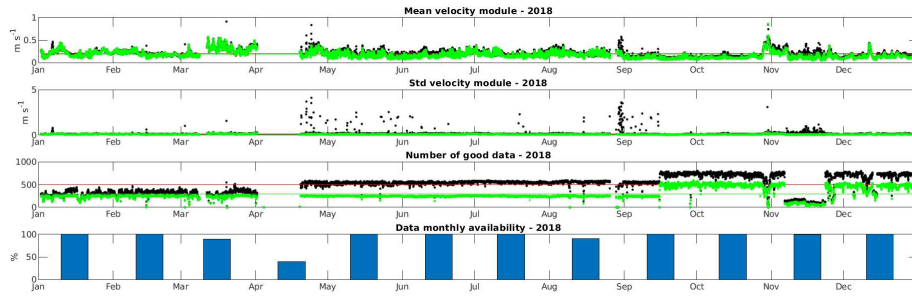
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**HFR-TirLig: HFR Surface current average [m/s]
01/01/2017 to 31/12/2017**

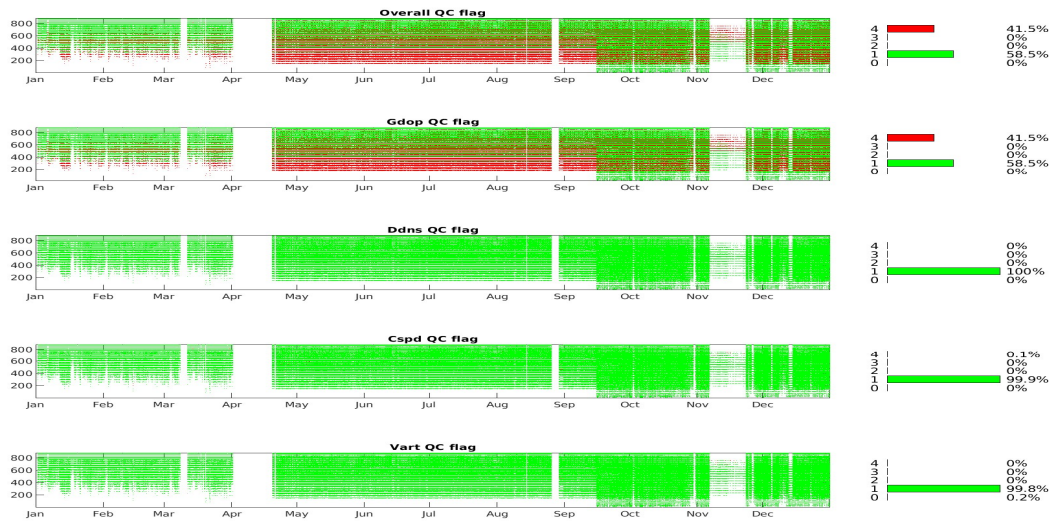


Period: 2018

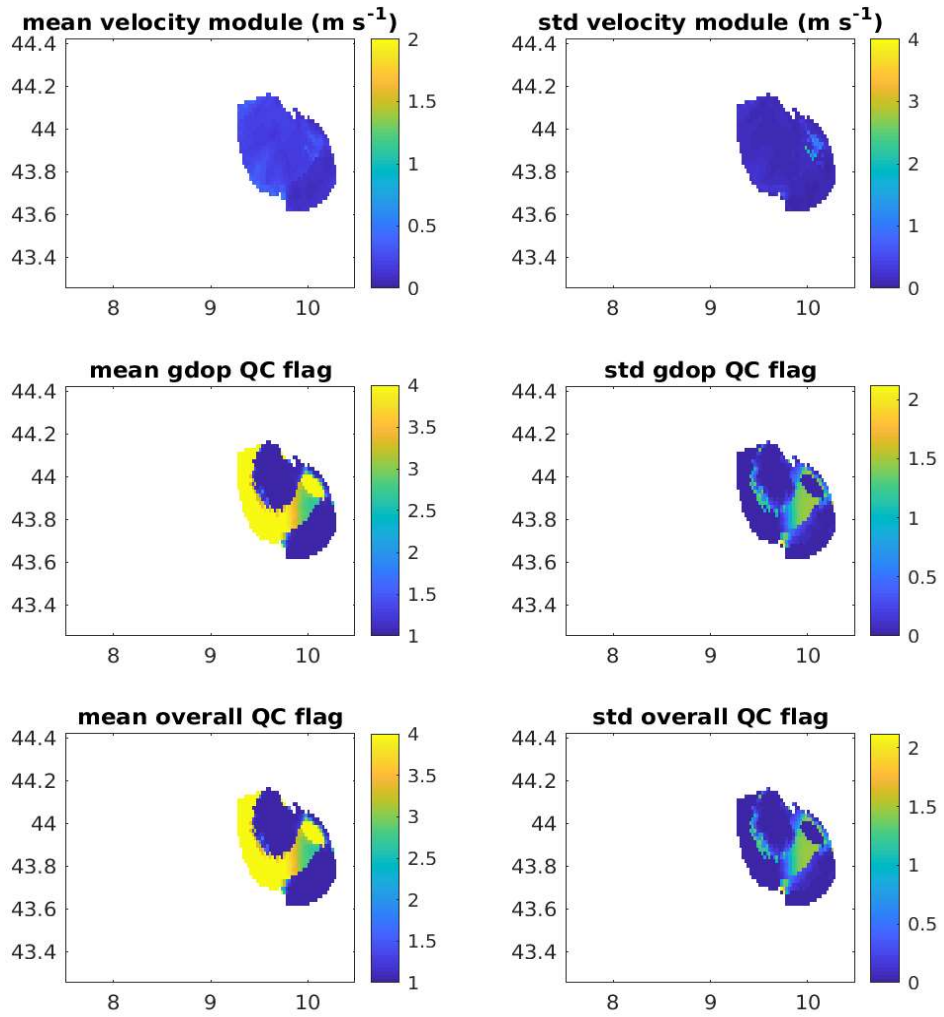
A



B

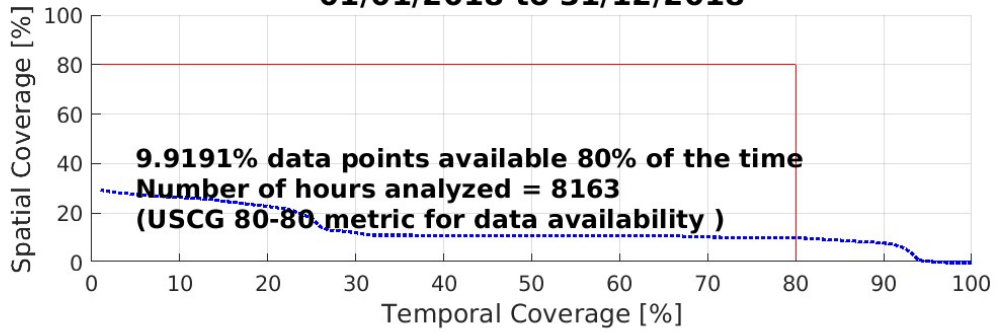


C



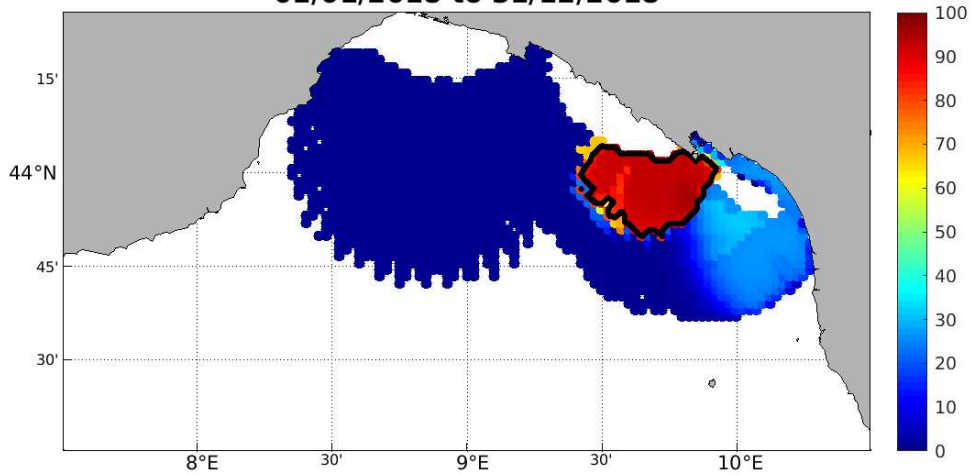
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**HFR-TirLig: Spatial Coverage vs. Temporal Coverage
01/01/2018 to 31/12/2018**



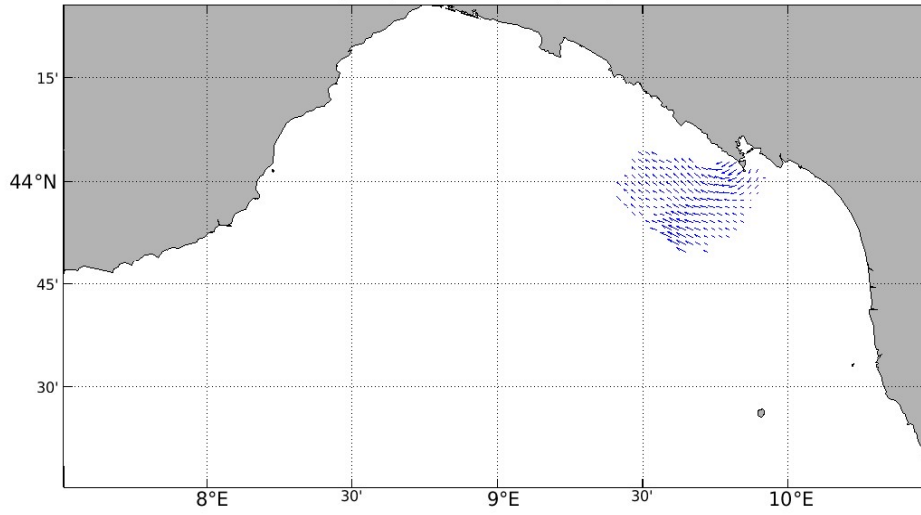
E

**HFR-TirLig: Percent Total Vector Coverage (contour showing >80%)
01/01/2018 to 31/12/2018**



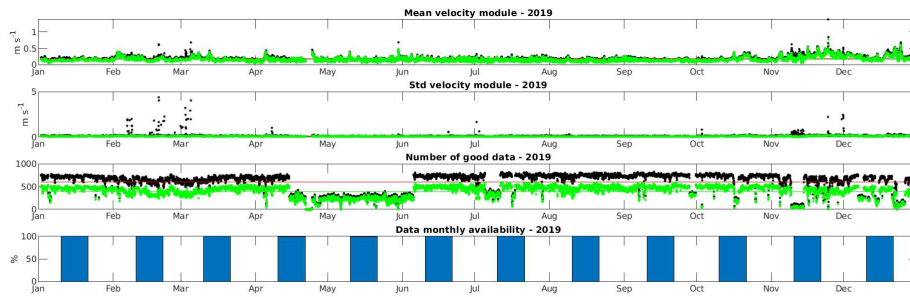
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**HFR-TirLig: HFR Surface current average [m/s]
01/01/2018 to 31/12/2018**

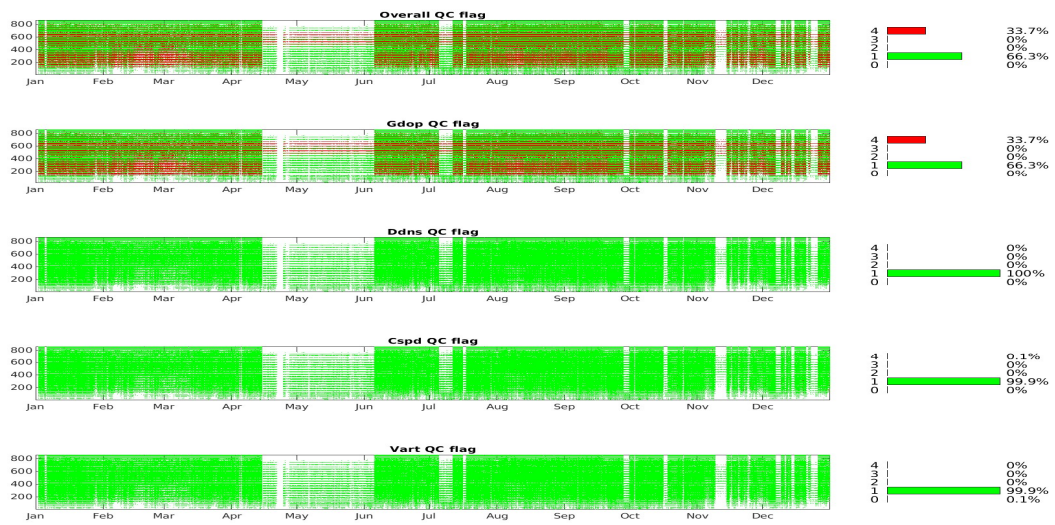


Period: 2019

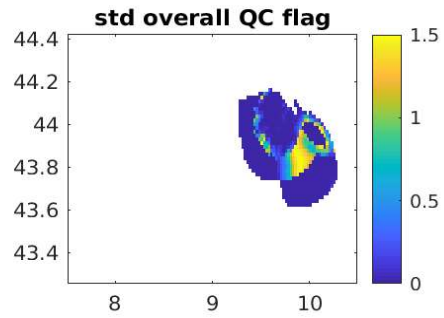
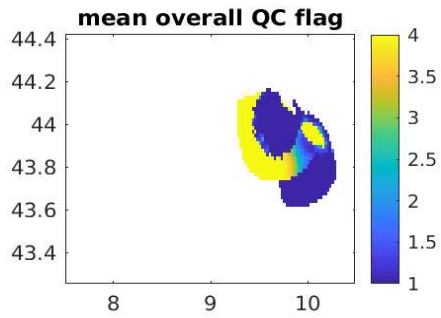
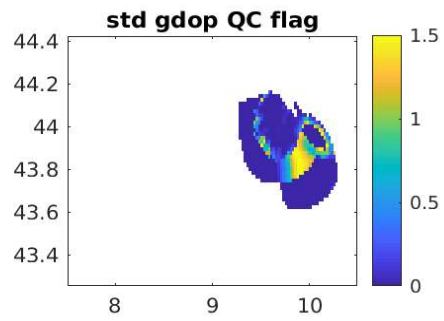
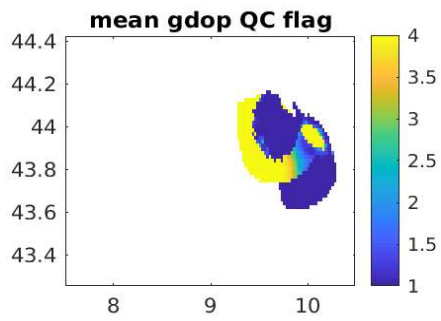
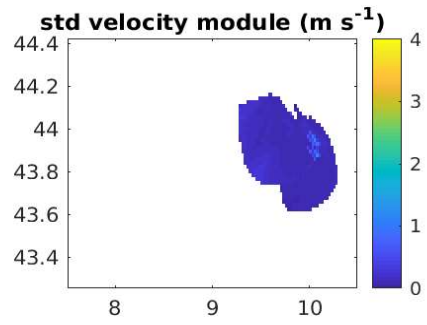
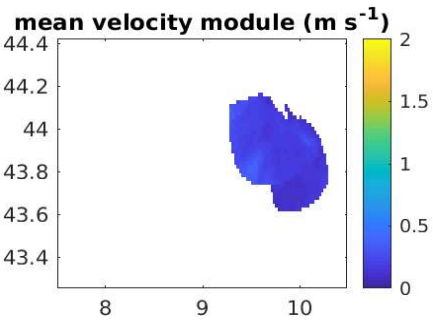
A



B

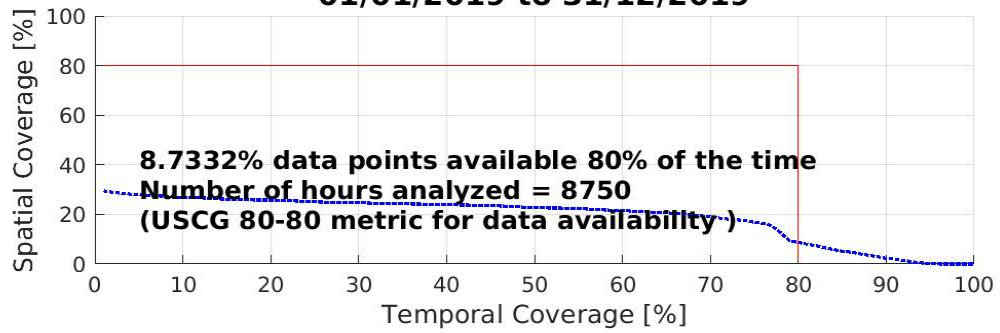


C



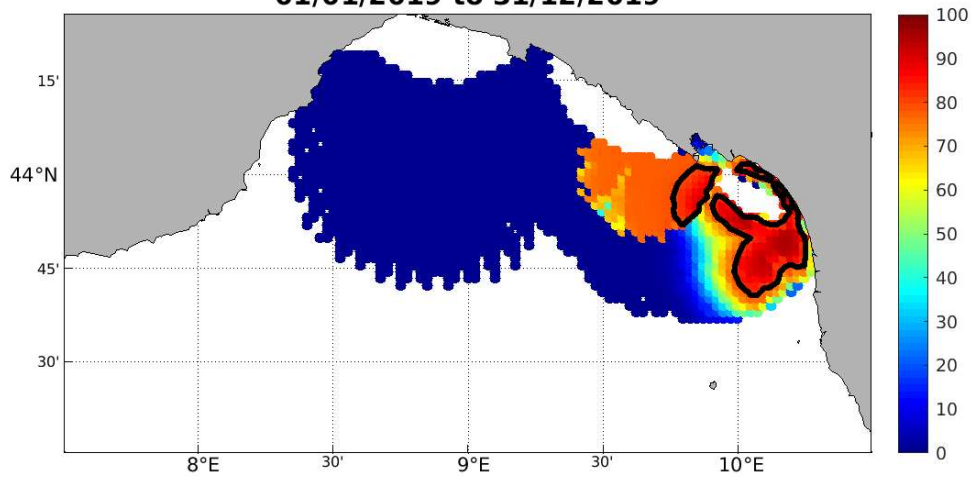
D

HFR-TirLig: Spatial Coverage vs. Temporal Coverage 01/01/2019 to 31/12/2019



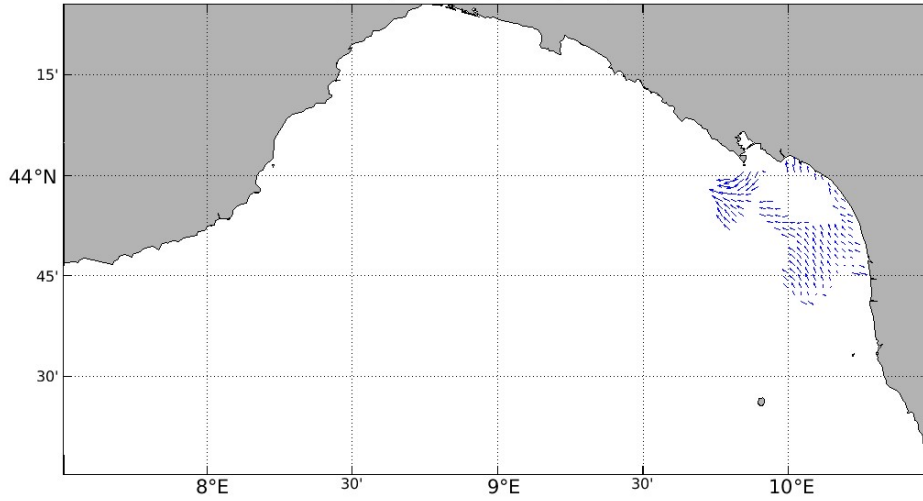
E

HFR-TirLig: Percent Total Vector Coverage (contour showing >80%) 01/01/2019 to 31/12/2019



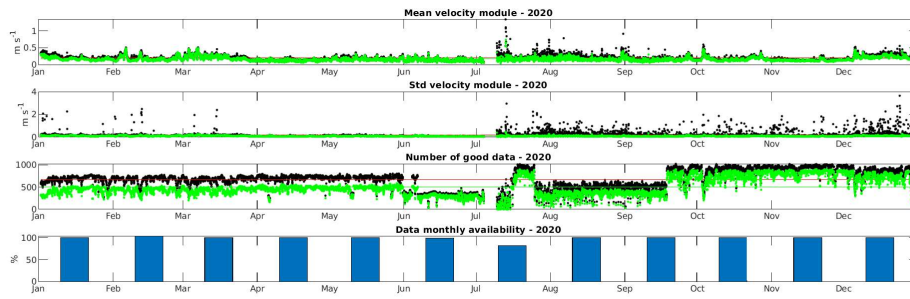
F

**HFR-TirLig: HFR Surface current average [m/s]
01/01/2019 to 31/12/2019**

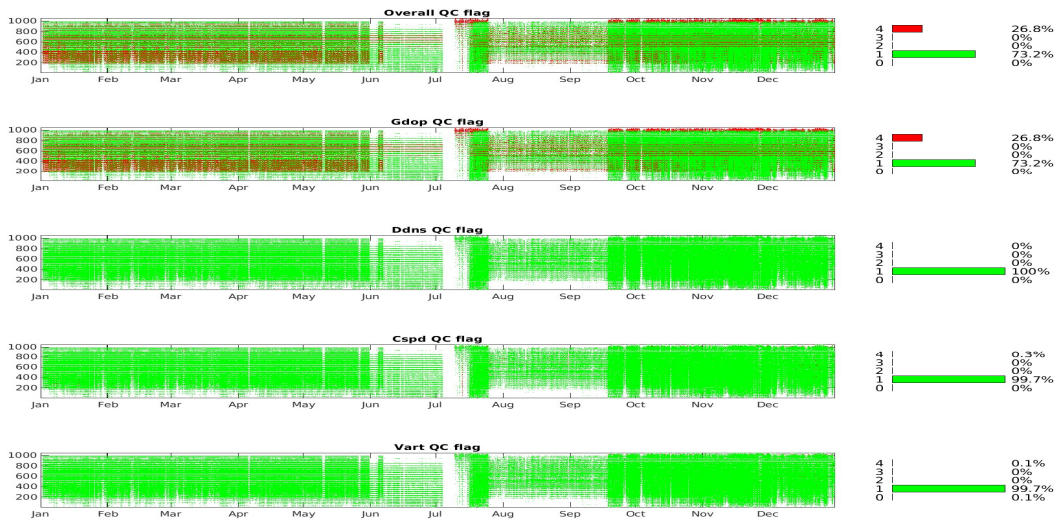


Period: 2020

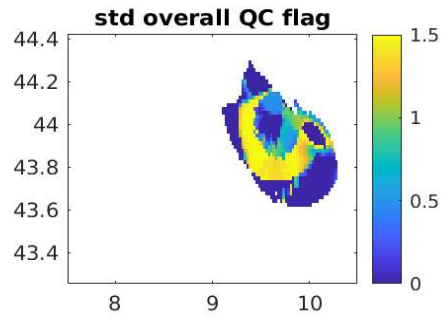
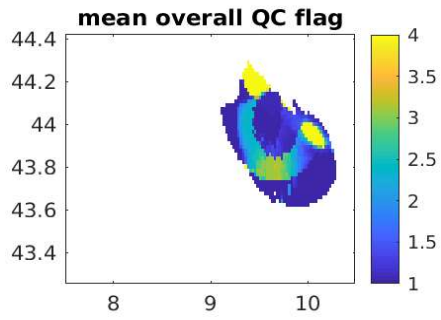
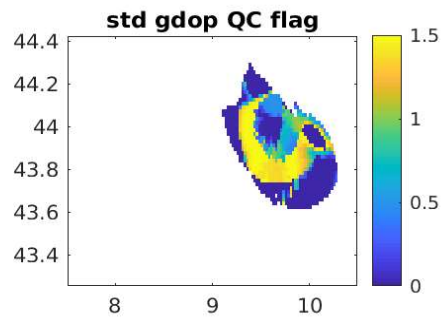
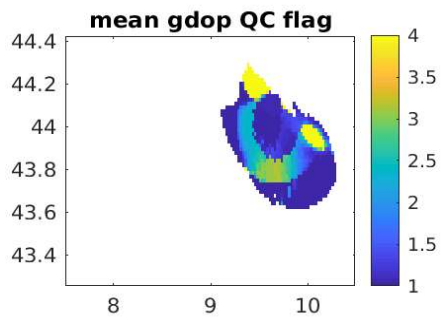
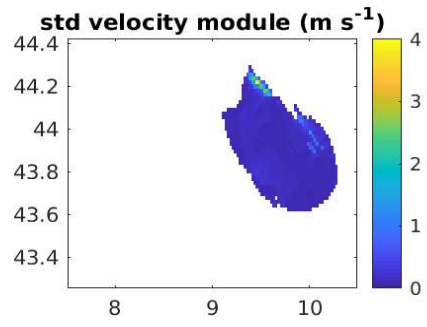
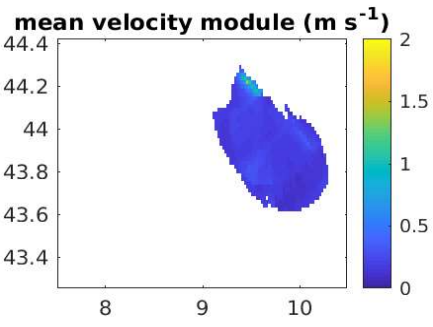
A



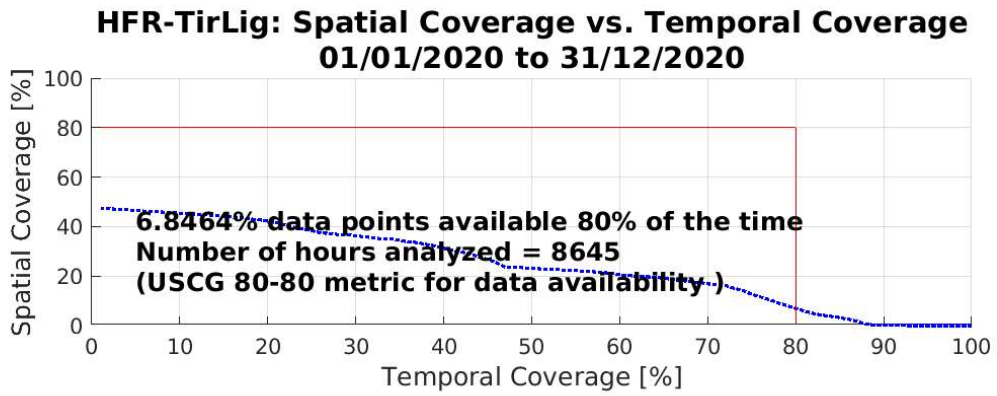
B



C

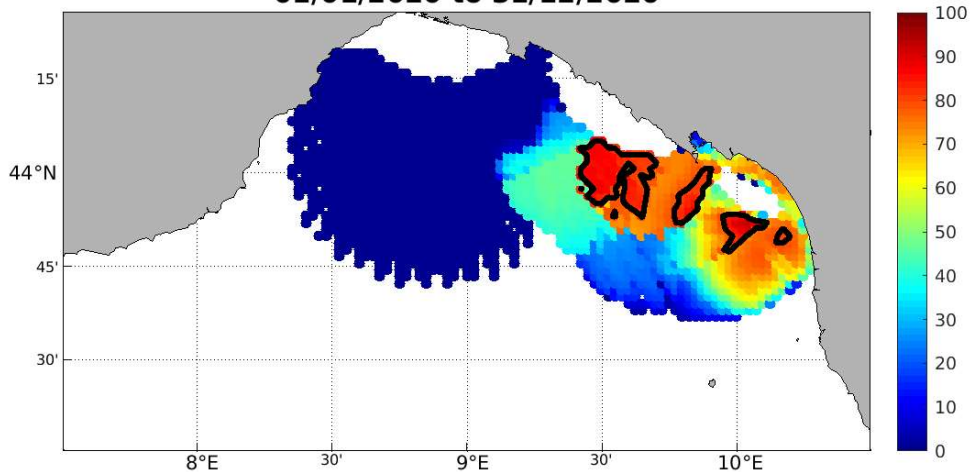


D



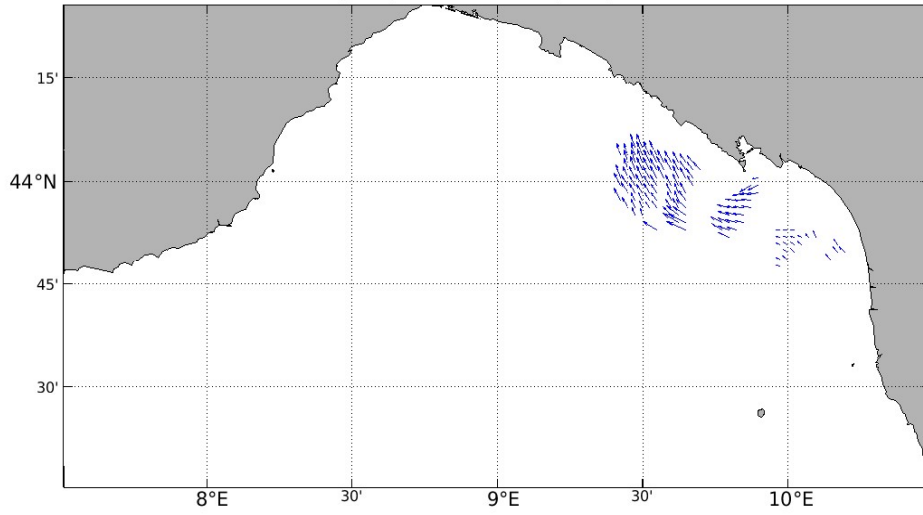
E

HFR-TirLig: Percent Total Vector Coverage (contour showing >80%) 01/01/2020 to 31/12/2020



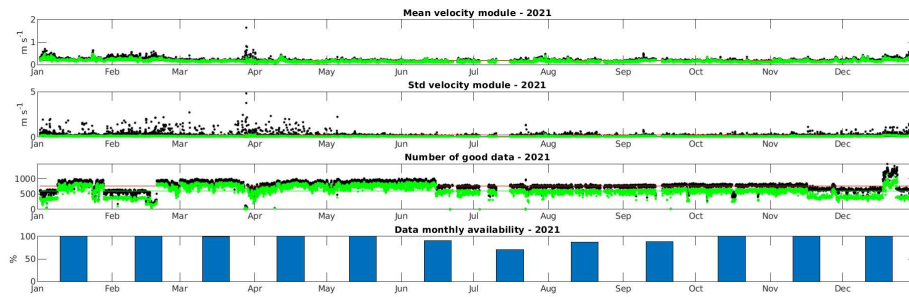
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**HFR-TirLig: HFR Surface current average [m/s]
01/01/2020 to 31/12/2020**

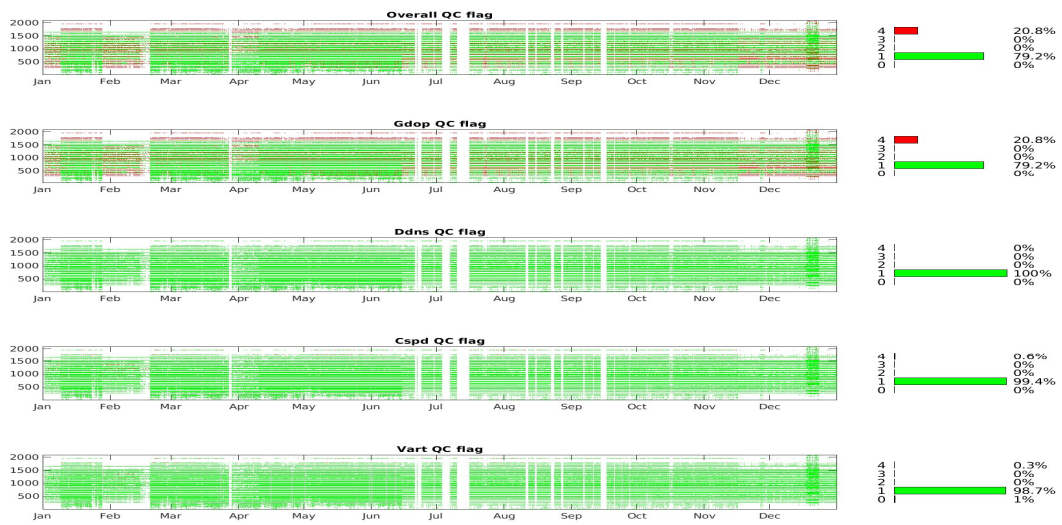


Period: 2021

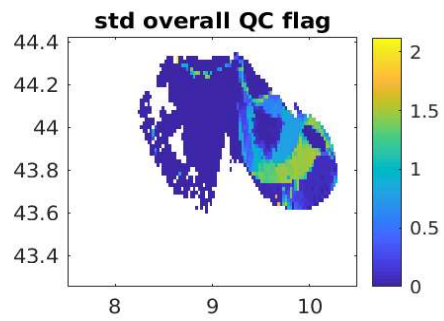
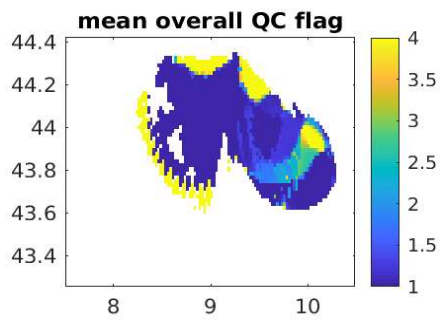
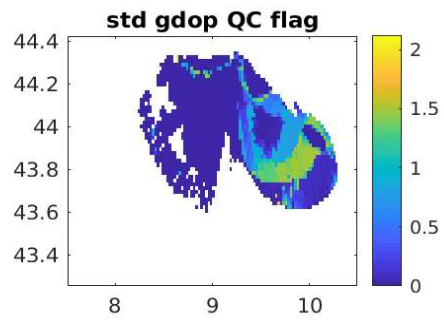
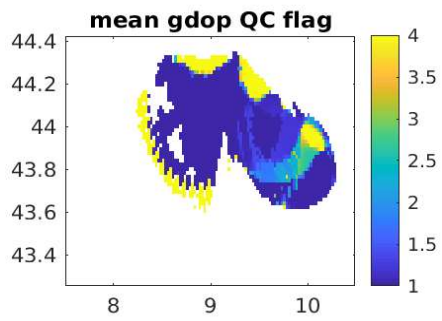
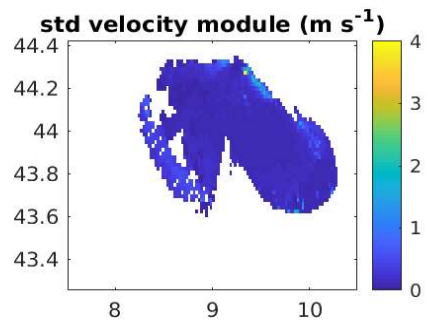
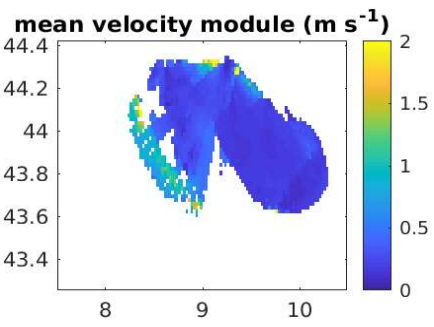
A



B

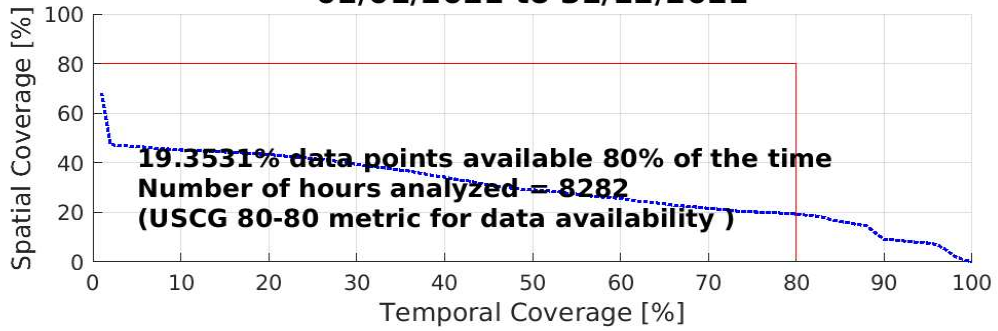


C



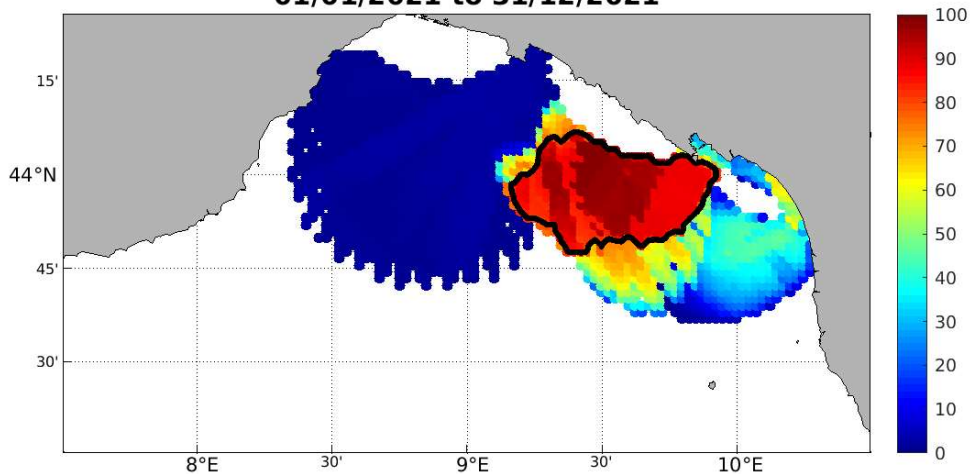
D

HFR-TirLig: Spatial Coverage vs. Temporal Coverage 01/01/2021 to 31/12/2021



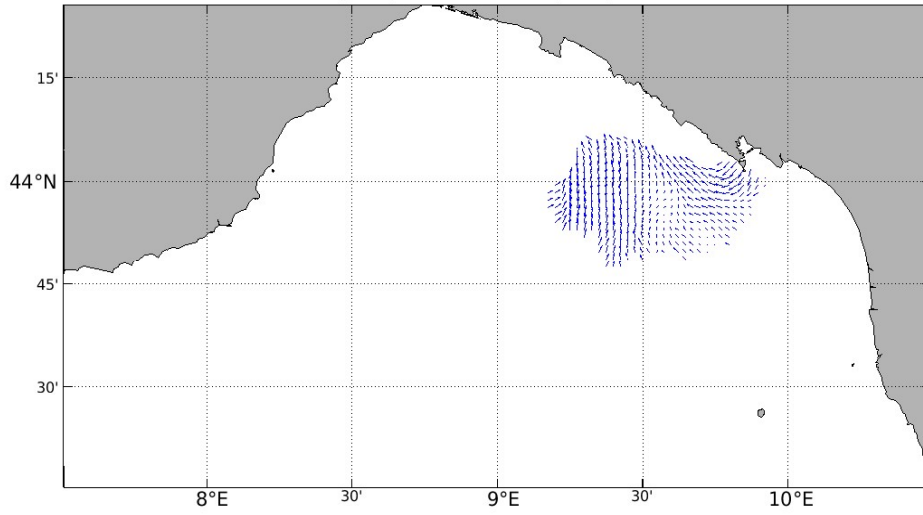
E

HFR-TirLig: Percent Total Vector Coverage (contour showing >80%) 01/01/2021 to 31/12/2021



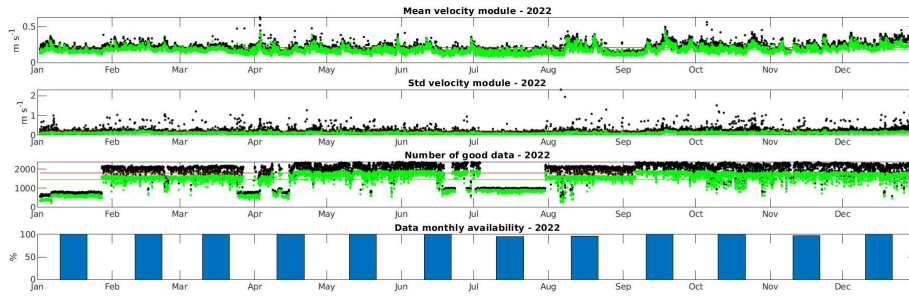
F

**HFR-TirLig: HFR Surface current average [m/s]
01/01/2021 to 31/12/2021**

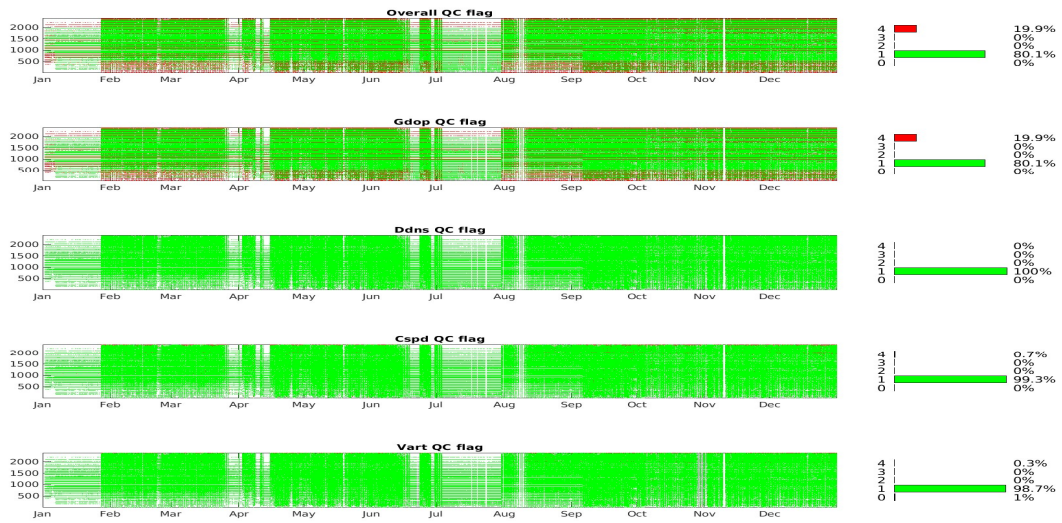


Period: 2022

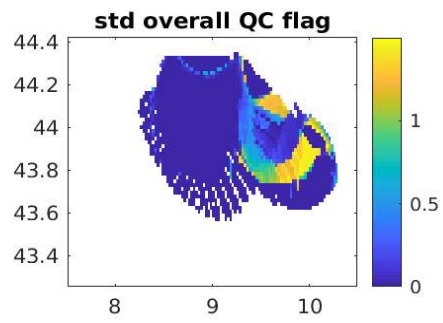
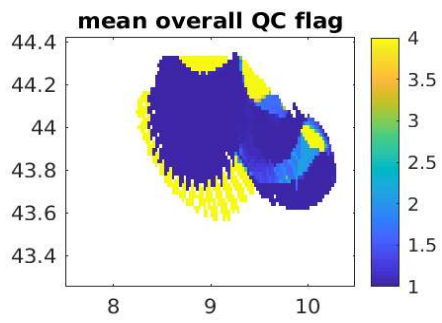
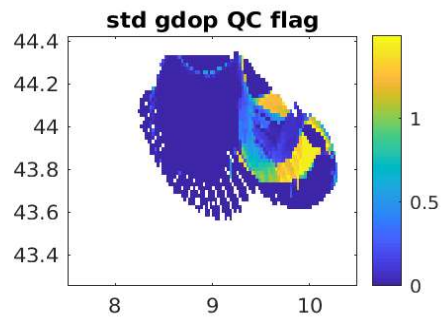
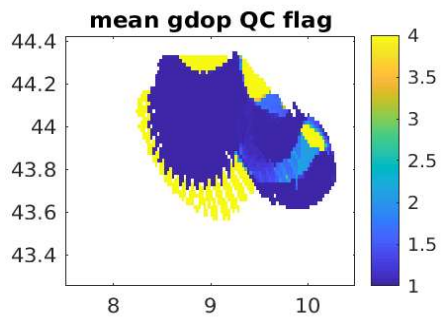
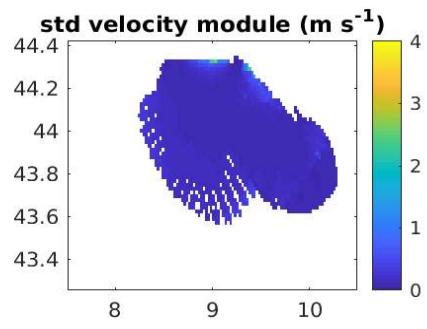
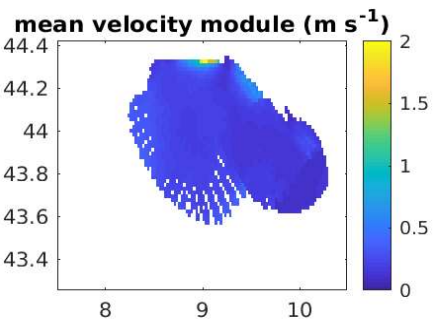
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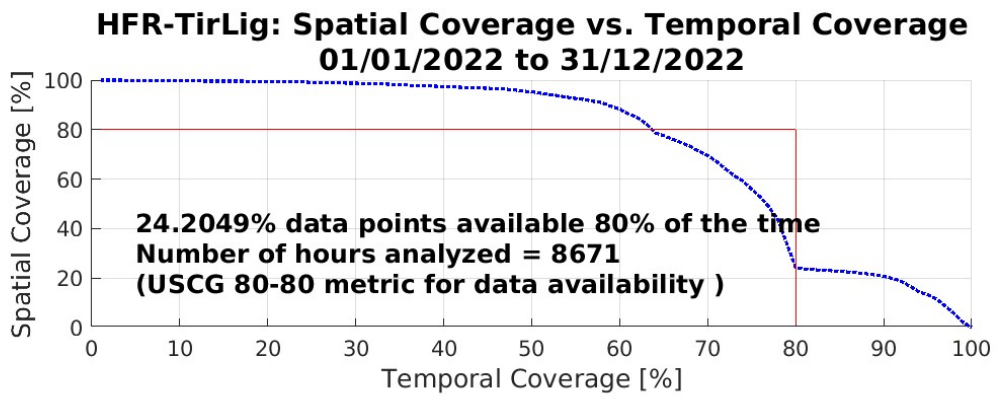
B



C

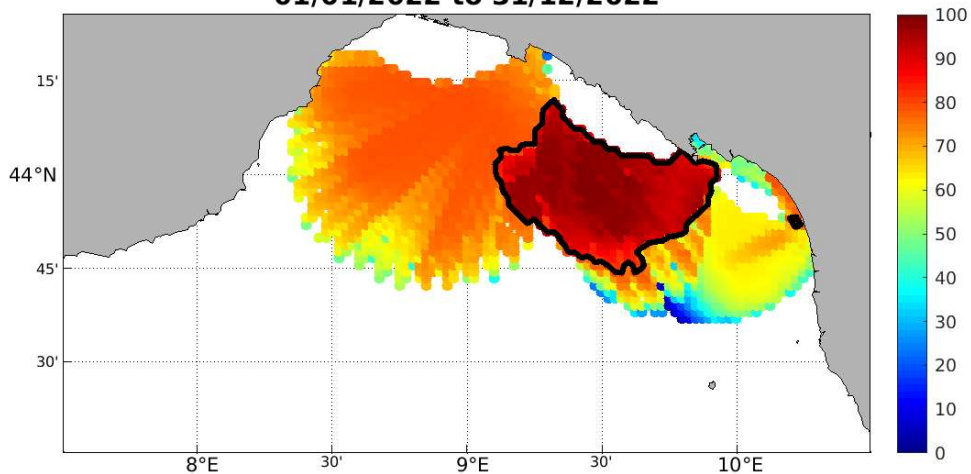


D



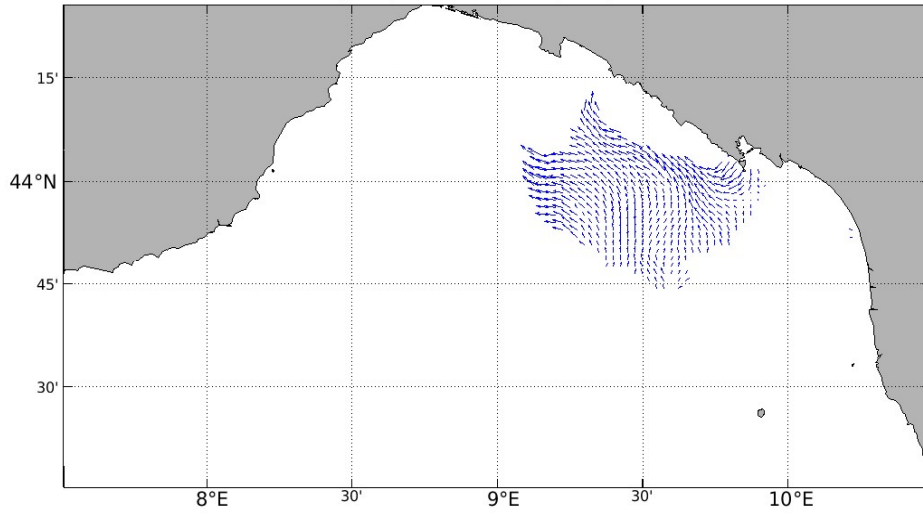
E

HFR-TirLig: Percent Total Vector Coverage (contour showing >80%) 01/01/2022 to 31/12/2022



F

**HFR-TirLig: HFR Surface current average [m/s]
01/01/2022 to 31/12/2022**



Version of the report	Changes made by	Nature of changes
V2	M. Chifflet/ A. Rubio	First complete version of the report
V3	M. Chifflet/ A. Rubio / C. Mantovani	Version including Figures
VR2020_12	L. Solabarrieta & A. Rubio	Update for 2020
VR2023_11	L. Solabarrieta & I. Manso-Narvarte	Update for 2021-22
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