



ISTITUTO NAZIONALE DI GEOFISICA E VULCANOLOGIA

Exploiting SeaDataCloud Temperature and Salinity time series data collections and comparing with Copernicus - a novel approach with SOURCE tool

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Problem and solution

Problems

- Observational data are fragmented between different repositories and infrastructures!
- Data can be fragmented within the same infrastructure due to the data ingestion process from the different data providers!

Solution

Use of SOURCE's merging tool to process the data and maximize the data available for usage!

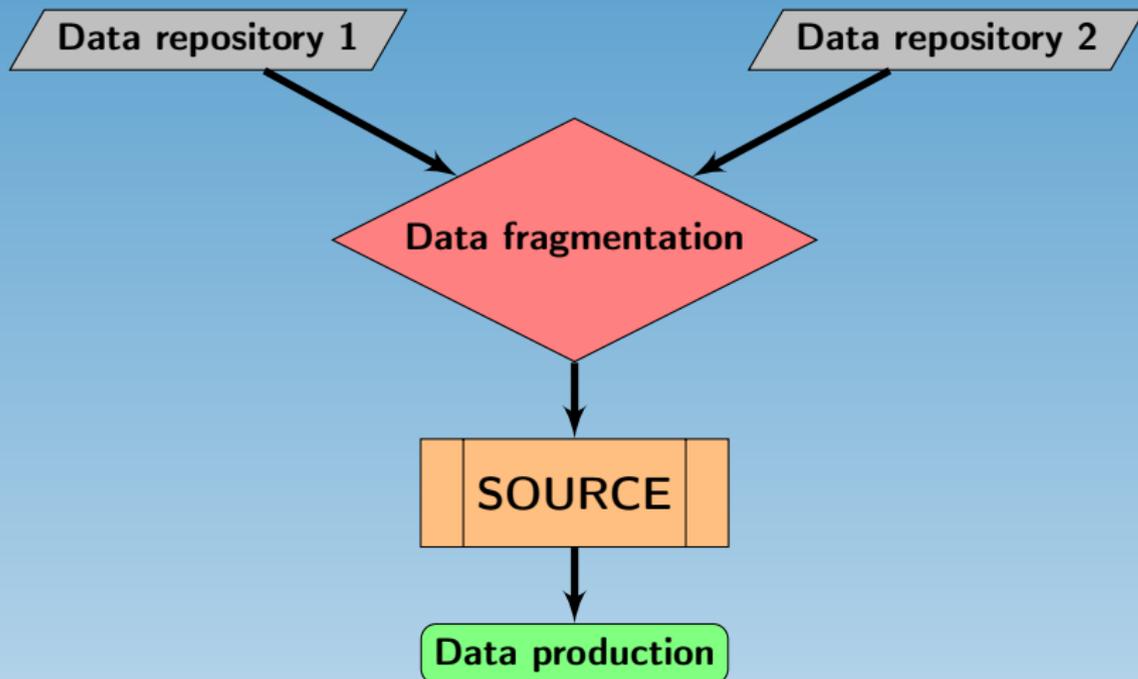


Outline

- 1 Generalities on data infrastructures (CMEMS and SeaDataCloud) and related issues;
- 2 SOURCE tool description;
- 3 SeaDataCloud Sea Temperature and Salinity time series database analysis;
- 4 Merging of SeaDataCloud database with CMEMS;
- 5 Merging case test;
- 6 New INGV web service application (VIDEO).



Solution





SOURCE (Sea Observations Utility for Reprocessing, Calibration and Evaluation)

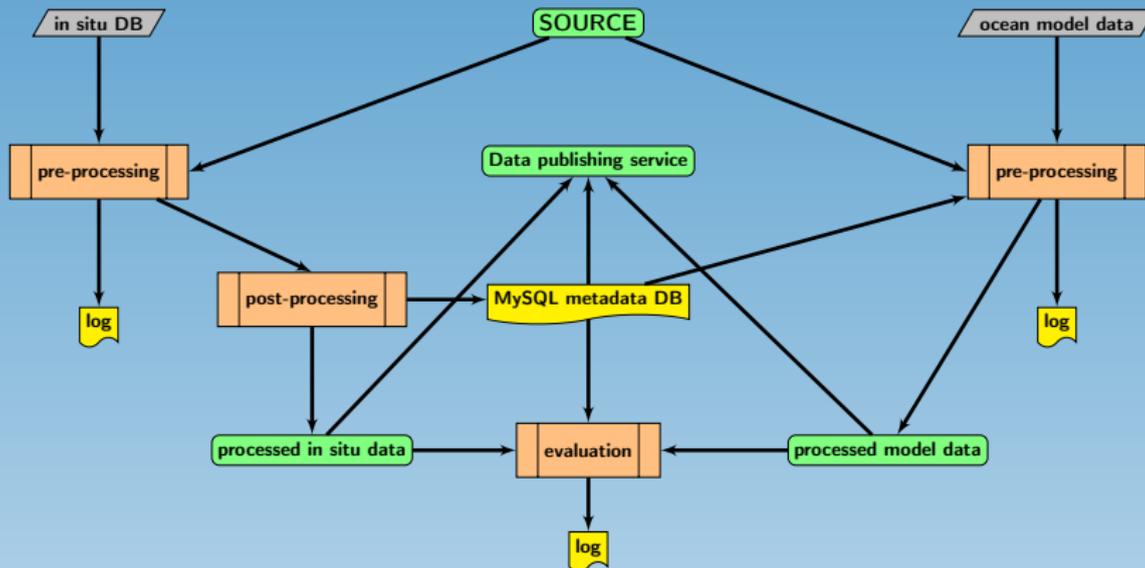
SOURCE is an open source software developed at INGV and written in Python that handles the pre-processing of the data coming from the different infrastructures, merging them in one final database. Post-processing consists of duplication removal and data quality control using several tools that follow the ocean best practices guidelines.

SOURCE was previously developed to deal with the Copernicus Marine Service (CMEMS) in situ TAC Near Real Time database.

The first infrastructures data merging test has been done between SeaDataCloud V2 and CMEMS sea temperature and salinity data collections.



SOURCE flow chart





SeaDataCloud data collection

SeaDataCloud ODV Database

A Global Ocean data time series collection in ODV (Ocean Data View) format has been exported in netCDF file and then analyzed.

The analyzed data sub-set covers the Mediterranean Sea and part of the Atlantic Ocean.

Only time series data from fixed platforms have been considered.

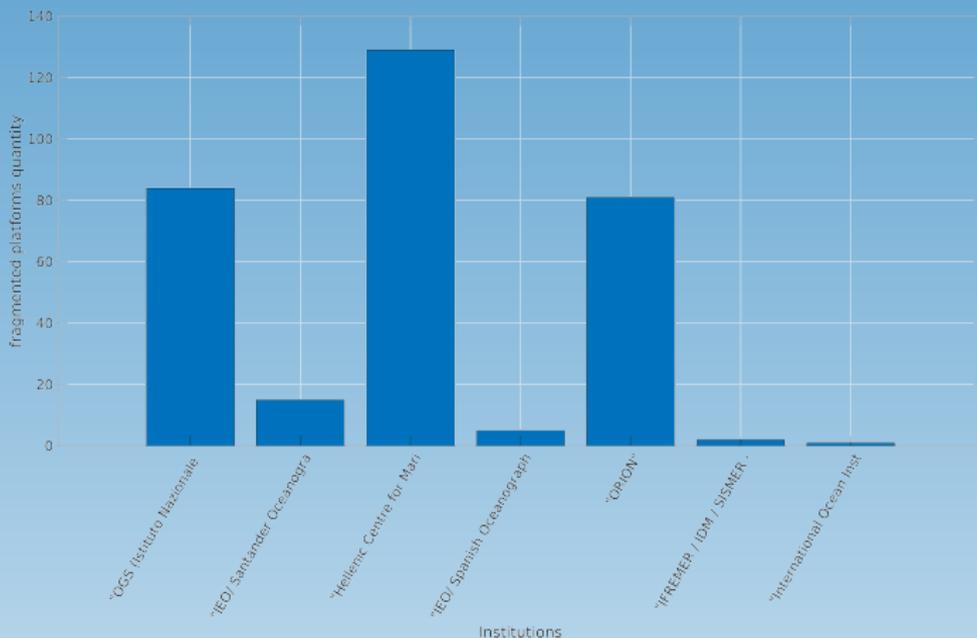


pre processing issues

- Finding and aggregating all broken time series using likeness in ID parameter strings
- organizing metadata
- correcting time units
- filtering the data by area of interest or instrument type
- producing information on the original QC scheme by SeaDataNet infrastructure
- producing log files with all warning messages (missing time, depth, data, wrong QC variables, etc.)

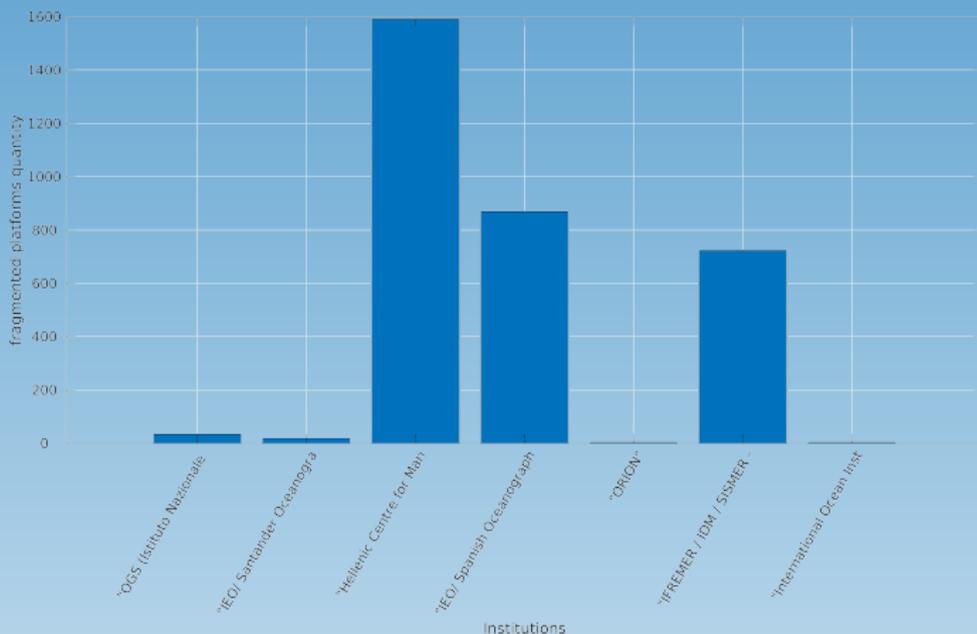


Amount of fragmented platforms for each institution without repetitions



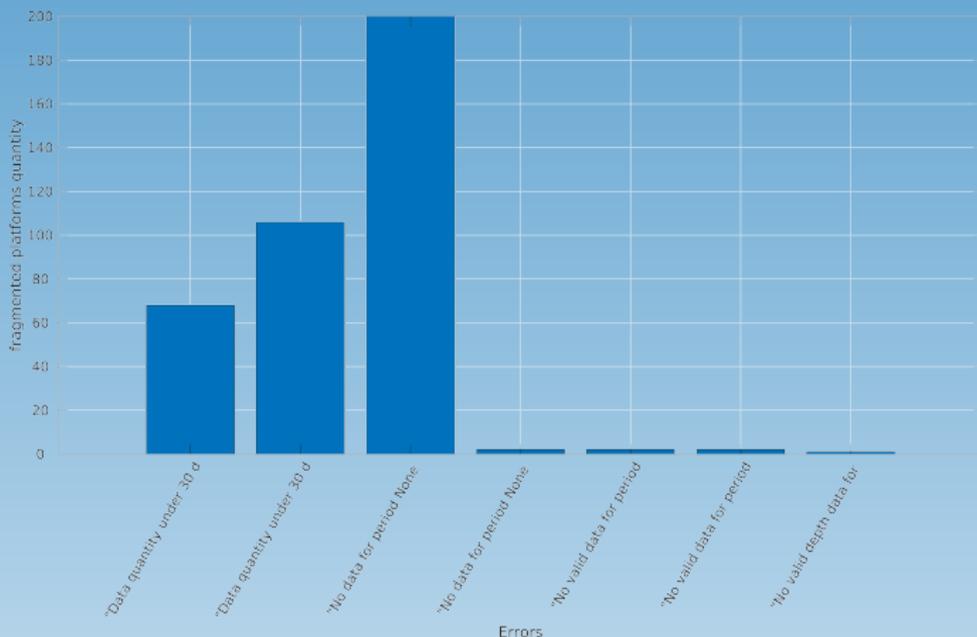


Amount of fragmented platforms for each institution with repetitions



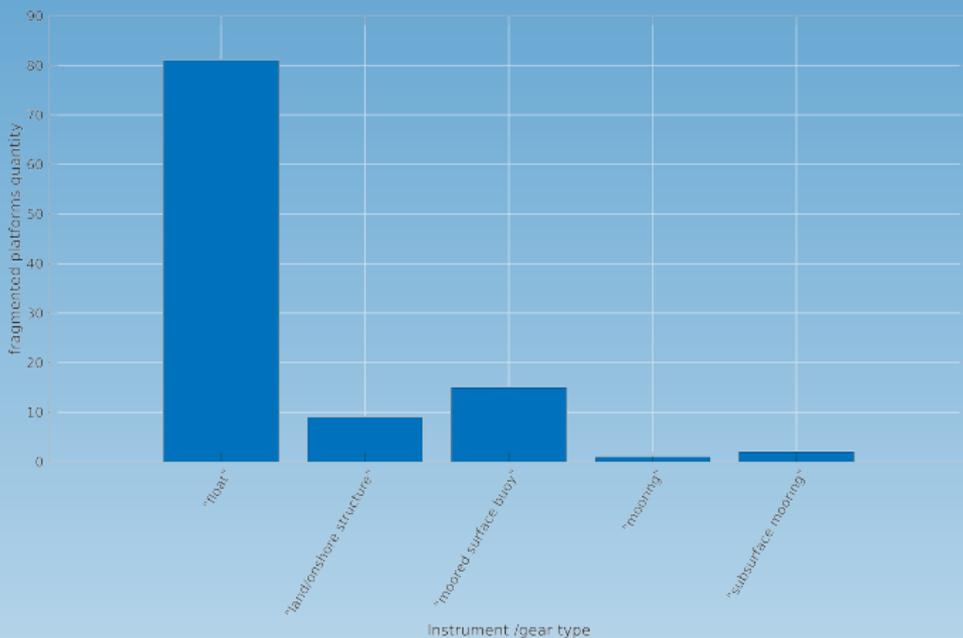


Amount of encountered warnings during platform data processing





Amount of fragmented platforms for each device type without repetitions





Merging procedure

Condition

- 1 Horizontal proximity;
- 2 likeliness in metadata identifiers.

If two platforms verifies the condition, the available fields and available depths for both platforms will be concatenated. Given z_1, \dots, z_n and z'_1, \dots, z'_m the recorded depths for the same field for two platforms, the merged time series will have the depths z''_1, \dots, z''_p , such that:

$$z'' = \begin{cases} z' & \text{if } z \notin \{z_1, \dots, z_n\}; \\ z & \text{if } z \notin \{z'_1, \dots, z'_m\}; \\ z(= z') & \text{otherwise,} \end{cases}$$



Post processing procedure

Merged data before the publishing phase **must** be checked for duplicates and reprocessed by passing several tests:

SOURCE Q/C procedures

- Global range check;
- Spike test;
- Stuck value test;
- Out of statistics and low probable iterative tests.



Pre-operational data publishing service

Upcoming web service deployed at INGV → Easy access, view and download processed data. More functionalities are planned.


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Cal/Val
MED-MFC Currents Evaluation
MED-MFC Biogeochemistry Evaluation
Help
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Buoy Time Series

Instrument: All instruments

Variable: Temperature

1st datasource: in situ daily mean

2nd datasource: in situ monthly mean

3rd datasource: in situ yearly mean

Compute datasources difference

Note 1: all data must have the same sampling to compute differences.

Note 2: differences will not work for current transport.

Organisation: All organizations

Start: Year: None Month: None

End: Year: None Month: None

Buoys

Depth, m: 3.0

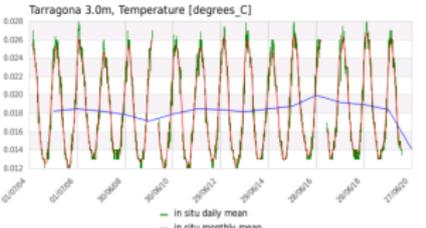
- Santander-current-meter
- Santorini
- Sarónikos
- Sausset Les Pins
- Savona
- Senigallia
- Serie
- Sillero-1-current-meter
- Skyros
- Son Blanc
- Tarragona

Buoy Profiles

Satellite



Tarragona 3.0m, Temperature [degrees_C]



— in situ daily mean
— in situ monthly mean
— in situ yearly mean

Tarragona

mooring

Institution: Puertos del Estado (Spain) (Spain)

CMEMS platform_code: 61280

WMO: 61280

Longitude: 1° 27' 11" E

Latitude: 40° 41' 42" N

Recorded fields:

Temperature: 3.0m

Information on field

Temperature :

Begin: 2004-08-20 14:00:00

End: 2020-01-31 23:00:00

Sampling time: 000 01:00:00 ddd hh:mm:ss

Quality controls:

FULL

Notes:

duplicate and reversed records

[Web page](#)



Merging case test: the Lesvos station

Example of data merging at the HCMR Lesvos Platform.

- Parameter: sea temperature
- Depth: 3.0m
- Time range: 2005-01-01 → 2007-12-31
- Data type: in situ daily mean



CMEMS data at Lesvos station



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Buoy Time Series

Instrument: All instruments
 Variable: Temperature
 1st datasource: in situ daily mean
 2nd datasource: None
 3rd datasource: None

Compute datasources difference

Note 1: all data must have the same sampling to compute differences.

Note 2: differences will not work for current transport.

Organisation: All organizations

Start: Year 2005 Month: None

End: Year 2008 Month: None

Buoys	Depth, m
Lesvos	3.0
Lion	10.0
Marseille	20.0
Mykonos	30.0
Nice	35.0
Nice et Dyfamed	40.0
Pylos	45.0
Santorini	
Saronikos	
Sete	
Silleiro2-current-meter	



Lesvos

moored surface buoy

Institution: HELLENIC CENTER FOR MARINE RESEARCH (HCMR) (Greece)

platform_code: LESVO
WMO: 6101004

Longitude: 25° 48' 25" E
Latitude: 39° 09' 22" N

Recorded fields:
Temperature: 3.0 10.0 20.0 30.0 35.0 40.0 45.0m
Salinity: 3.0m

Information on field

Temperature :

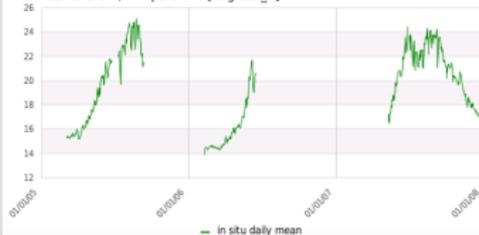
Begin: 2001-01-29 12:00:00
End: 2012-07-28 12:00:00
Sampling time: 000 03:00:00 ddd hh:mm:ss

Quality controls:

FULL

Notes:

Lesvos 3.0m, Temperature [degrees_C]





SeaDataCloud data at Lesvos station



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Buoy Time Series

Instrument:
 Variable:
 1st datasource:
 2nd datasource:
 3rd datasource:

Compute datasources difference

Note 1: all data must have the same sampling to compute differences.

Note 2: differences will not work for current transport.

Organisation:

Start: Year: Month:

End: Year: Month:

Buoys Depth, m
 3.0
 Livorno
 MACUB
 MAMBO 10M 00001
 MAMBO1
 Molo Bandiera
 MYKONOS
 Ortona
 Otranto
 Palermo
 Porto Empedocle
Data: Tides



Lesvos

moored surface buoy

Institution: Hellenic Centre for Marine Research, Hellenic National Oceanographic Data Centre (HCMR/HNODC) (Greece)

platform_code: 269-GN36200707LES_00001_269_D90
WMO:

Longitude: 25° 48' 29" E
Latitude: 39° 09' 22" N

Recorded fields:
Temperature: 3.0m
Salinity: 3.0m

Information on field

Temperature :

Begin: 2004-09-02 06:04:34
End: 2011-12-31 20:47:31
Sampling time: 000 03:12:29 ddd hh:mm:ss

Quality controls:

FULL

Notes:



Integrated data set at Lesvos station



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Buoy Time Series

Instrument: All instruments

Variable: Temperature

1st datasource: in situ daily mean

2nd datasource: None

3rd datasource: None

Compute datasources difference

Note 1: all data must have the same sampling to compute differences.

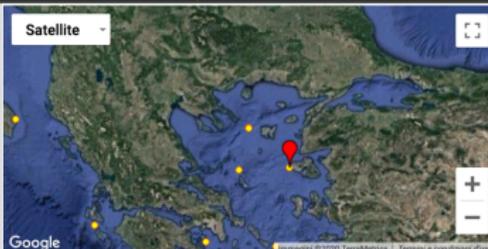
Note 2: differences will not work for current transport.

Organisation: All organizations

Start: Year 2005 Month None

End: Year 2008 Month None

Buoys	Depth, m
FI3520050601112042	3.0
FI35200506011412079	10.0
FI35200506011412200	20.0
Gijon	30.0
Gironde Bordeaux	35.0
Gironde Libourne	40.0
Gironde Pauillac	40.0
Gironde Portets	45.0
Imperia	
Kalamata	
Koper	
Lesvos	



Lesvos

moored surface buoy

Institution: Hellenic Centre for Marine Research, Hellenic National Oceanographic Data Centre (HCMR/HNODC) (Greece)

platform_code: LESVO_269-GN36200707LES_00001_269_D90
WMO:

Longitude: 25° 48' 27" E

Latitude: 39° 09' 22" N

Recorded fields:

Temperature: 3.0 10.0 20.0 30.0 35.0 40.0
45.0m
Salinity: 3.0m

Information on field

Temperature :

Begin: 2001-01-29 12:00:00

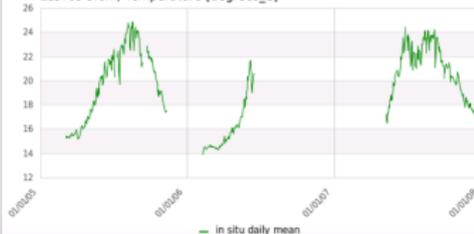
End: 2012-07-28 12:00:00

Sampling time: 000 03:00:00 ddd hh:mm:ss

Quality controls:

FULL

Lesvos 3.0m, Temperature [degrees_C]





Web service video (please check for version 1 to see the video separately if any problems)

click



Conclusions

When the web service will be online and the production chained, SOURCE will allow a continuous monitoring of the coastal environment through the widest and highest quality Temperature and Salinity observational time series database.

This is the base to develop new services and applications to serve a variety of different users, such as integrated coastal monitoring systems, early-warning system for coastal environmental protection and preservation.



Thank you for your attention

