On-going SVC activities: Overview & status of **BOUSSOLE**

David Antoine, Vincenzo Vellucci
CNRS-LOV, Villefranche/mer, France
Curtin University, Perth, W Australia

LOV

OBSERVATOIRE OCEANOLOGIQUE VILLEFRANCHE/MER

Curtin University

43°22'N 7°54'E BOUSSOLE

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In broad terms…

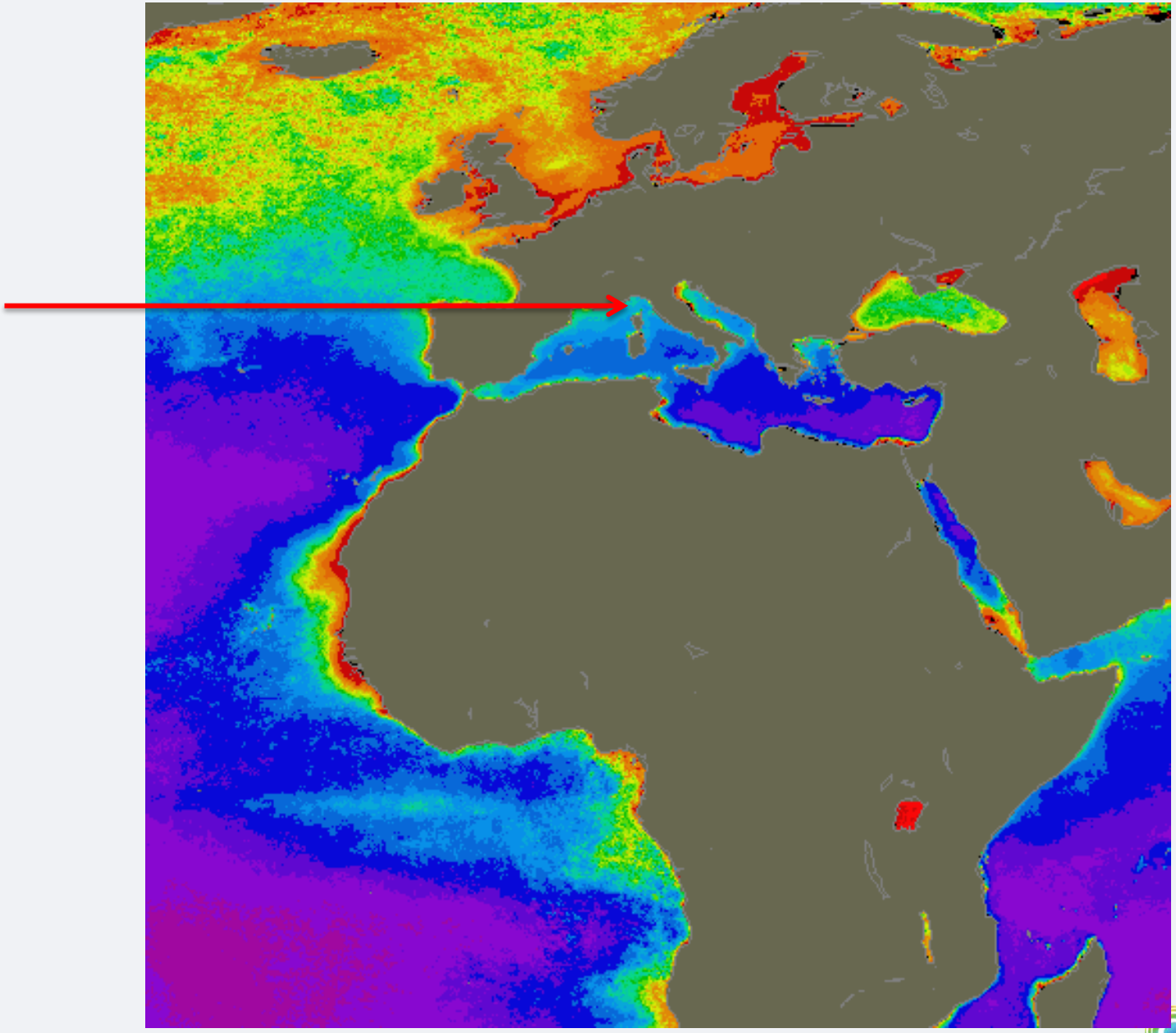
- The concept is to build a **long-term time series** of **radiometric** measurements plus **optical properties and BGC quantities** in clear oceanic **Case 1 waters**, in support of satellite **OCR SVC and validation**, and in support of research in **bio-optics**
- To achieve this, we designed a **unique platform**, specifically for **radiometry measurements**, and equipped with **commercial off-the-shelf (COTS) radiometers.**
- Complemented by a program of **monthly cruises**
- Paralleled by a **scientific program**
- Supported by **National institutes and space Agencies**

Let's start with facts

BOUSSOLE, it is:

- A site well **adapted for OCR SVC** / validation
- Close to **20 years** of existence / experience [1999-today]
- **~15 years** of operational data production (95% success rate for data acquisition in the last 6 years)
- Currently **1 of 2 sites** for OCR SVC, along with MOBY
- A **unique radiometry + IOPs + BGC** data set
- A model for how **science & operational** objectives come together for mutual benefits
- Permanent effort towards increased **data quality** (calibration, characterization, QA/QC in general etc…)
- A number of **scientific users** (publications)
- A programme in good standing to **continue for the coming decade**

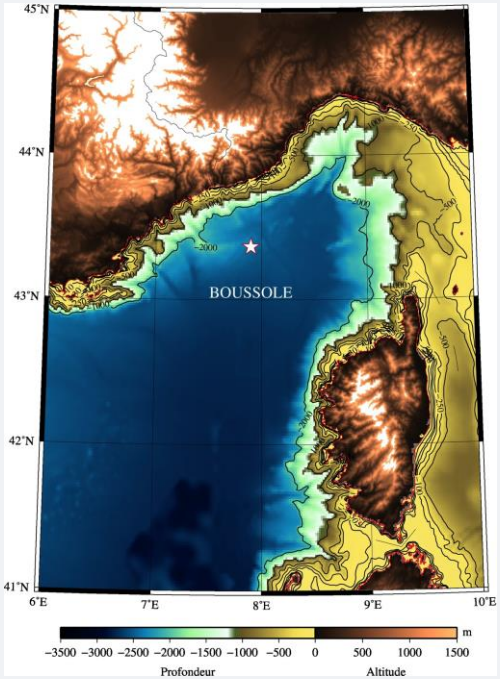
Where is BOUSSOLE?



Where is BOUSSOLE? Site characteristics

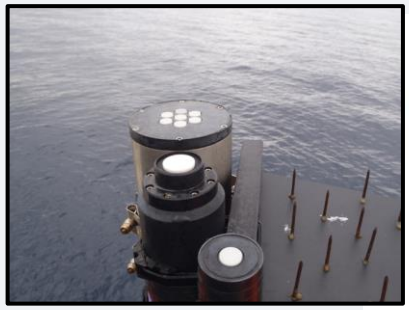
43°22″N, 7°54″E

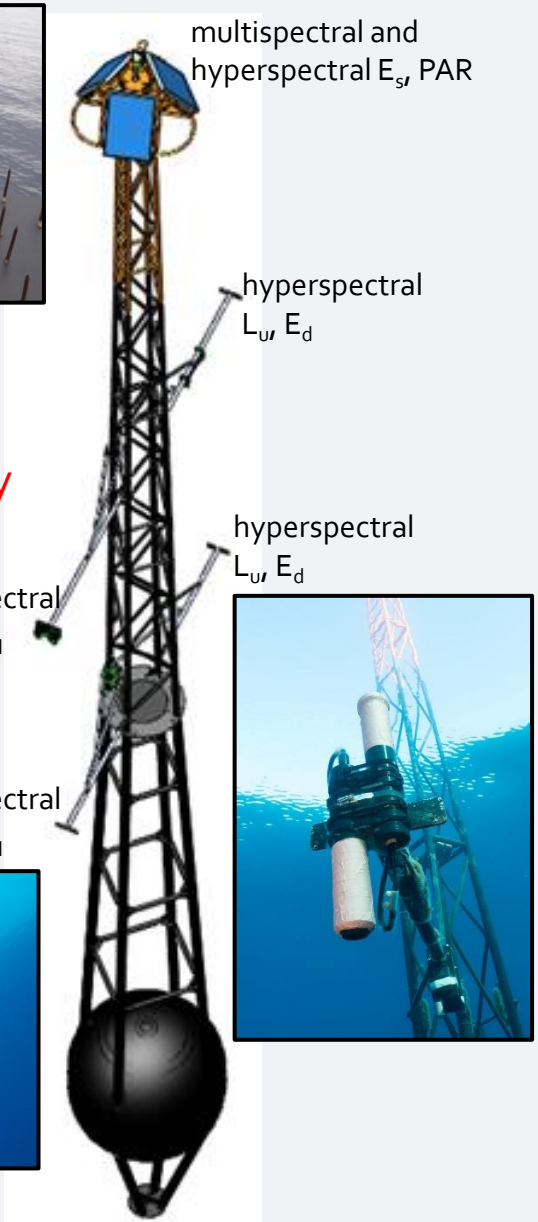
- Ligurian Sea (NW Mediterranean)
- Deep ocean site (Water depth: 2440m)
- 60 km offshore, 3 hours of steaming
- Meso- to oligotrophic Case 1 waters
- Stable enough for cal/val purposes
- Dynamic enough to make it scientifically interesting
- Clear atmosphere (low aerosol content)
- Low cloudiness (maximizing matchups)
- Long history of measurements (context)
- Well characterized



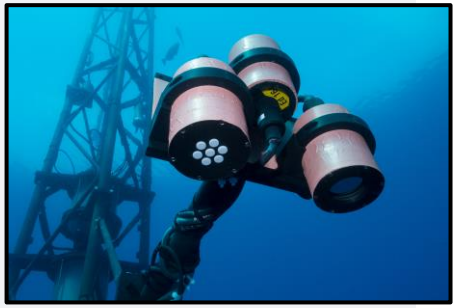
See also Zibordi & Mélin, RSE 2017, 190, 122-136

What's at BOUSSOLE? The buoy & instruments





Minimizing shading
Maximizing stability



Radiometry (Satlantic)

> 200 series: [412, 443, 490, 510, 555, 560, 665, 670, 683 nm] fixed gain
> **Hyper-OCR series 350:3:800 nm (since 2007),** auto integration time
> PAR (400-700 nm) (since 2007)

Data loggers (Satlantic)

> DACNet Acquisition Node (prototype)
> DATA-100 series (OCPs, MVD)
> STOR-X (after 2007)

Ancillary

> Sea-Bird, SBE-37 CTD
> AOSI, EZ-compass III (tilt, heading)
> Garos, Strain gauge

Data Transmission

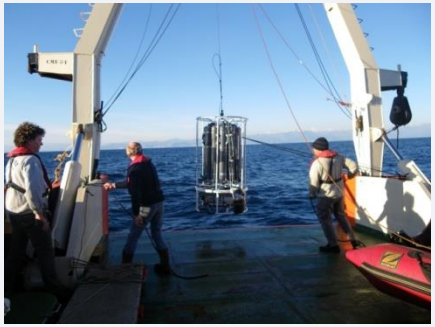
> ARGOS beacon (data sample)
> CISCO wireless
> ARGOS emergency beacons (position)

IOPs

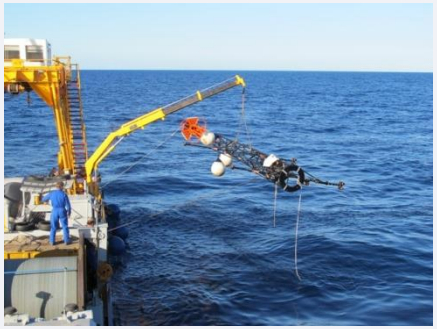
> Wetlabs, C-Star (c_p, 660 nm)
> Hobilabs, HS-IV (442,488,555,620 nm)
> Wetlabs ECOFLNTUs (fluorescence $470_{ex}/695_{em}$, turbidity 700 nm)

What else happens at BOUSSOLE? cruises

✓ ~**462** days at sea since July 2001 (178 monthly cruises aboard the Tethys-II R/V)




✓ ~**63**days at sea for buoy deployments / recoveries

✓ ~**118** days at sea for on-demand maintenance operations (cleaning, repairs etc..)




Photos: E. Diamond, LOV; D. Luquet, OOV, D. Antoine, LOV

Operational data collection

Year 2016:

Month	Days with data
Jan	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Feb	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
Mar	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 -- -- -- -- -- -- -- -- -- -- -- -- -- --
Apr	-- -- -- -- -- -- -- -- -- -- -- -- -- -- -- 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
May	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Jun	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Jul	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Aug	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Sep	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Oct	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Nov	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Dec	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

Back to top

Year 2015:

Month	Days with data
Jan	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Feb	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
Mar	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 -- -- -- -- -- -- -- -- -- --
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Back to top

Year 2014:

Month	Days with data
Jan	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
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95%
success rate

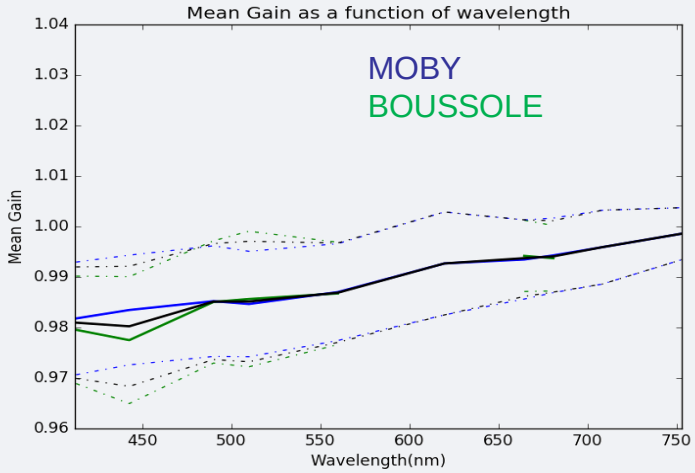
Data availability, distribution and use

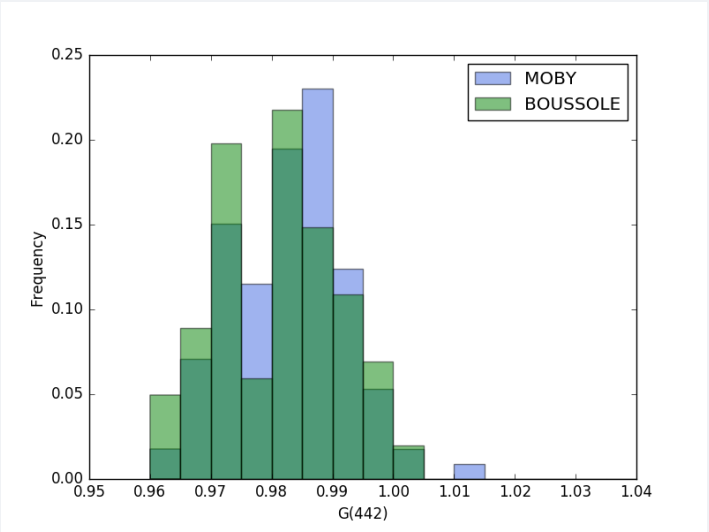
Free access to the entire data sets, after having been given a login /password

http://www.obs-vlfr.fr/Boussole/html/boussole_data/login_form.php

Outcomes for SVC

MERIS SVC, merging BOUSSOLE and MOBY data (4th reprocessing)





On-going activities for SVC of the following sensors, in collaboration with:

S3-OLCI:	ACRI-ST/S3MPC,	C. Lerebourg, N. Lamquin *et al*.
S2-MSI:	GSFC / SSAI, Greenbelt,	N. Pahlevan *et al*.
S-GLI:	JAXA S-GLI cal/val team,	H. Murakami *et al*.

Other outcomes

http://www.obs-vlfr.fr/Boussole/html/publications/publications.php

Recent evolutions

- Establishment of a thorough **uncertainty budget** for the radiometry measurements (NPL collaboration; Monte Carlo method)

$u\ in\ \%$ / $\lambda\ in\ nm$	E_s	L_{u4}	L_W	R_{rs}	$u_{abs}(R_{rs})$
412	2.1	2.6	3.1	3.7	0.000215
443	2.0	2.6	3.1	3.7	0.000225
490	2.0	2.6	3.0	3.7	0.000175
510	2.0	2.6	3.0	3.7	0.000155
560	2.0	2.6	3.1	3.7	0.0000725
665	2.1	3.9	5.9	6.3	0.00000410
681	2.1	4.0	5.9	6.3	0.00000195

- From May 2017: multi-spectral radiometry no longer maintained, and only **hyperspectral radiometry** will proceed
- Extension of the **data use for SVC** through partnerships/collaborations (S3-OLCI, S2-MSI, S-GLI, VIIRS)

The future of BOUSSOLE

- Rather **clear until 2021** (current ESA+CNES support)

- Then, **BOUSSOLE is one option for the long-term SVC** of the S3-OLCI and S2-MSI instruments. Among conclusions of the ESA FRM4SOC activity:

"At least two SVC sites in Europe: In priority, BOUSSOLE should be maintained and strengthened […]"

- Continued development of the **science activity** around the long-term time series

THANKS FOR YOUR ATTENTION

D. Antoine – PI
V. Vellucci – Project Manager
M. Golbol, E. Soto, E. Diamond – Cruises
V. Taillander – CTD processing
C. Dimier, J. Ras – HPLC
B. Gentili – Code development
A. Bialek – Uncertainties
E. Leymarie – Montecarlo simulations
A. Bricaud – CDOM
G. De Liege, D. Luquet, D. Robin – Diving
S. Marty – Calibrations
J. Uitz, H. Claustre, F. D'Ortenzio – Expertise
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