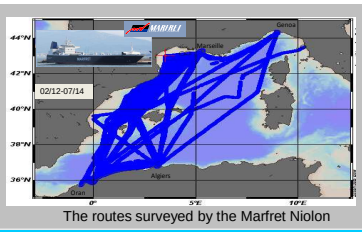
Long term in situ atmospheric and oceanic measurements aboard the ship of opportunity Marfret Niolon during HyMeX LOP

I. Taupier-Letage (1), D. Legain (2), J. Barrié (2), E. Maguet (3), G.Rougier (1), C. Bachelier (1)
(1) MIO/ Aix-Marseille University UM110, Marseille, France.
(2) CNRM/GAME, Météo-France UMR 3589 CNRS, Toulouse, France.
(3) Météo France DSI, Paris, France.

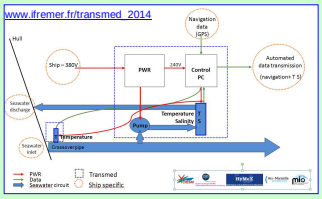
Since January 2012, and for the expected duration of the HyMeX LOP (2020), 2 autonomous systems have been installed on a ship of opportunity (*Marfret Niolon* *) to provide high frequency continuous measurements of atmospheric (SEOS system) and oceanic (TRANSMED system) parameters. The ship crosses the western Mediterranean basin on a weekly frequency between France (Marseille) and Algeria (from Oran: ~0° to Algiers: ~3°E). These data were used for the AROME-WMED validation and are being used for the HyMeX SOP1 and SOP2 studies.

* : Both systems had to be removed early July 2014 due to the assignment of Marfret Niolon on an other route. A new ship of opportunity is being seeked.

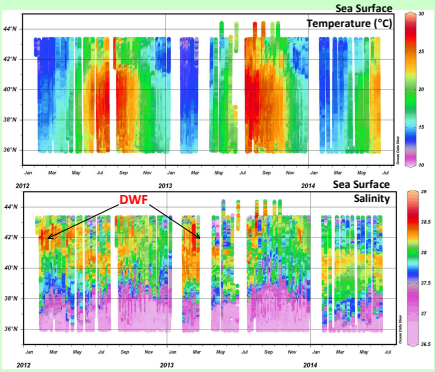


The routes surveyed by the Marfret Niolon

Oceanic system TRANSMED

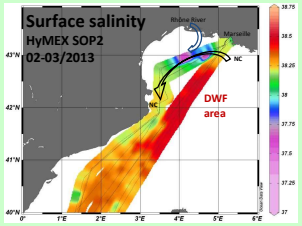


The system **TRANSMED** (low cost fully autonomous thermo –salinometer) provides geo-localized **SST** and **SSS** data at ~3m deep with ~100m resolution. Raw data are generally transmitted hourly from ship. Checked and subsampled (~1km) data are transmitted daily to Coriolis, MyOcean and GOSUD.

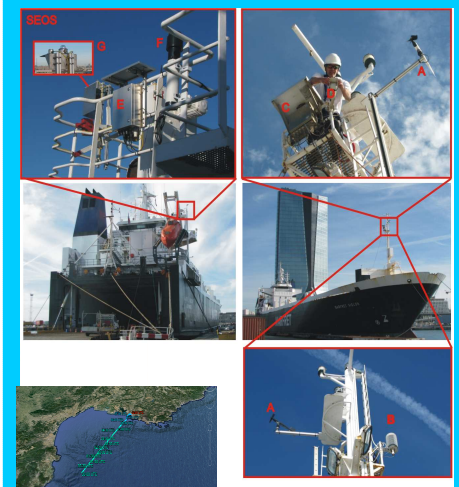


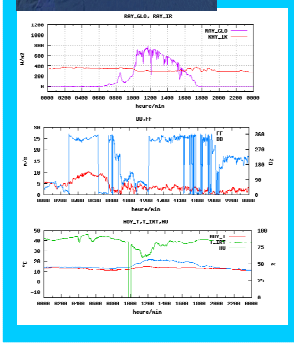
Time series of the annual cycle of SST and SSS in the Western Basin. Maxima of salinity evidence **D**ense **W**ater **F**ormation / deep convection (strong episodes in 2012 and 2013)

Westward spatial extent of the DWF zone during the SOP2 (01/02-15/03/2013), as shown by the SSS recorded underway. Maximum salinity recorded: ~38.53.



DWF : Dense Water Formation
LOP : Long Observing Period
NC : Northern Current
SOP : Special Observing Period
SSS : Sea Surface Salinity (~3m deep)
SST : Sea Surface Temperature (~3m deep)



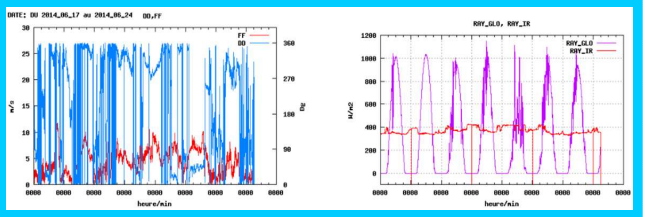


Atmospheric system SEOS

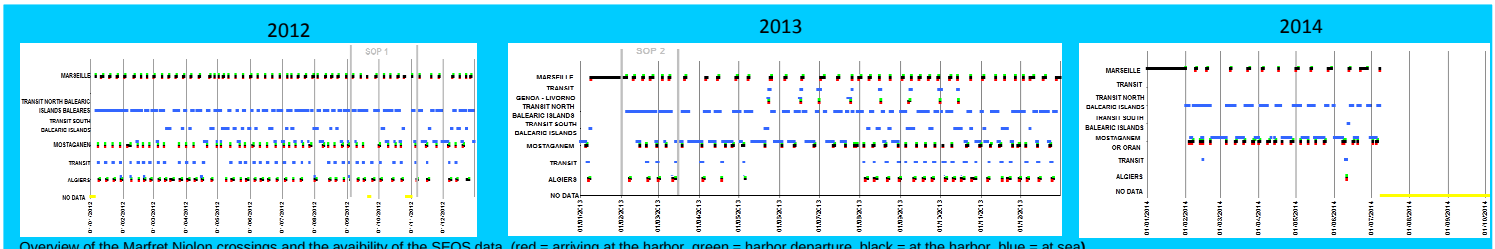
The fully autonomous meteorological station **SEOS** (**S**ea **O**bservation **E**mbedded **S**ystem) has been especially designed for ships of opportunity. To curb the problems i) of the quality of atmospheric measurements aboard a ship, which depends on the geometry of the ship superstructures (Bradley, 2006) and of the station itself, and ii) of the electrical wiring availability, the SEOS system has been conceived with a decentralized architecture whose elements are linked by radio, with low-power sensors, and with independent power supply (battery and solar cells). This system provides measurements of wind, air temperature and humidity, precipitation, downward, longwave and shortwave radiative fluxes and skin temperature of the sea surface.

	Type	Manufacturer	Heigth above sea level / position	Sampling rate / storage rate	Accuracy (after correction)
Ship speed, course and position (C)	GPS receiver OEM403	Lextronic (France)	21 m / prow mast	1 s / 1 min	0.5 m/s 5 ° 10 m
Air humidity (B)	Capacitive HMP155 (Socrima radiation shield)	Vaisala (Finland) Socrima (France)	21 m / prow mast	1 min / 1 min	5 %
Air temperature (B)	PT1000 Class A (Socrima radiation shield)	Atexis (France) Socrima (France)	21 m / prow mast	1 min / 1 min	0.5 °C
Air pressure at sea level (C)	Vaisala PTB210 with Young port pressure 61002	Vaisala (Finland) RM Young (USA)	21 m / prow mast	15 min / 15 min	1 hPa
Precipitation (F)	Rain gauge 50202	RM Young (USA)	20.6 m / stern starboard	1 min s / 1 min	1 mm
Wind speed and direction (A)	Anemometer 05106	RM Young (USA)	21 m / prow mast	1 s / 1 min	0. 5 m/s 5°
Skin SST (sea surface temperature) (D)	Infrared thermometer IR100	Campbell Scientific (UK)	20.9 m / prow mast	1 min / 1 min	1° C
Downwelling shortwave radiations (G)	CM6P	Kipp et Zonen (The Netherlands)	21.2 m / stern starboard	10 s / 1 min	10 % of daily accumulated
Downwelling longwave radiations (G)	CGR3 + PT100 ClassA	Kipp et Zonen (The Netherlands)	21.2 m / stern starboard	10 s / 1 min	10 % of daily accumulated

Raw data are processed (Maguet, 2012) to :
- calculate true wind with GPS data. As the heading of ship is not measured, true wind direction is calculated only if ship speed is > 1 kt.
- calculate the atmospheric pressure at sea level.
- discard skin SST data when the ship calls in harbor.
- qualify shadowing of radiatives fluxes sensors.
- take into account the effect of relative wind on rainfall captation.



Examples of SEOS measurements : one week of high-resolution wind, IR and solar incoming radiatives fluxes (right); air-sea data recorded across the gulf of Lion on March 9, 2013 (left).



Overview of the Marfret Niolon crossings and the avaibility of the SEOS data. (red = arriving at the harbor, green = harbor departure, black = at the harbor, blue = at sea**).**
Both SEOS and TRANSMED data are available on the HyMeX/SEDOO database.

References :
• Bradley F, Fairall C., 2006, A guide to making climate quality meteorological and flux measurements at sea; NOAA Technical Memorandum OAR PSD-31.
• Le Beaupin-Brossier C. *et al* ., 2014, Ocean mixed layer responses to intense meteorological events during HyMeX-SOP1 from a high-resolution ocean simulation, *in rev.* for Ocean Modelling.
• Maguet Eric, 2012, Traitement et validation de mesures météorologiques à bord de navires d'opportunité dans le cadre de Hymex Technical report, ENM, Toulouse.
• Rainaud R., Le Beaupin Brossier C., Ducrocq V., Giordani H., Nuret M., Fourrié N., Bouin M.N., Taupier-Letage I., Legain D., 2014, Air-sea exchanges over the Western Mediterranean Sea during the HyMeX SOP1 campaign from the AROME-WMED model, *in rev. for* QJRMS.

Contact SEOS: dominique.legain@meteo.fr
Contact TRANSMED : isabelle.taupier-letage@univ-amu.fr (www.ifremer.fr/transmed_2014)

This work has been sponsored by the MISTRALS/HyMeX programme.
The authors thank the Marfret company and crew for their permission to set up SEOS and TRANSMED systems aboard and their dedicated cooperation, and the CIESM and the Division Technique de l'INSU for supporting the development of the TRANSMED system.