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Thermohaline variability of the North Ionian and South Adriatic Sea in 2013 - 2016

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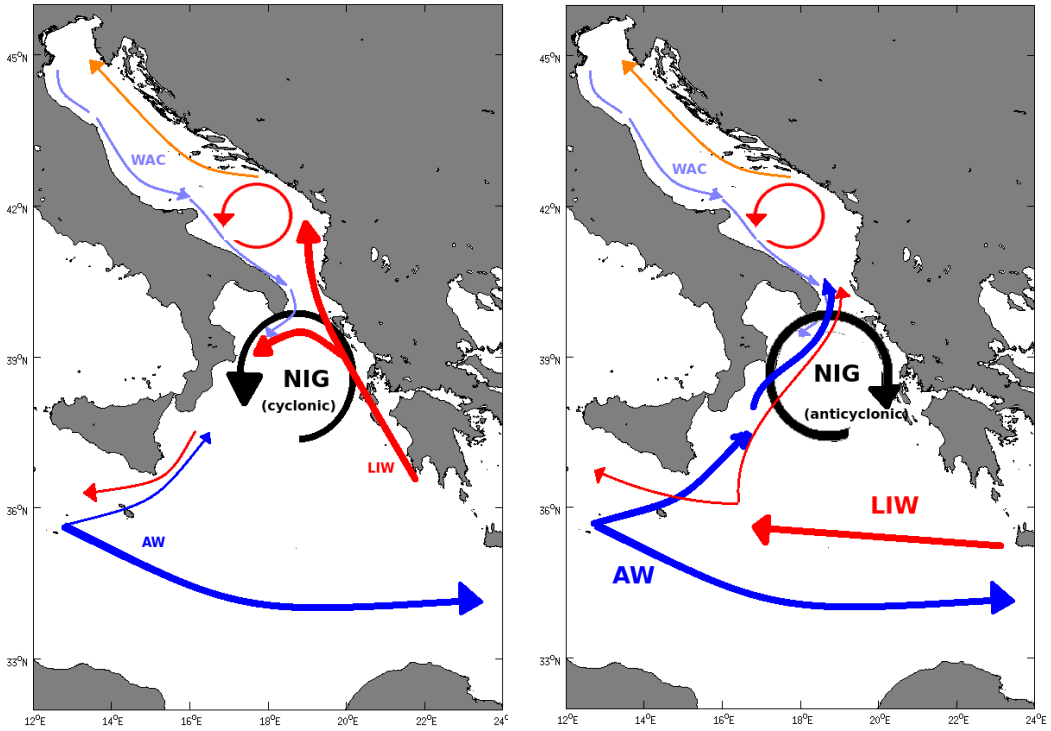
4- 5 July 2017, Paris

Surface and Intermediate water masses and Circulation



- Water masses
- The low salinity Atlantic Water (AW), coming from the western Ionian, flowing in the surface layer (50 – 150 m).
- The saline Levantine Intermediate Water (LIW), advected from the eastern Ionian, entering in the South Adriatic Pit (SAP) at the depth of 200 – 400 m
- Rivers runoff in the surface layers. 30% of the whole Mediterranean river runoff is concentrated in the Central Mediterranean and mainly along the Adriatic coasts with the River Po to be the main representer and the main freshwater source.

...and water formation

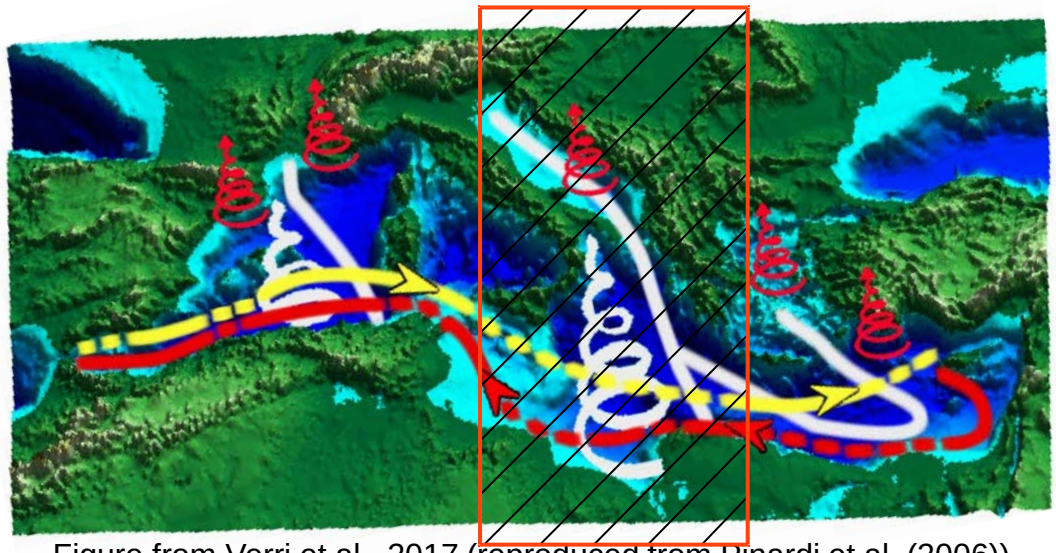


Figure from Verri et al., 2017 (reproduced from Pinardi et al. (2006))

Central Mediterranean Overturning Circulation (CMOC) conveyor belt:

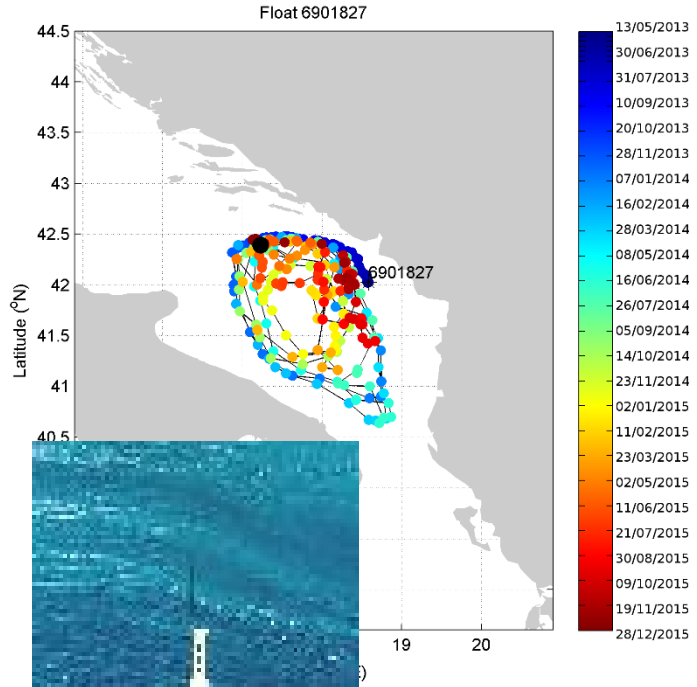
The presence of a quasi-permanent cyclonic gyre in the SA + the LIW + the winter conditions→ can drive to dense water formation

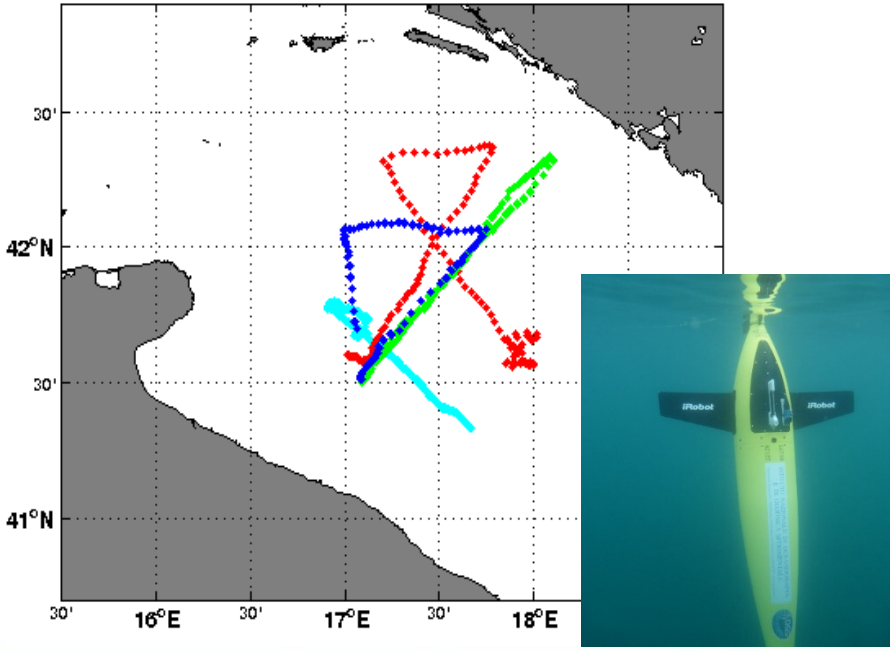
The Adriatic Dense Water is formed prevalently by the open-ocean vertical convection → then is exported through the Strait of Otranto to the rest of the Eastern Mediterranean basin → becomes the main component of the Eastern Mediterranean Deep Water (EMDW).

Rivers affect the Adriatic dense water volumes → they reduce the dense water formation in the NA → they directly affect the vertical mixing processes in the SAP by changing the water column stratification (decreasing the dense water volumes) (Zore-Armanda 1969,Verri et al., 2017)

Available data

- Glider campaigns,1 or 2 per year to cover preconvection, convection or post convection conditions in the SA.
- Float data from SA and Ionian Sea for further investigation of the thermohaline characteristics





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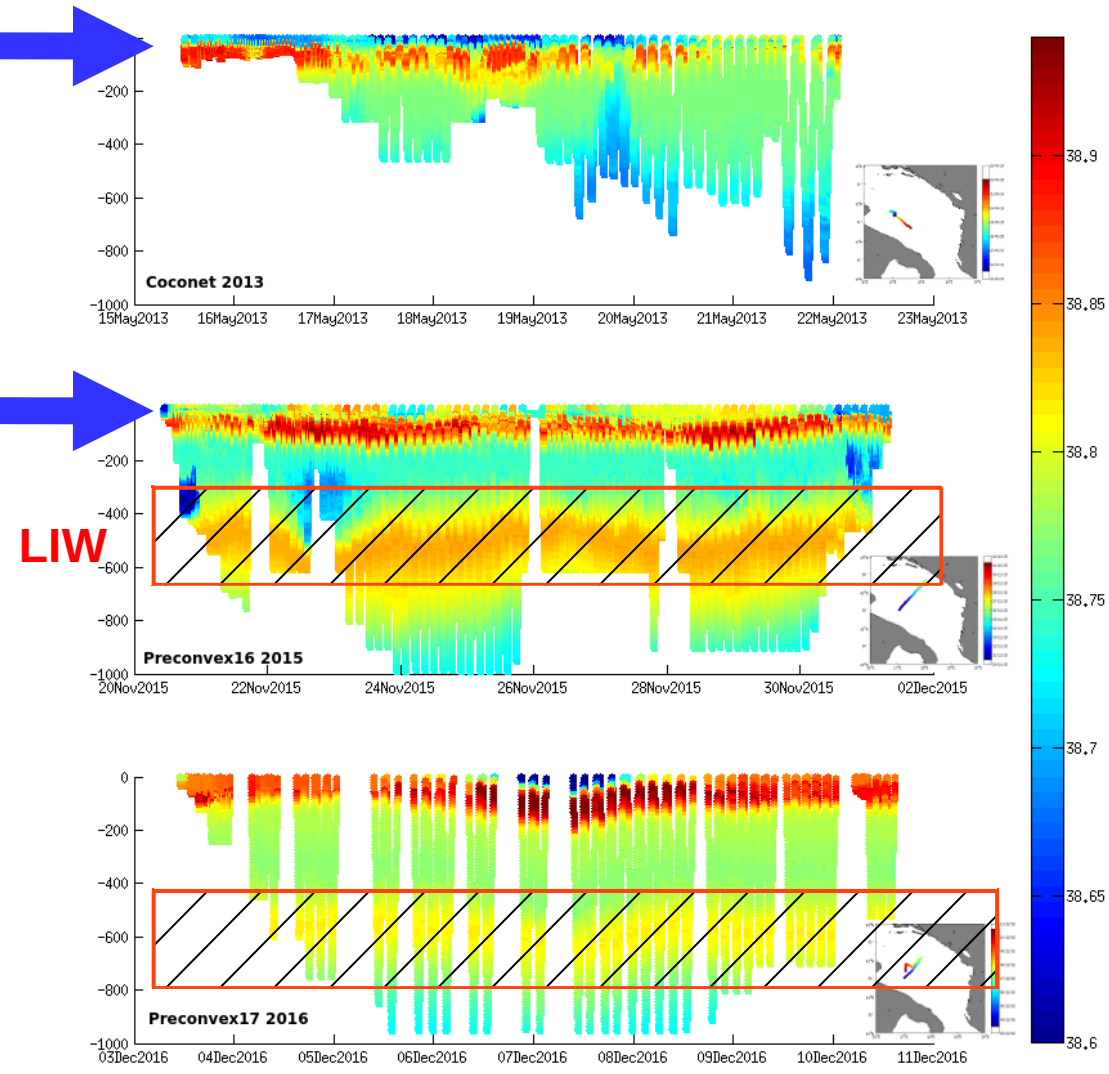
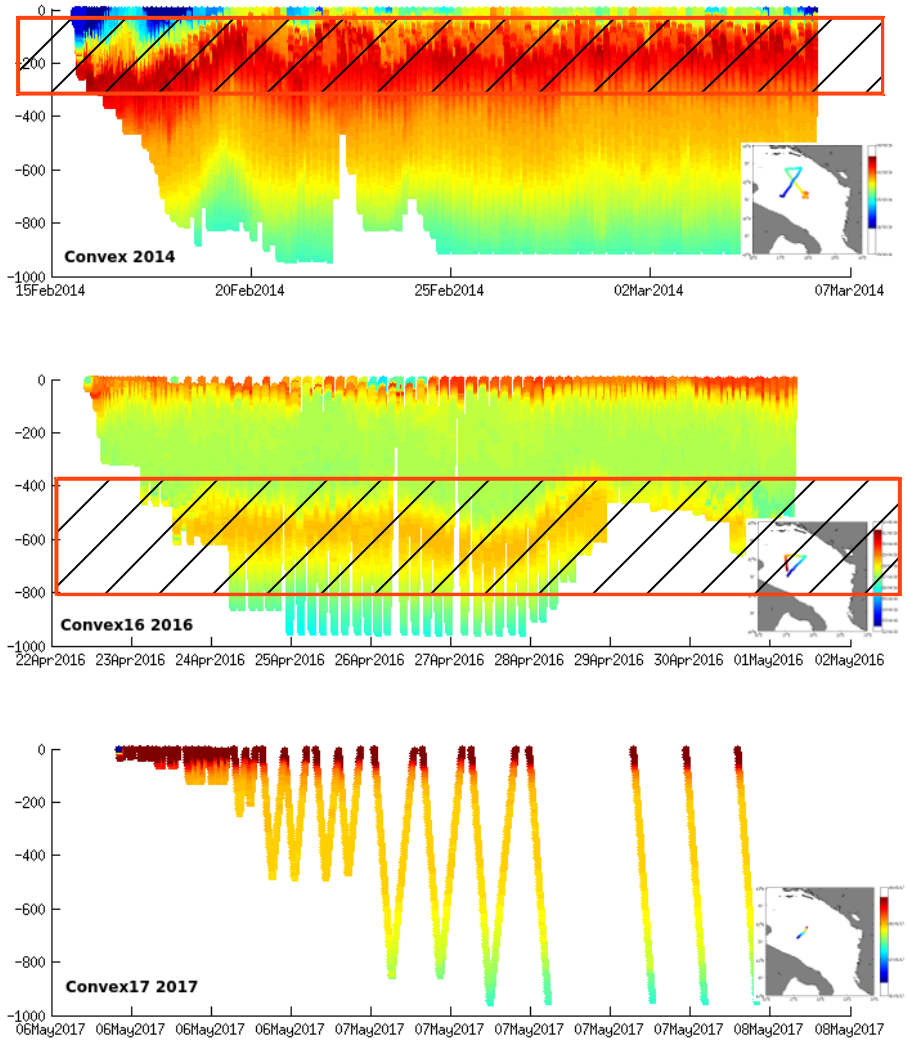
Glider data



LIW



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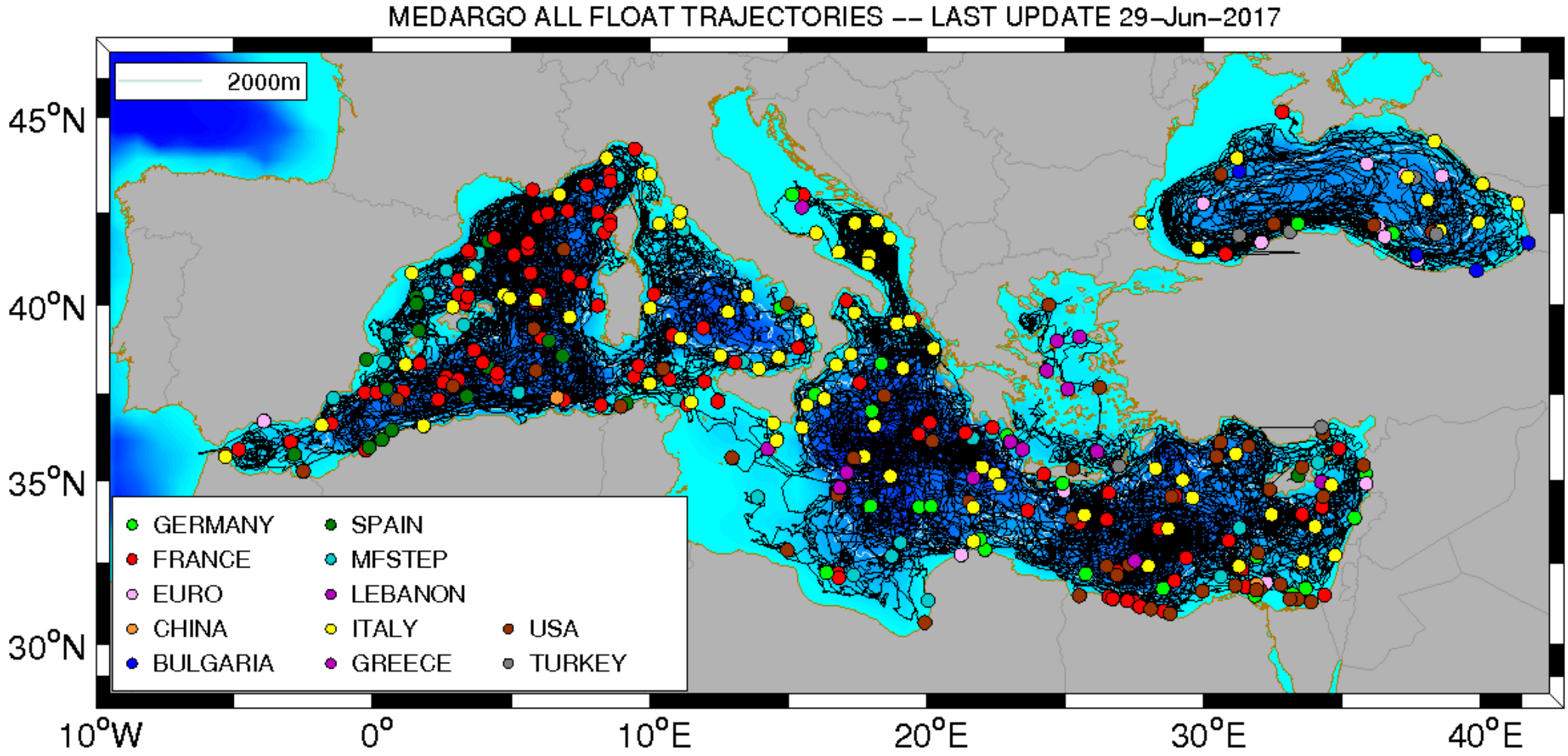
Float data

Argo float data in North Ionion, Southern & Middle Adriatic since March 2012



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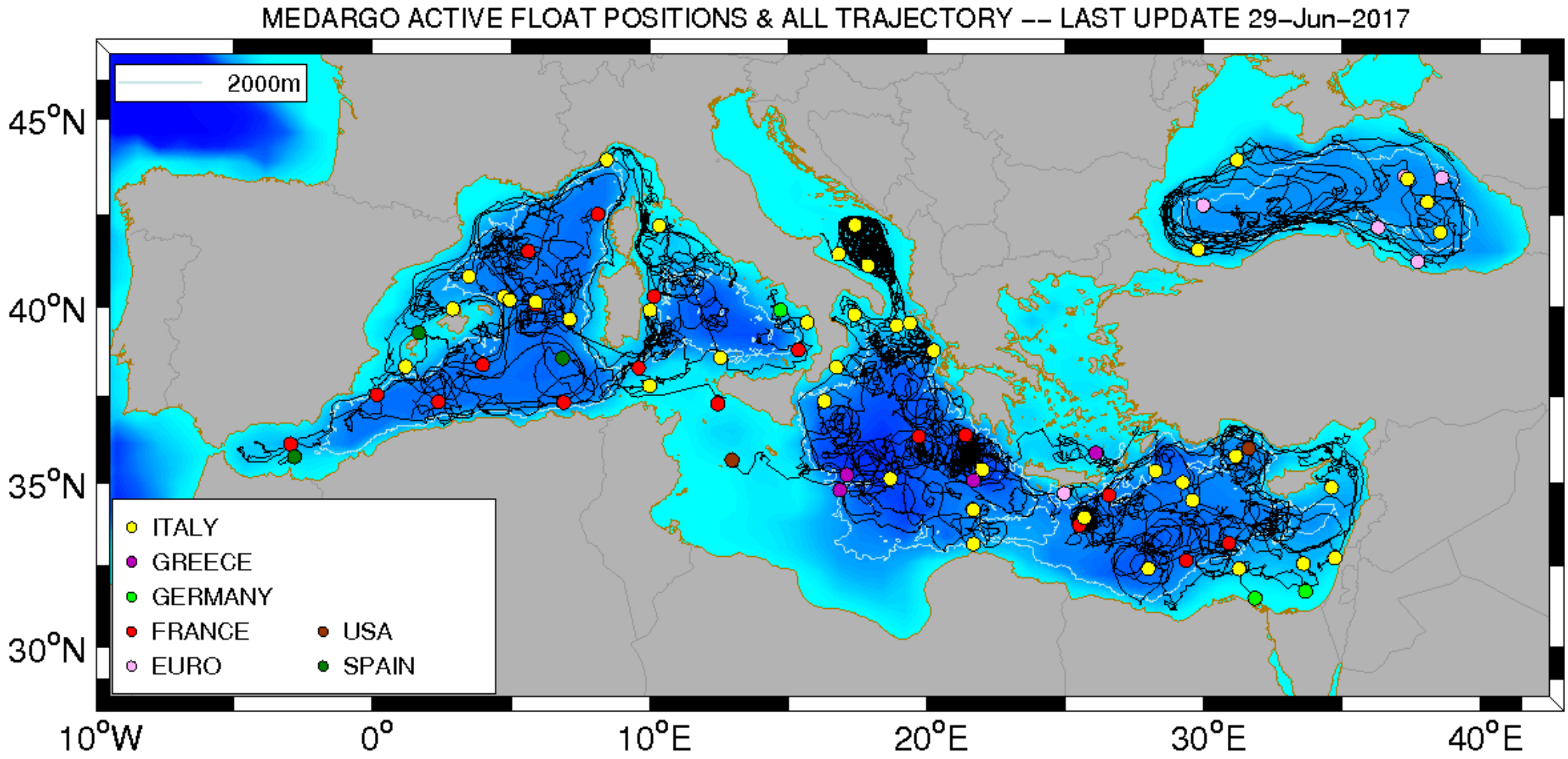
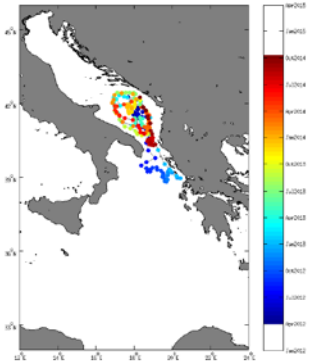
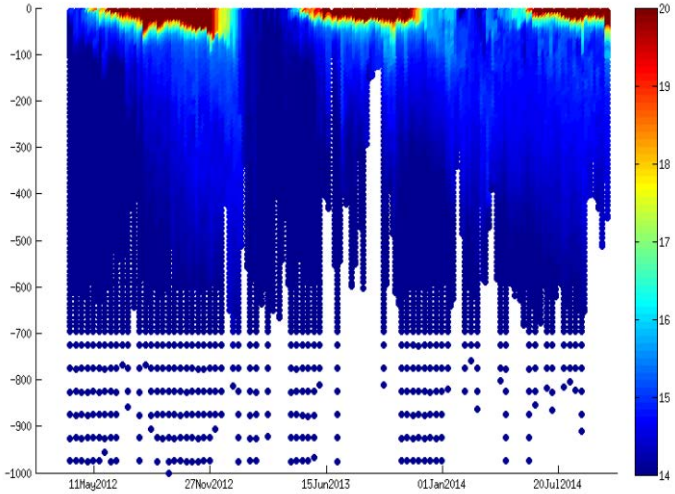
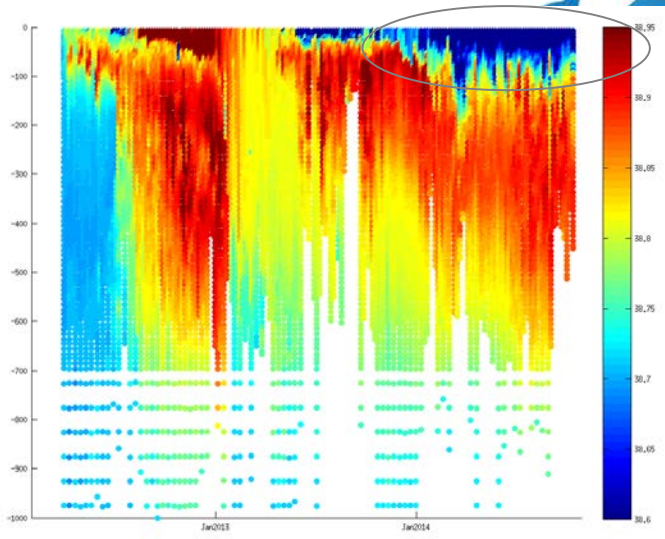
Active floats



Float data

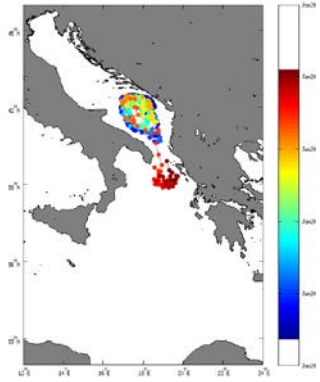


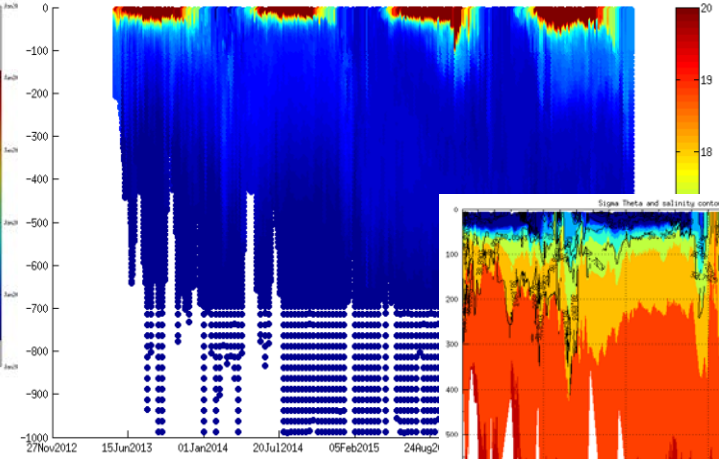


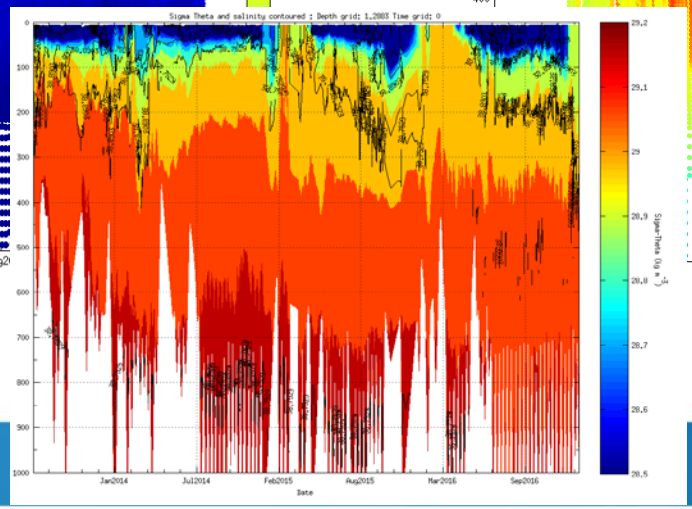


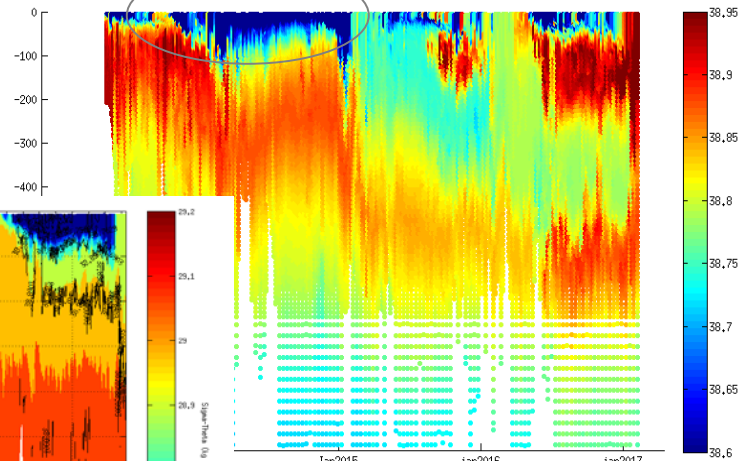
Arvor/Provor 6901040
Active 2012-2014
Subsurface drift 350m

Convection events



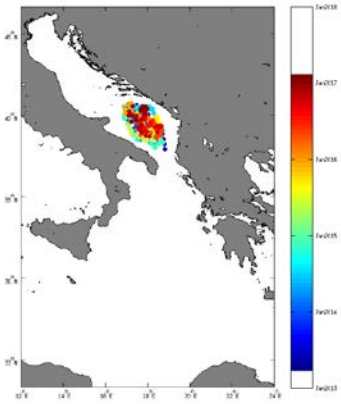




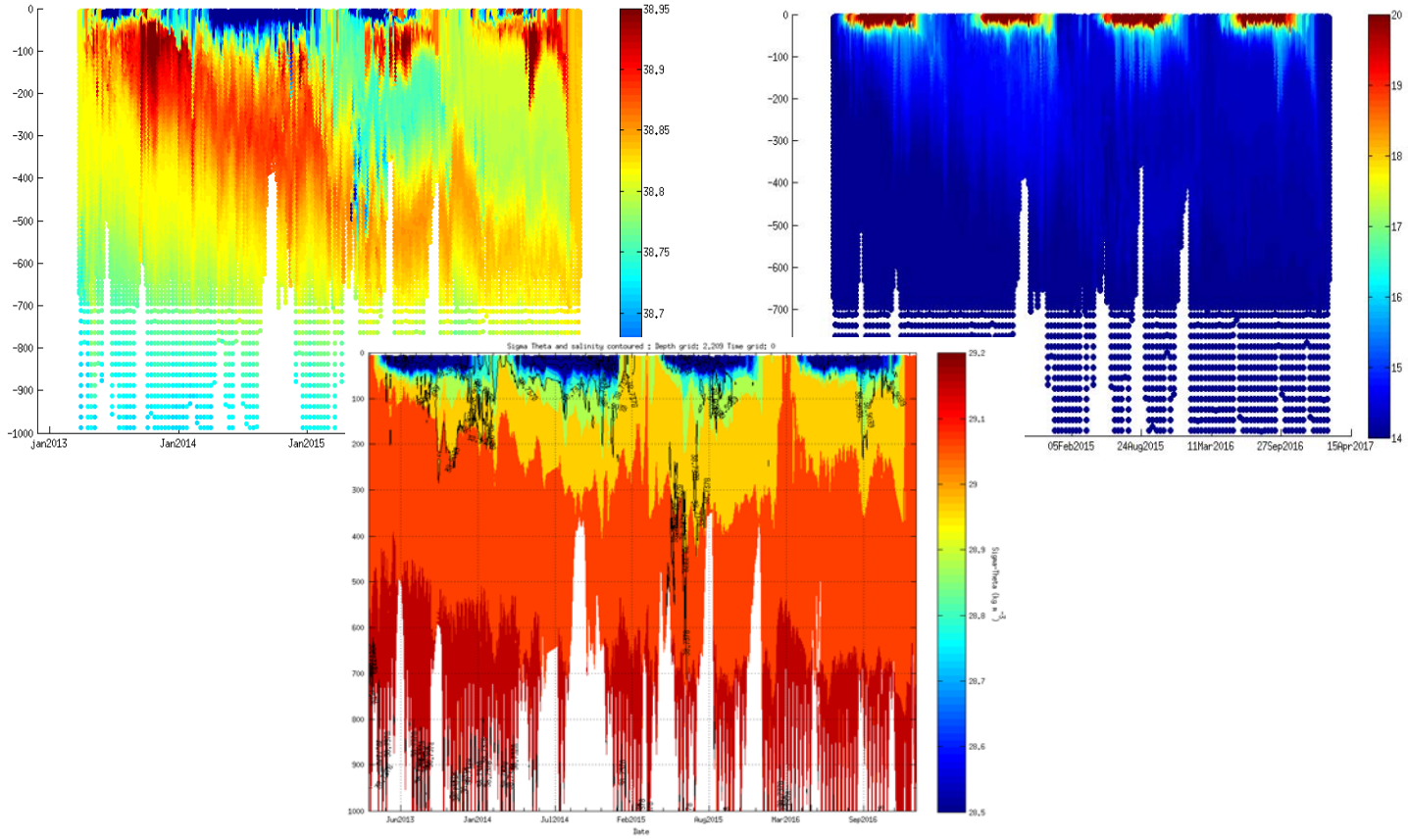


Provor 6901827
Active 2013-now
Subsurface drift 350m

Float data

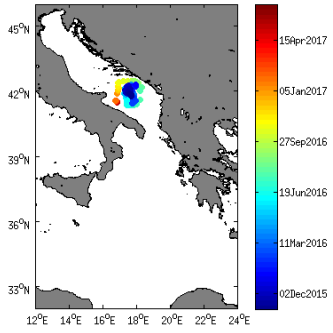


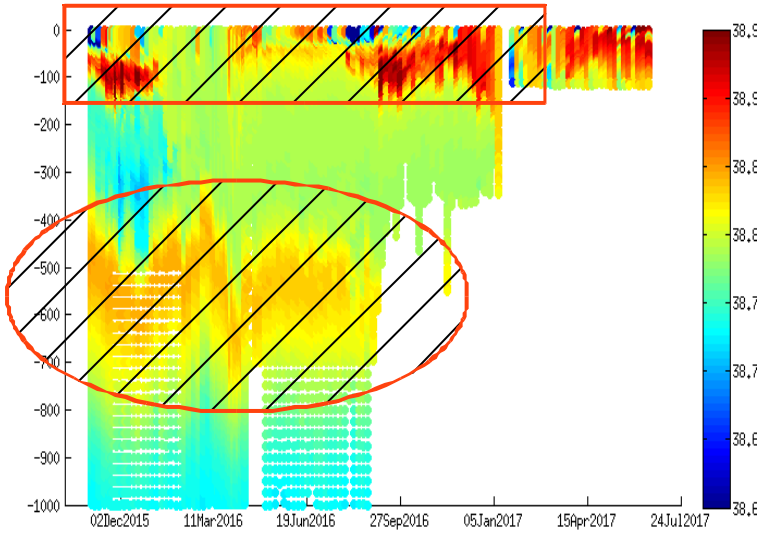
Arvor 6901822
Active 2013-now
Subsurface drift 350m

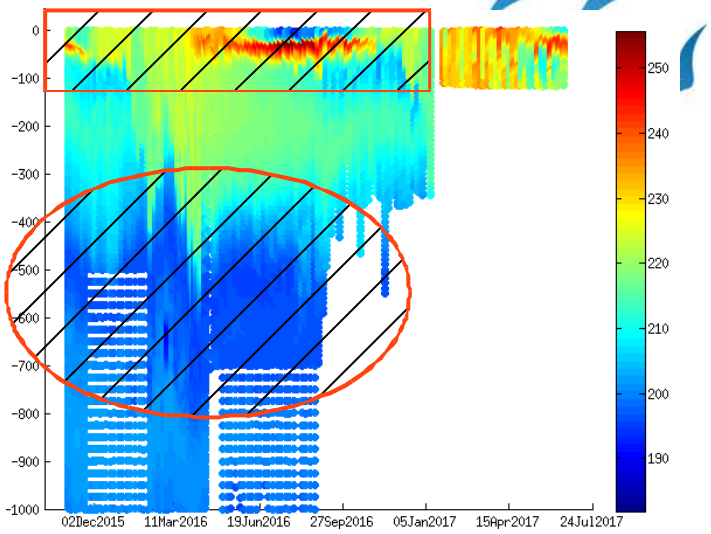


- Temperature follows the expected profile demonstrating the seasonal variability but it does not following the particular salinity profiles.
- Density is depicting better the temperature profiles and varies from 28.5 kg/m3 in the surface until 29.1 kg/m3 in the deeper layers.

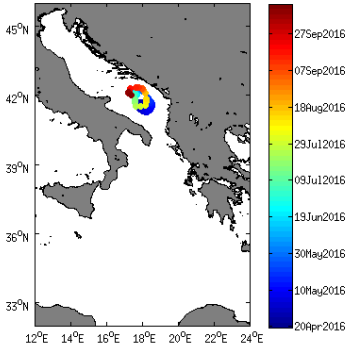
Float data

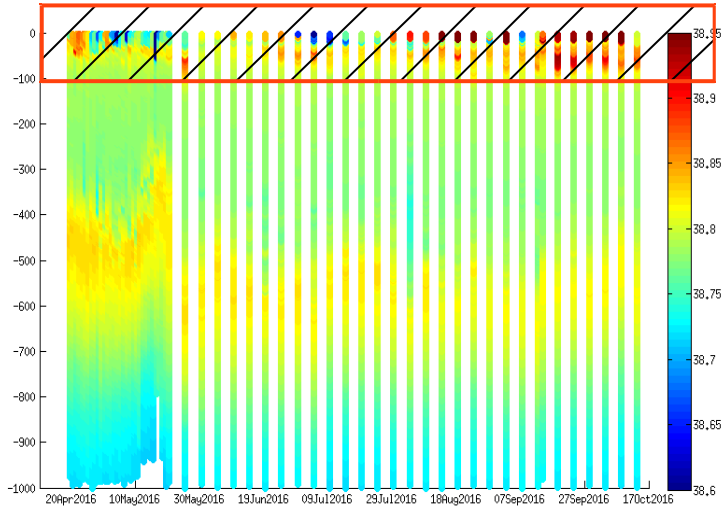


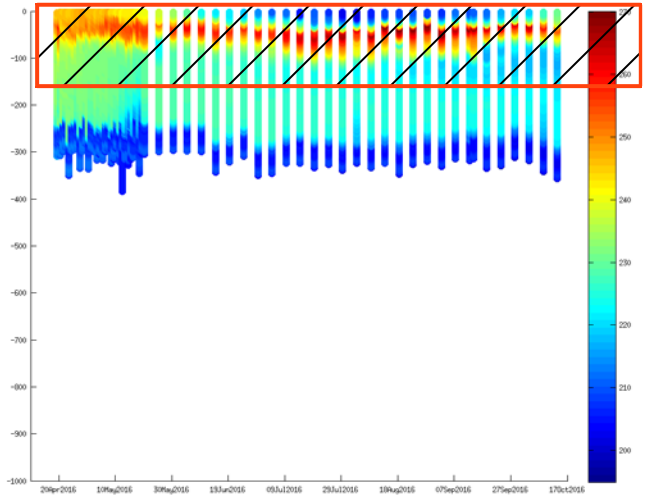




Provor Nut
Active 2016
Subsurface drift 350m
+ DOXY (µmole/Kg)







Provor Nut
Active 2016
Subsurface drift 350m
+ DOXY (µmole/Kg)

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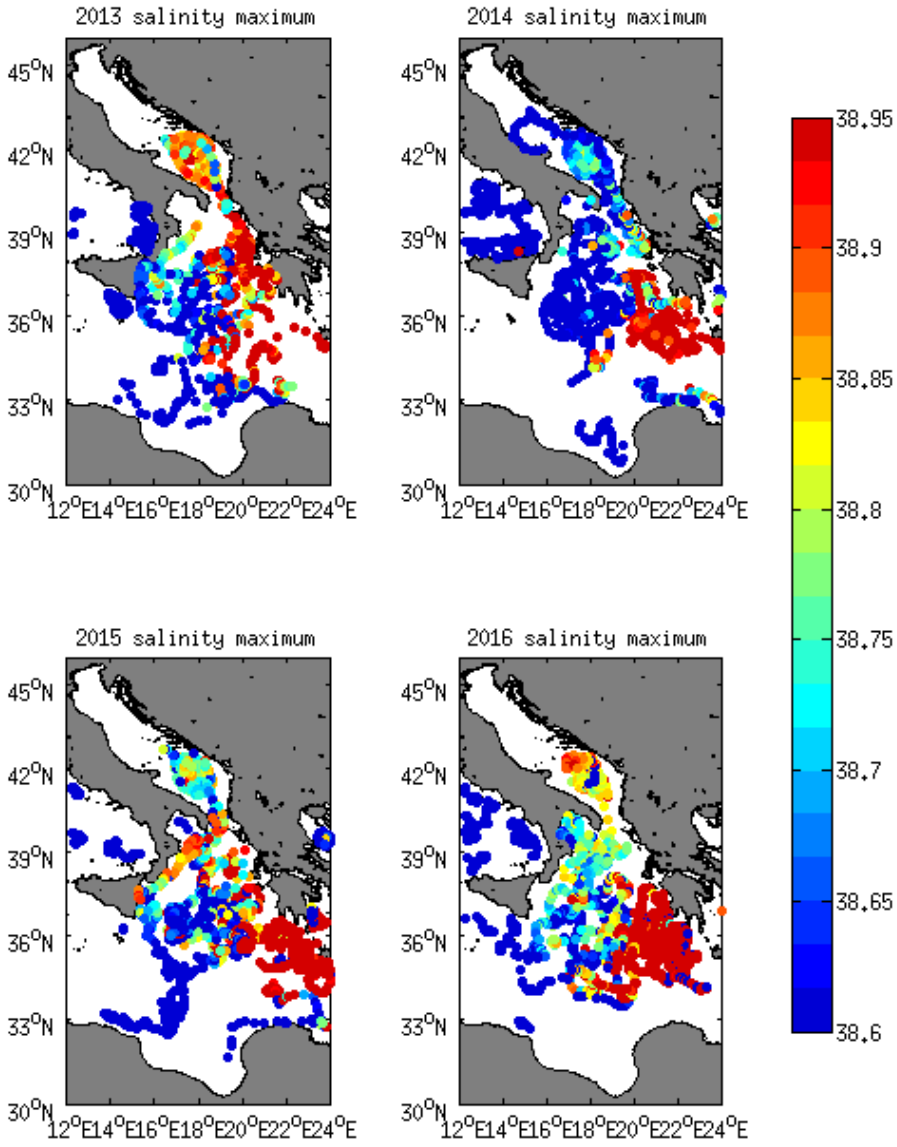
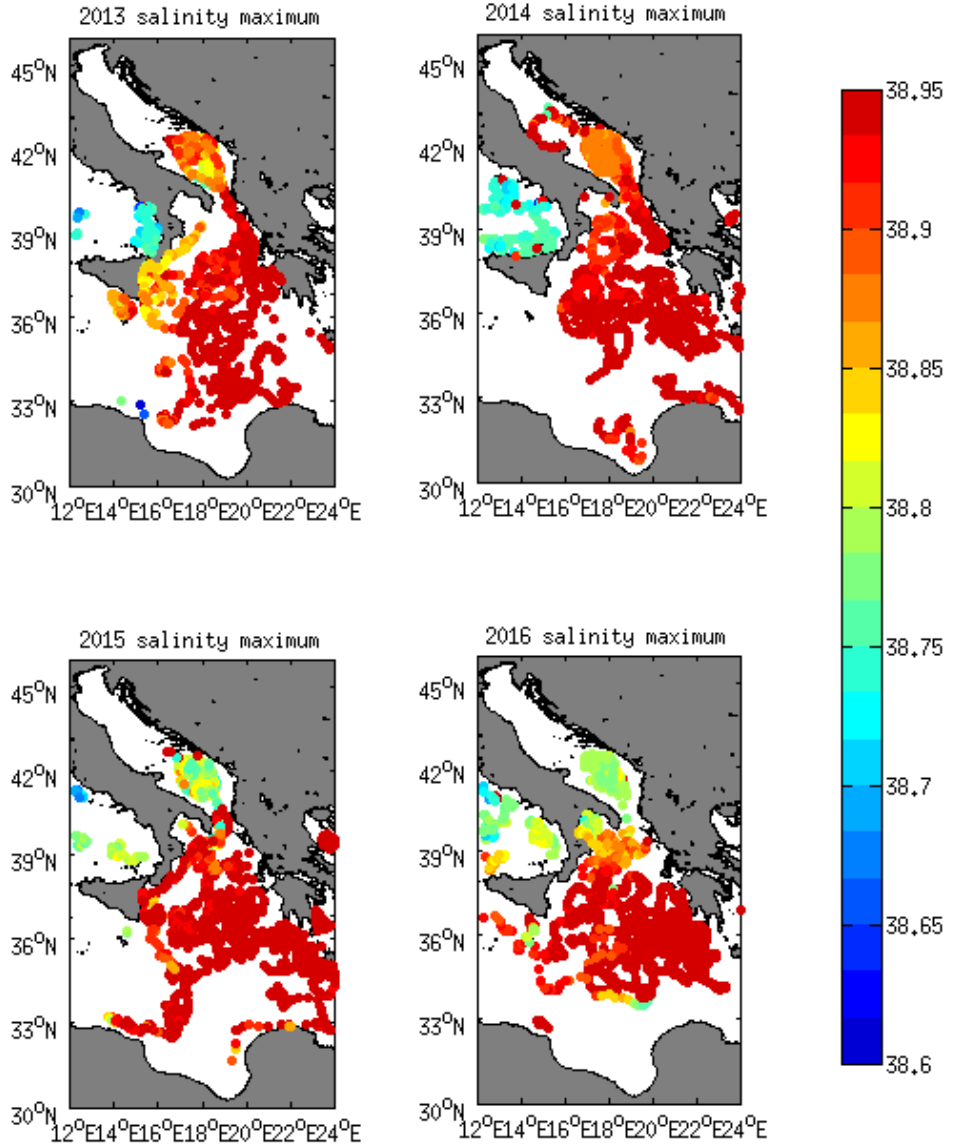
Salinity maximum



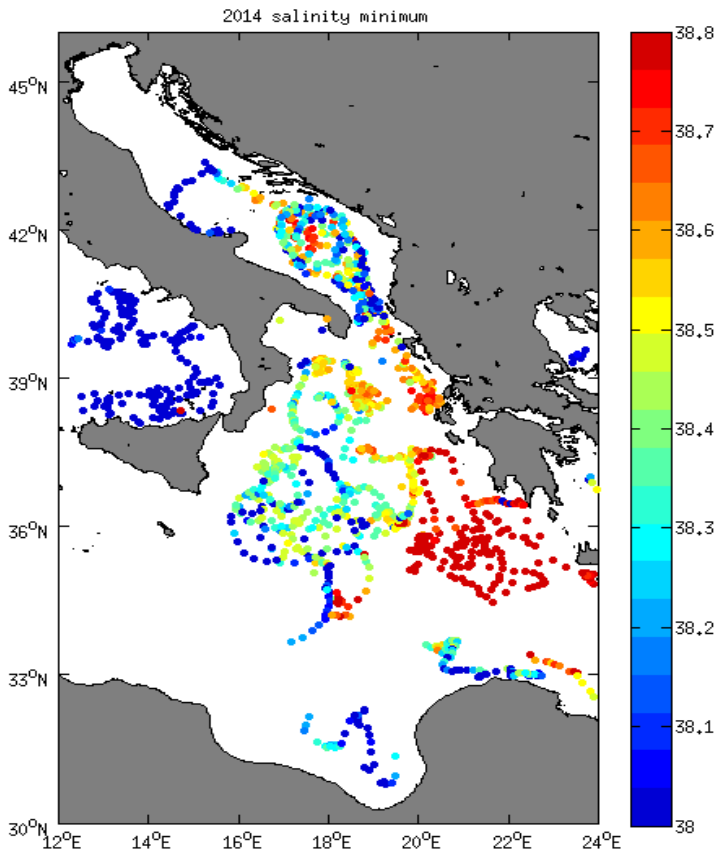
Salinity maximum 0-50m



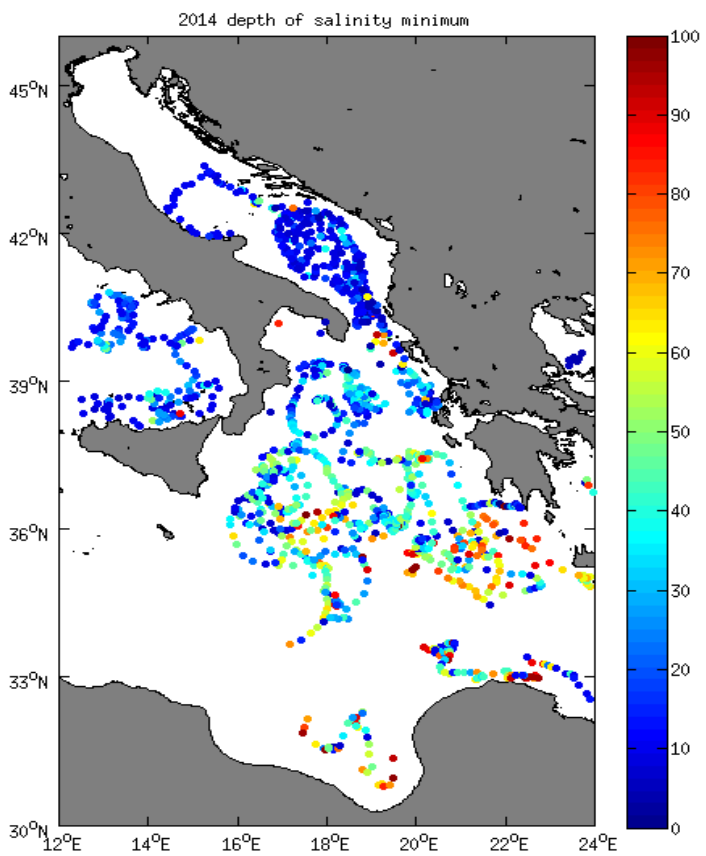
Salinity maximum 200-450m

Salinity minimum 2014

Salinity minimum 0-100m



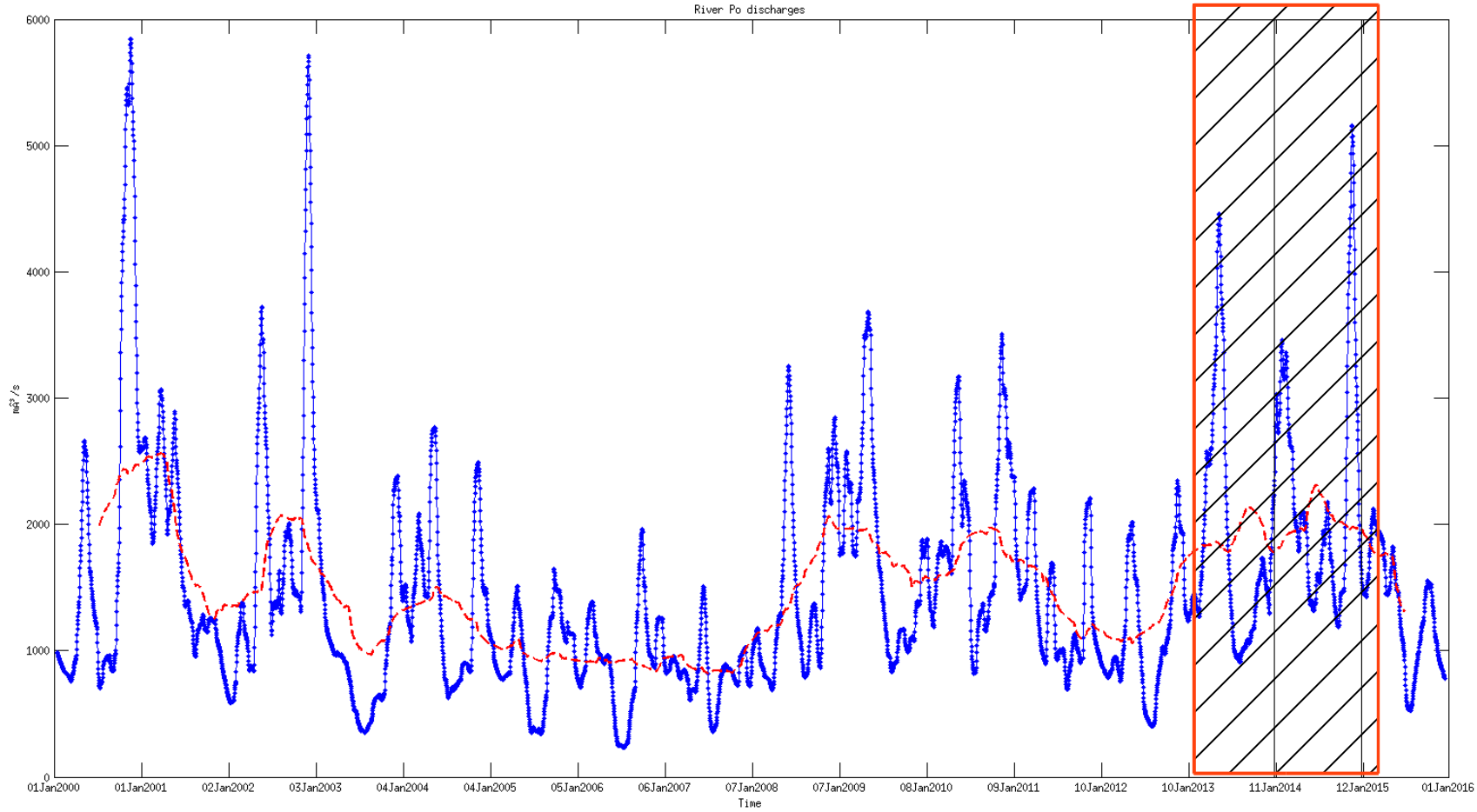
Depth of Salinity minimum



In the North Ionian and in the SAP the minimum of salinity is placed in the surface layers, while In the southern Ionian is in the subsurface layers depicting the presense of the AW.

If not AW, then what ?

River Po discharges



Daily data of discharges from Pontelagoscuro station (ARPA institute)

The high river discarges along with a mild winter seems to be responsible for the haline profile of 2014 & the double salinty maximum of 2015 - 2016.

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Conclusions

- We were able to monitor the thermohaline variability in the SA & NI Seas. During 2013-2016, salinity demonstrated particular profiles, while temperature was following the expecting profiles.
- In 2013, a saline vein was found entering from the Ionian Greek coasts via the Otranto Strait into the SAP.
- In 2014 the SA and the northern part pf the Ionian surface layer was occupied by a low salinity layer (<38.6).
- This water mass remained in the area for a whole year and resulted to the deepening of the existing LIW in the SAP.
- The convection of February 2015 contributed also to the dilution of the SAP.
- In 2015 the saline vein re-enters in the SAP and create a double salinity maximum.
- We tried to investigate the origin of the surface water mass in year 2014. It seems to be the result of the high river discharges and surface AW inflow in the SAP, during the mild year 2014.