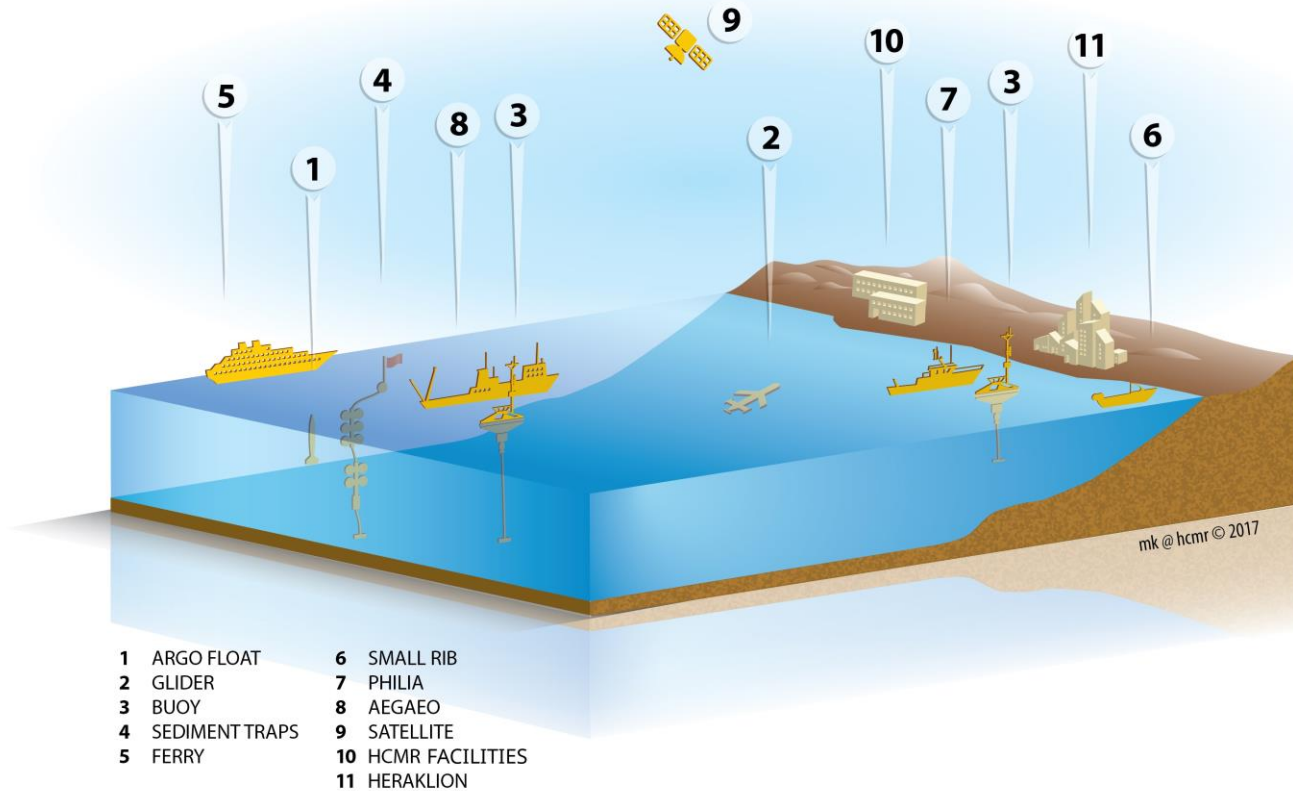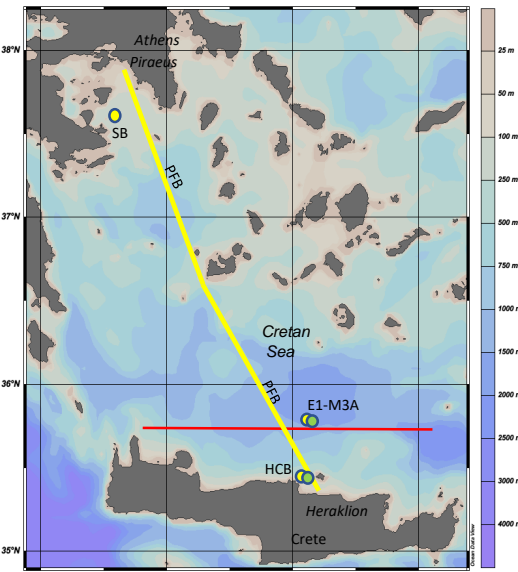# A multiplatform intercomparison of FerryBox Data
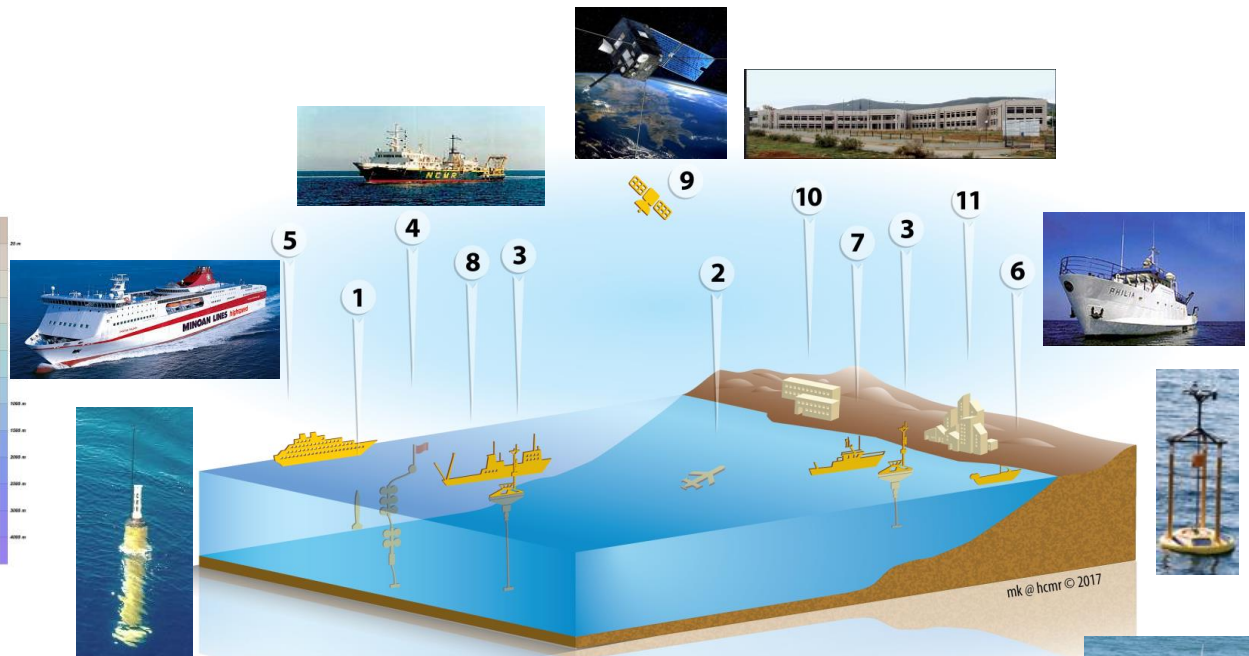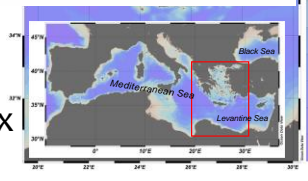
C. Frangoulis, A. Kalampokis, M. Sotiropoulou, M. Ntoumas, M. Pettas, S. Christodoulaki, G. Korres, L. Perivoliotis, and G. Petihakis
POSEIDON Team, Institute of Oceanography, Hellenic Centre for Marine Research

POSEIDON - Cretan Sea Observatory (2019)

- RV(CTD)
- Buoy
- Ferrybox
- Glider

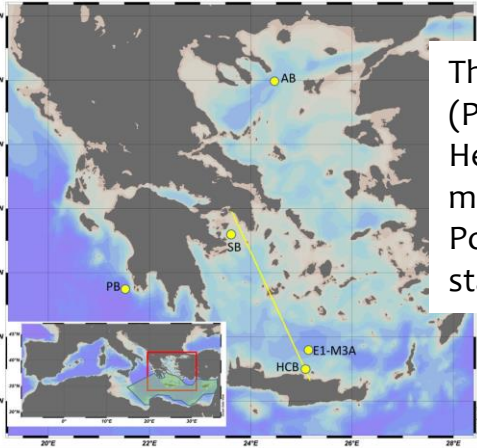|	
1 ARGO FLOAT	6 SMALL RIB
2 GLIDER	7 PHILIA
3 BUOY	8 AEGAEO
4 SEDIMENT TRAPS	9 SATELLITE
5 FERRY	10 HCMR FACILITIES
	11 HERAKLION

An integrated open-coastal biogeochemistry, ecosystem and biodiversity observatory of the eastern Mediterranean – the Cretan Sea component of the POSEIDON system

George Petihakis[1], Leonidas Perivoliotis[1], Gerasimos Korres[1], Dionysios Ballas[1], Constantin Frangoulis[1], Paris Pagonis[1], Manolis Ntoumas[1], Manos Pettas[1], Antonis Chalkiopoulos[1], Maria Sotiropoulou[1], Margarita Bekiari[1], Alkiviadis Kalampokis[1], Michalis Ravdas[1], Evi Bourma[1], Sylvia Christodoulaki[1], Anna Zacharioudaki[1], Dimitris Kassis[1], Emmanuel Potiris[1,a], George Triantafyllou[1], Kostas Tsiaras[1], Evangelia Krasakopoulou[1,a], Spyros Velanas[1], and Nikos Zisis[1]

POSEIDON Ferrybox (PFB)

High-Speed Ferry "Festos Palace" covering the distance every night in 7 hours (speed > 20 knots).

Temperature-Conductivity

(Thermo-Salinometer FSI)

Fluorescence-Turbidity

(Scufa II Turner Design)

Dissolved Oxygen

(Aanderaa optode)

The FB route (Piraeus – Heraklion) meets three Poseidon stations/buoys.

Planned upgrades

CO_2 /pH sensor

Water Sampler

Microplastics sampler

Additional temperature sensor at start of water circuit

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Quality control procedure

✓ : made for POSEIDON FB

EuroGOOS Data-MEQ Recommendations for RTQC procedures_V1.2 (Ferrybox)

- ✓ RTQC1: Platform metadata check
- ✓ RTQC2: Impossible date test
- ✓ RTQC3: Impossible location test
- ✓ RTQC4: Frozen date/location/speed test
- ✓ RTQC5: Speed range test
- ✓ RTQC6: Pump or flow-meter test
     (PFB: valve filter test)
- ✓ RTQC7: Pump history test
     (PFB: ship outgoing test)
- ✓ RTQC8: Global range test
- ✓ RTQC9: Regional range test
     (PFB: adapted to sub-regional range test)
- ✓ RTQC10: Gradient test (includes spike test)
- ✓ RTQC11: Frozen test

QARTOD

Group 1 Required
- ✓ Test1: Gap Test
- ✓ Test2: Syntax test
- ✓ Test3: Location test
- ✓ Test4: Gross Range test
- ✓ Test5: Climatological Test

Group 2 Strongly Recommended
- ✓ Test 6: Spike test
- Test 7: **Rate of Change test**
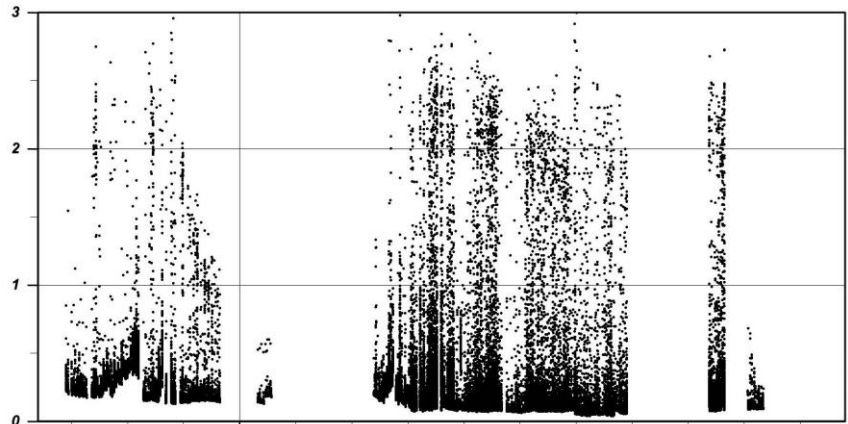- ✓ Test 8: Flat Line test

Group 3 Suggested
- **Test 9: Multi-Variate Test**
- Test 10: Attenuated Signal Test
- **Test 11: Neighbor Test**

POSEIDON FB
QC under incorporation
Rate of change
Neighbor Test
Multivariate test

Present study

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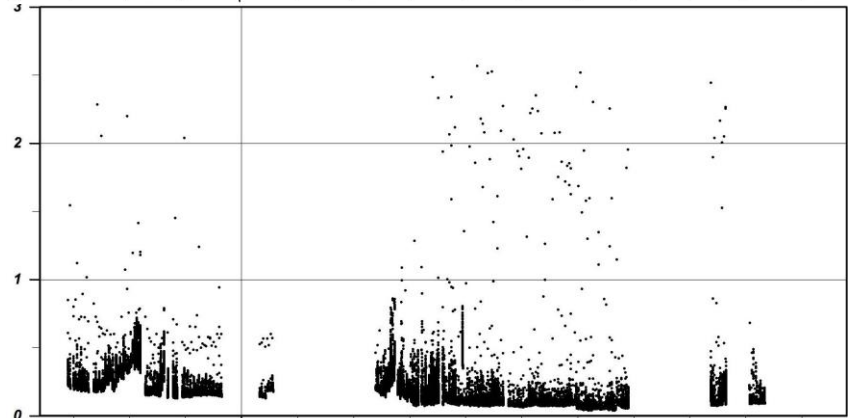Monitoring, Forecasting and Information System for the Greek Seas

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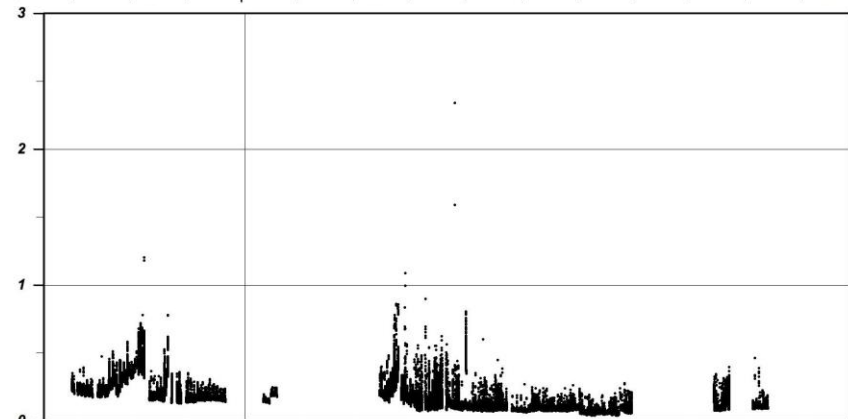# PFB QC example : FLUORESCENCE

Chla (mg m^{-3})

After
- ✓ Platform metadata check
- ✓ Impossible date test
- ✓ Impossible location test
- ✓ Frozen date/location/speed test
- ✓ Speed range test
- ✓ Global range test
- ✓ Regional range test (adapted to sub-regional range test)
- ✓ Gradient test
- ✓ Frozen test

After
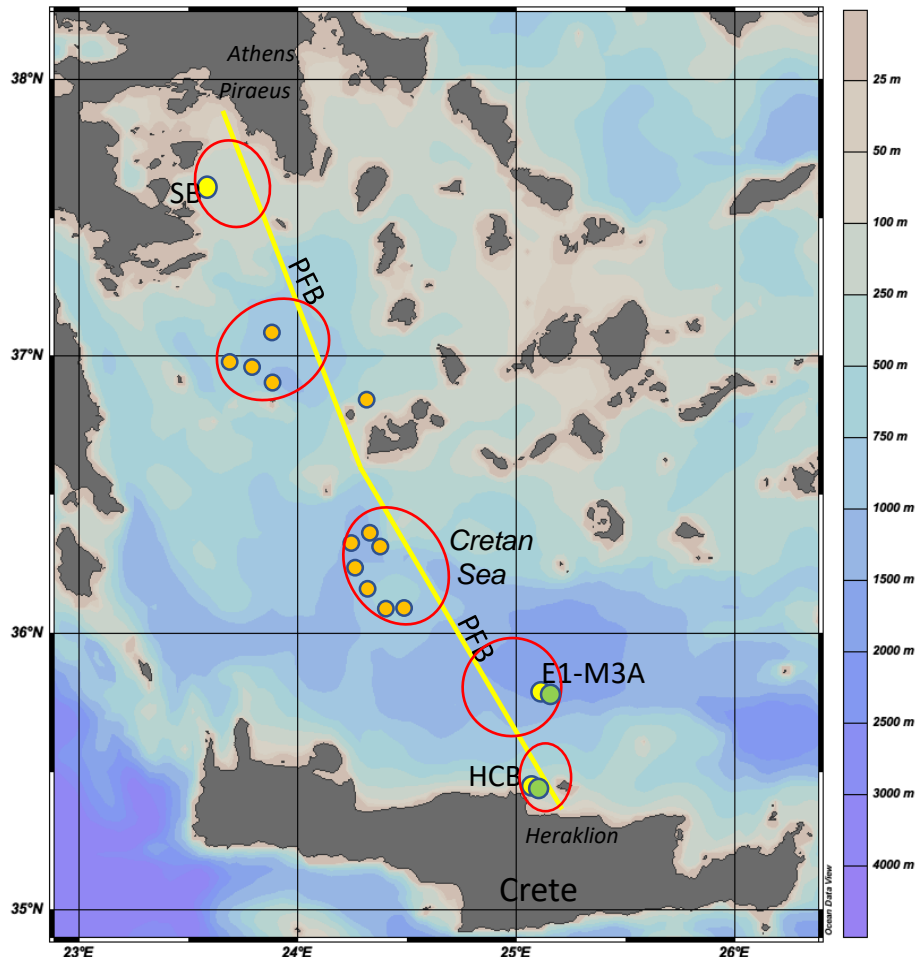- ✓ Pump or flow-meter test
  (PFB: valve filter test)

After
- ✓ Pump history test
  (PFB: ship outgoing test)

S O N D J F M A M J J A S O

Data Matchups
(pairs of neighbors used to develop neighbor QC test)

BUOYS

E1-M3A - PFB
Δ distance : <15 km
Δ depth (T, S): < 3 m
Δ depth (DO, CHLA): 20 m
Δ time < 1.5 hours

HCB - PFB
Δ distance : <10 km
Δ depth : < 3 m
Δ time < 1.5 hours

SB- PFB
Δ distance : <15 km
Δ depth : < 3 m
Δ time < 1.5 hours

RV(CTD)

RV@E1-M3A - PFB
Δ distance : <15 km
Δ depth : < 3 m
Δ depth(DO) : < 7 m
Δ time < 3 hours

RV@HCB - PFB
Δ Distance : <15 km
Δ Depth : < 3 m
Δ time < 3 hours

ARGOS

Argos- PFB
Δ distance : <30 km
Δ depth : < 3 m
Δ time < 6 hours

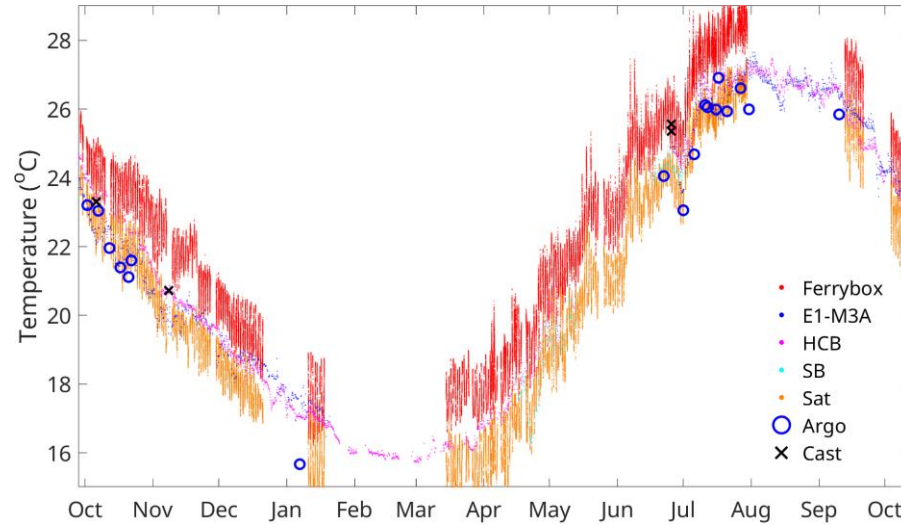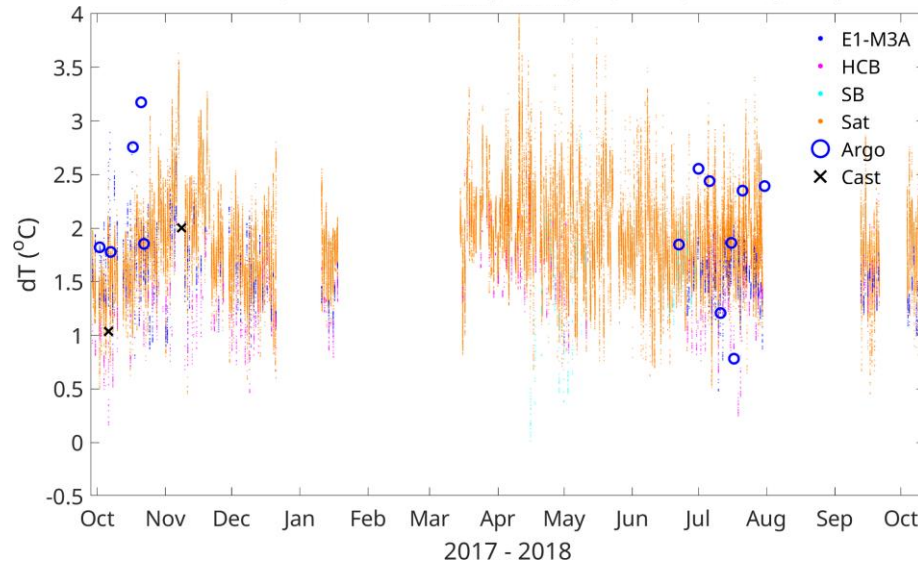**SAT**

Sat - PFB
Δ distance (T) : <0.01 º
Δ distance (chla) : <1 km
Δ depth (T, CHLA) : < 3 m
Δ time (CHLA) < 12 hours
Δ time (T) < 6 hours

Argos   Buoy   RV(CTD)   Ferrybox

1. Temperature neighbors

a. All data

b. Matchup data
(dT = T_{FB} − $T_{other\ platform}$)

! ISSUE !

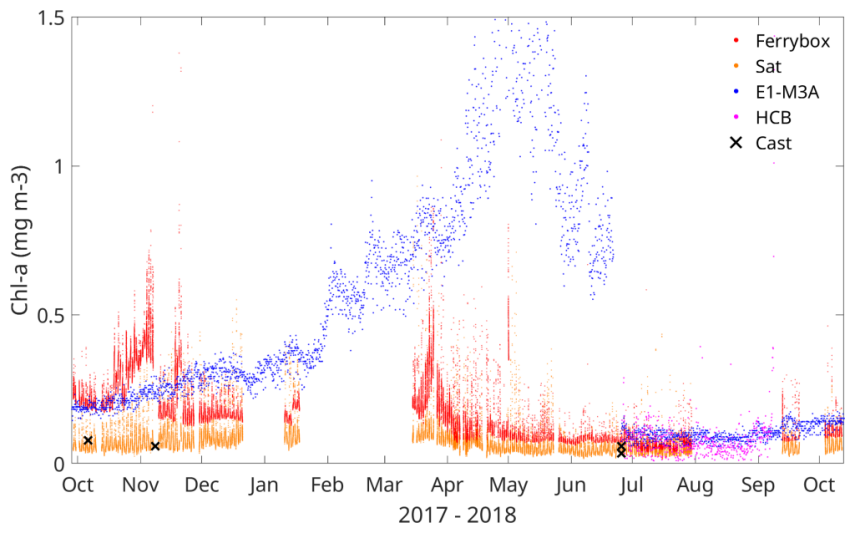All (buoys, Sat, Argo, Casts) confirm that FB overestimates T by 1-3 °C

Due to Ferry engine room
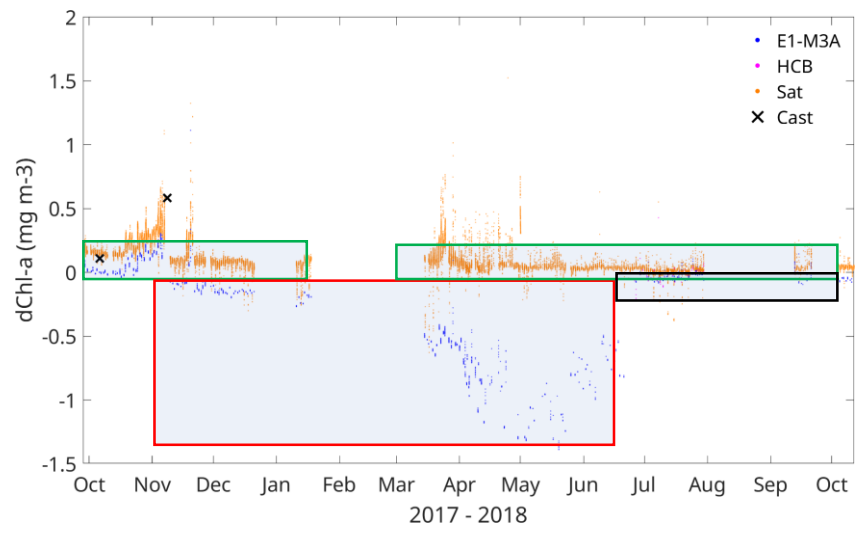
=>New T sensor to be installed at start of circuit

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2. Fluorescence neighbors

a. All data

! E1-M3A data at 20m
=> Not comparable to other platforms ?

b. Matchup data
(dChla =
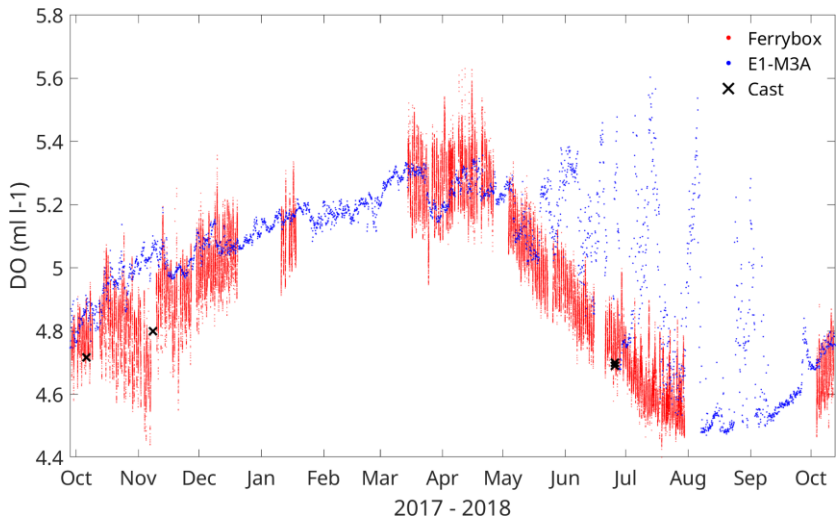Chla_{FB} – Chla_{other platform})

Sat can be used for QC of FB

HCB <u>maybe</u> can be used for QC of FB
(need of more data)

E1-M3A maybe can be used for QC of FB
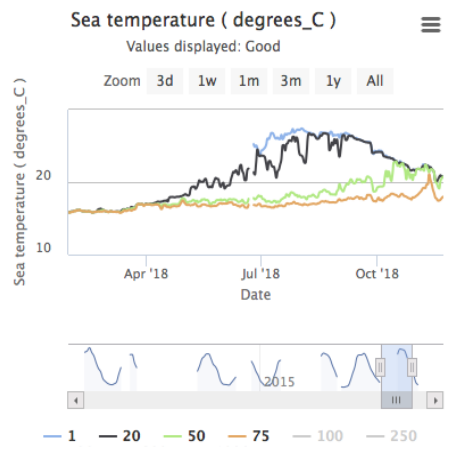<u>outside</u> the bloom period i.e. July to Nov

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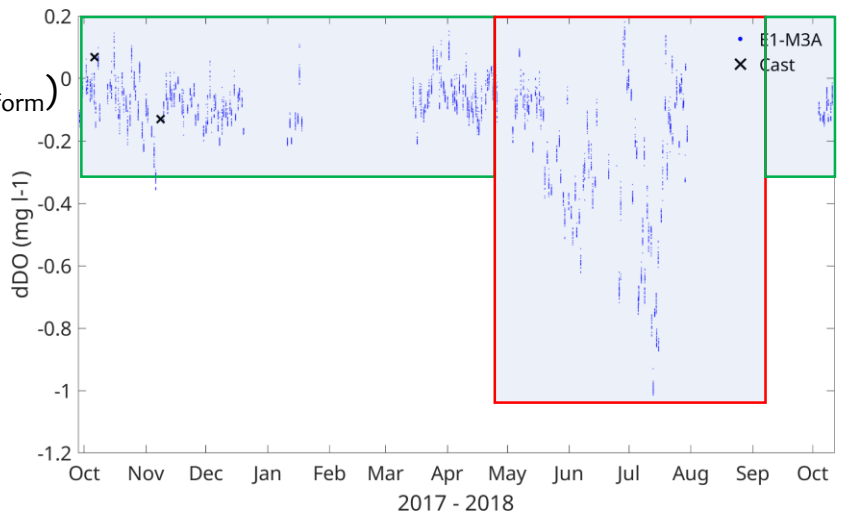ΕΛΚΕΘΕ

3. Oxygen neighbors

a. All data

! E1-M3A at 20m
! FB at 3m

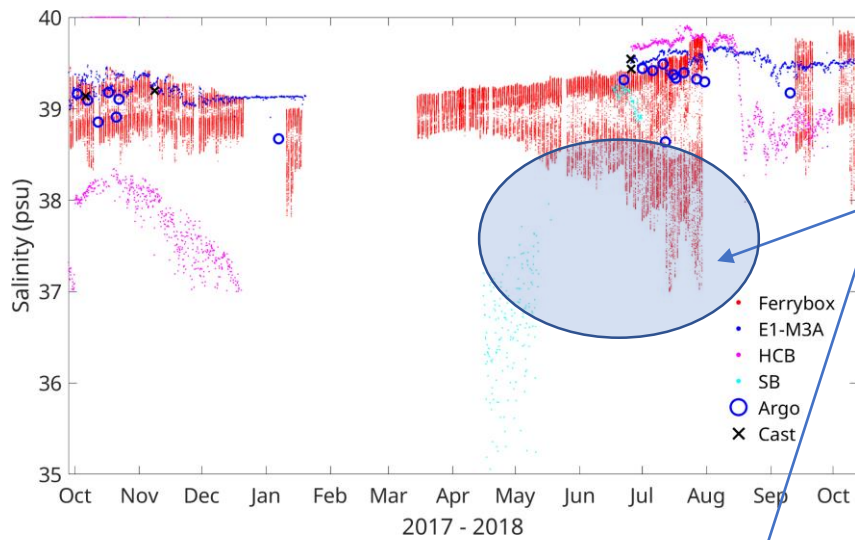Why in summer noisy E1-M3A data?
Stratification effect on sensor at 20m

b. Matchup data
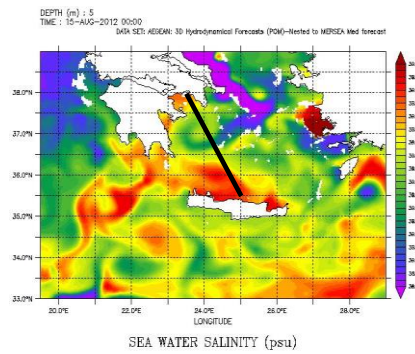(dDO = $DO_{FB} - DO_{other\ platform}$)

E1-M3A can be probably used for QC of FB outside the stratified period

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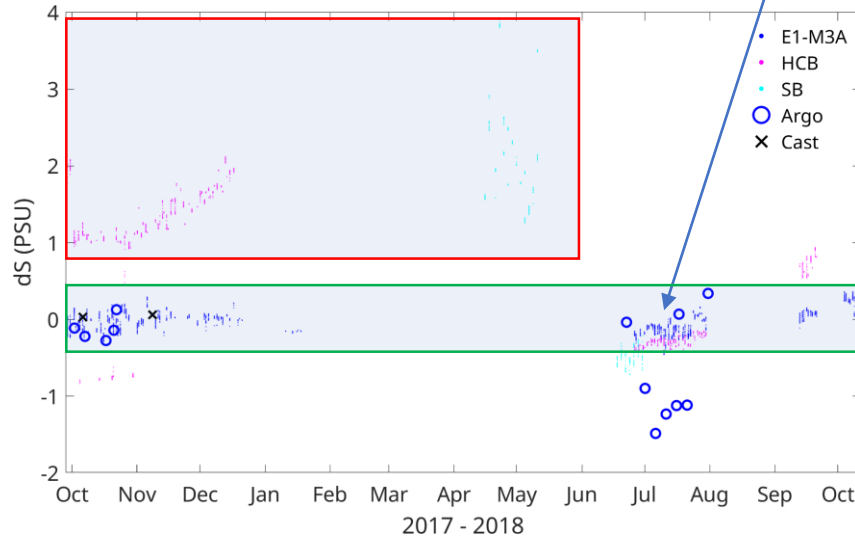ΕΛΚΕΘΕ

4. Salinity neighbors

a. All data

FB Sensor problem?
No. E1-M3A, HCB, Argo data confirm FB is ok.
=> Water mass with lower salinity entering (BSW)

b. Matchup data
(dS = S_{FB} − $S_{other platform}$)

SB, HCB (due to rapid fouling issues) cannot be used for QC of FB
(BUT FB could be used for QC of SB, HCB)

E1-M3A can be used for QC of FB

Poseidon System

Monitoring, Forecasting and Information System for the Greek Seas
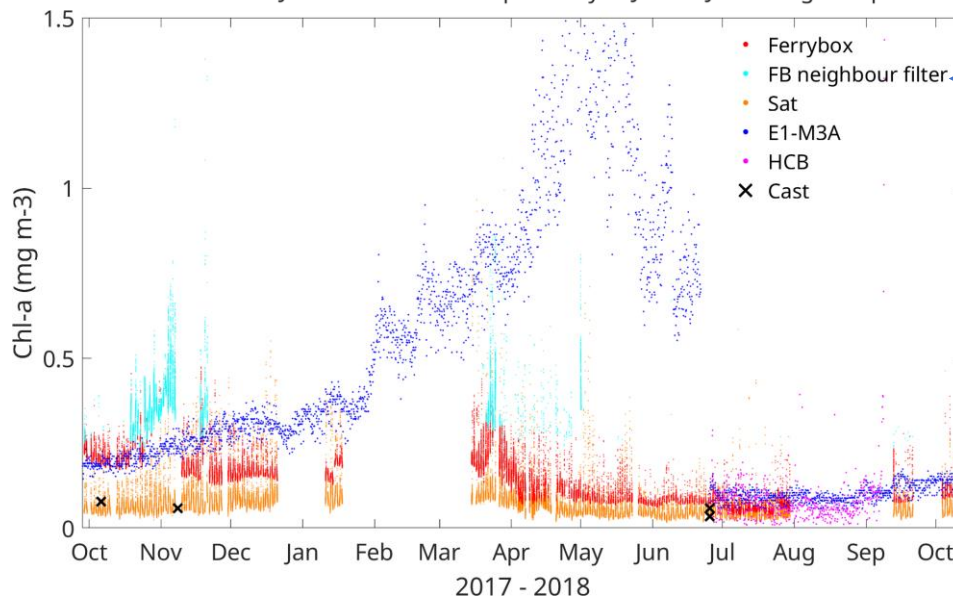
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Neighbor filter first trial

Example with Fluorescence flagging based on SAT – FB neighbors

a. Before neighbor QC
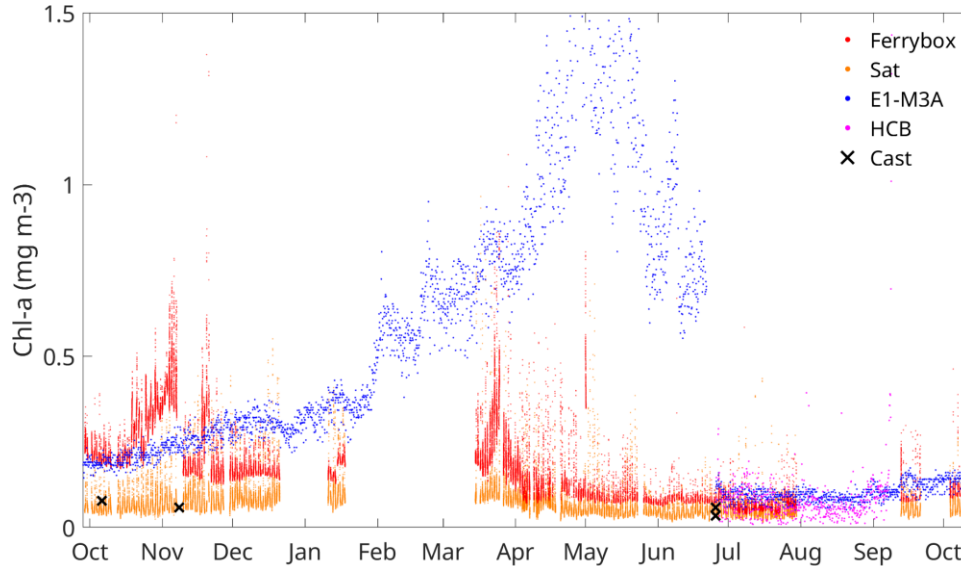
b. After neighbor QC

Flagged probably bad

Conclusions & Perspectives

Conclusions

- Multiplatform intercomparison allows to :
    - detect or confirm presence/absence of offset in sensors
    - apply neighbor test QC to complement other QC tests

- Possibility to apply neighbor test may depend :
    - on the parameter
    - on the platform
    - on the period (i.e. stratified or outside bloom period)

- Neighbor test may be unilateral
    (i.e. from a reference platform to another)

Perspectives

- Need to repeat the exercise on a another data set
    - with corrected FB temperature
    - with more reference CTD casts (or samples)
    - with better salinity recordings at coastal buoys
    - with fixed platform fluorescence at subsurface

- Further development of neighbor test

- Test multivariate analysis (e.g. oxygen relation to T, S, Chla)