INTERVENTION ON MOMAR OBSERVATORY

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WORKSHOP ON SEA OPERATIONS FOR OCEAN OBSERVATORIES

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This presentation reports a collaborative work :

thanks to Patrick Simeoni, Christophe Duchi, Marc Nokin, Loic Dussud, Pascale Lherminier …

MoMAR : a multidisciplinary acoustically linked observing system with satellite connection to shore.

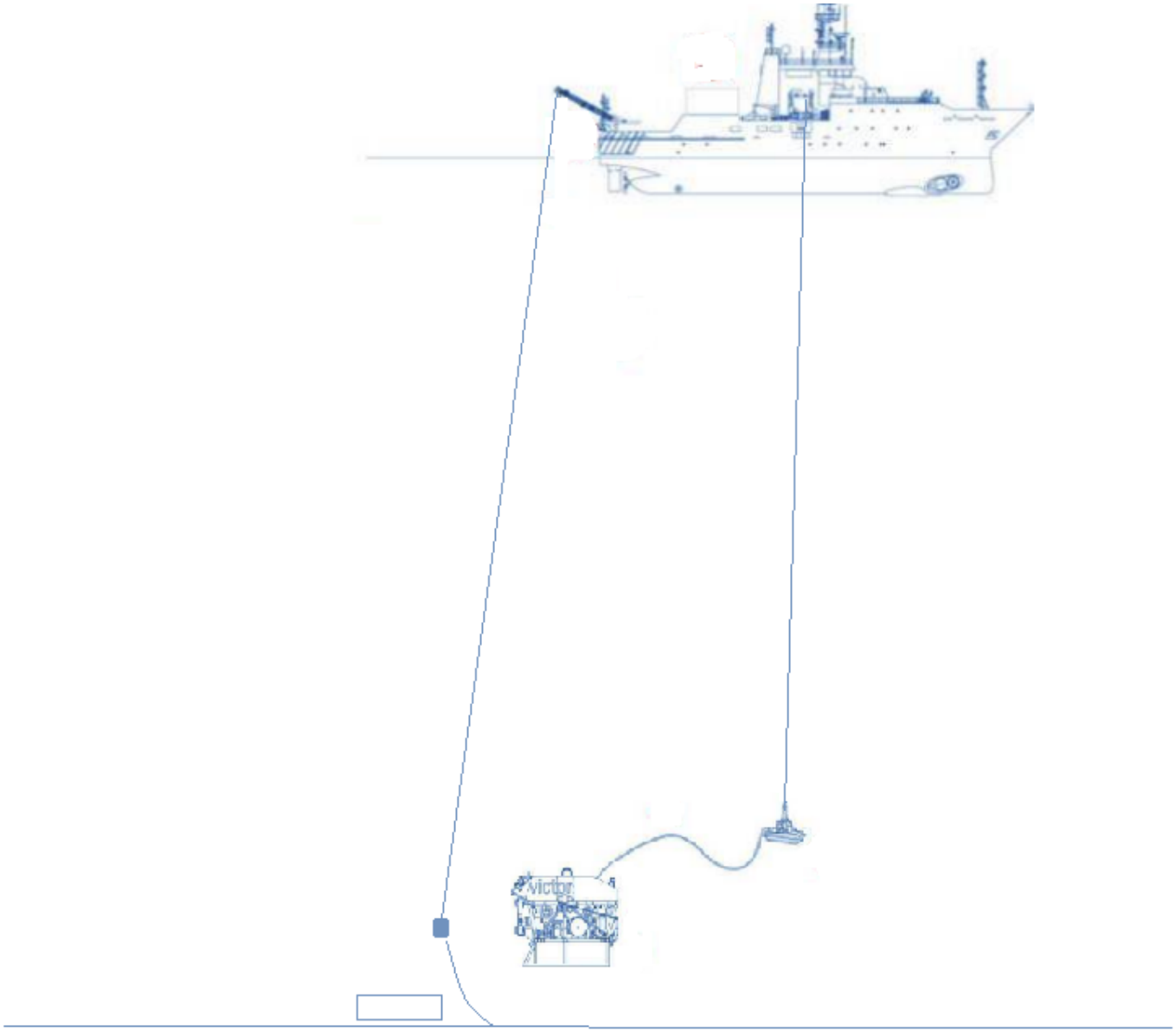
2 "SeaMoN" stations, serviced every year :

a recovery and a re-installation procedure

Recovery phase

- time-consuming operation
- a deadweight is left on the seafloor

Operation with 2 cables ?

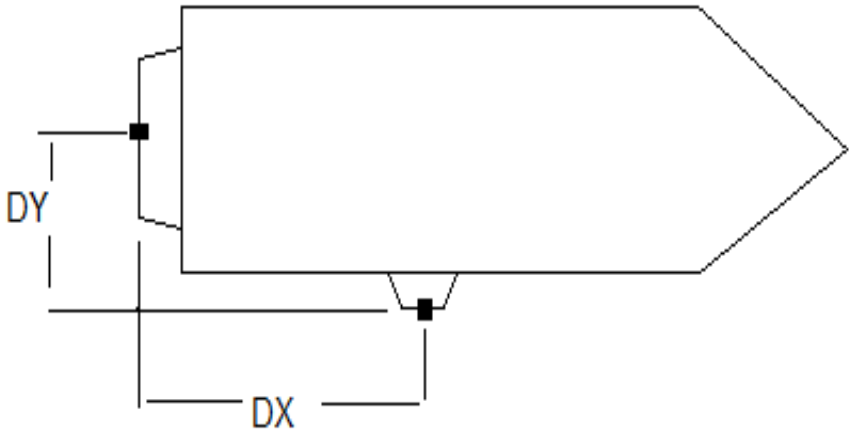


Issues to be addressed

- the risk of contact between the 2 cables, (or between the ROV tether and the ascending station)

- the dynamic behaviour of the handling cable with the station attached to its lower end

Ship data

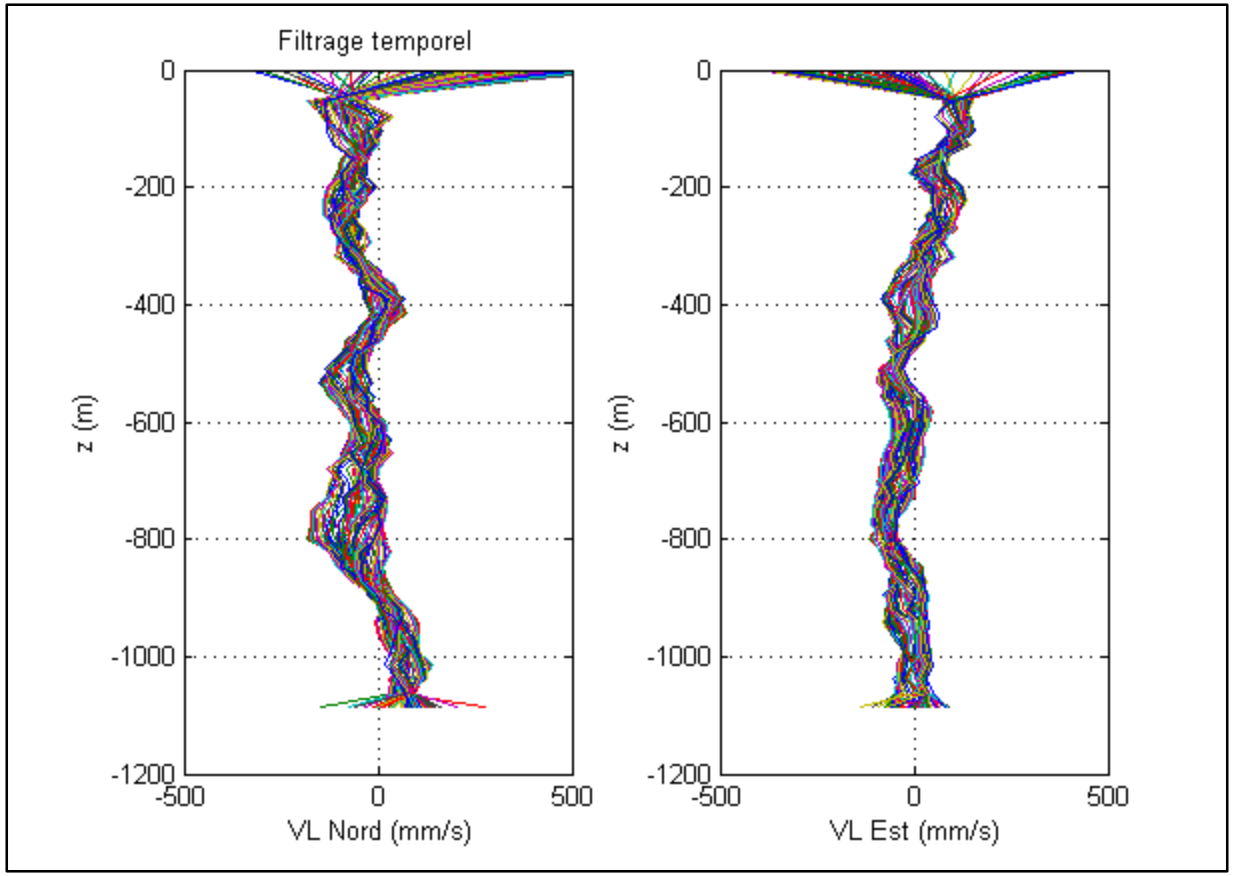


	Atalante	Pourquoi-Pas
Length	85 m	107 m
DX	19 m	29 m
DY	13 m	18 m

Can we optimize the ship control stategy ?

Which information on current profiles is available ?

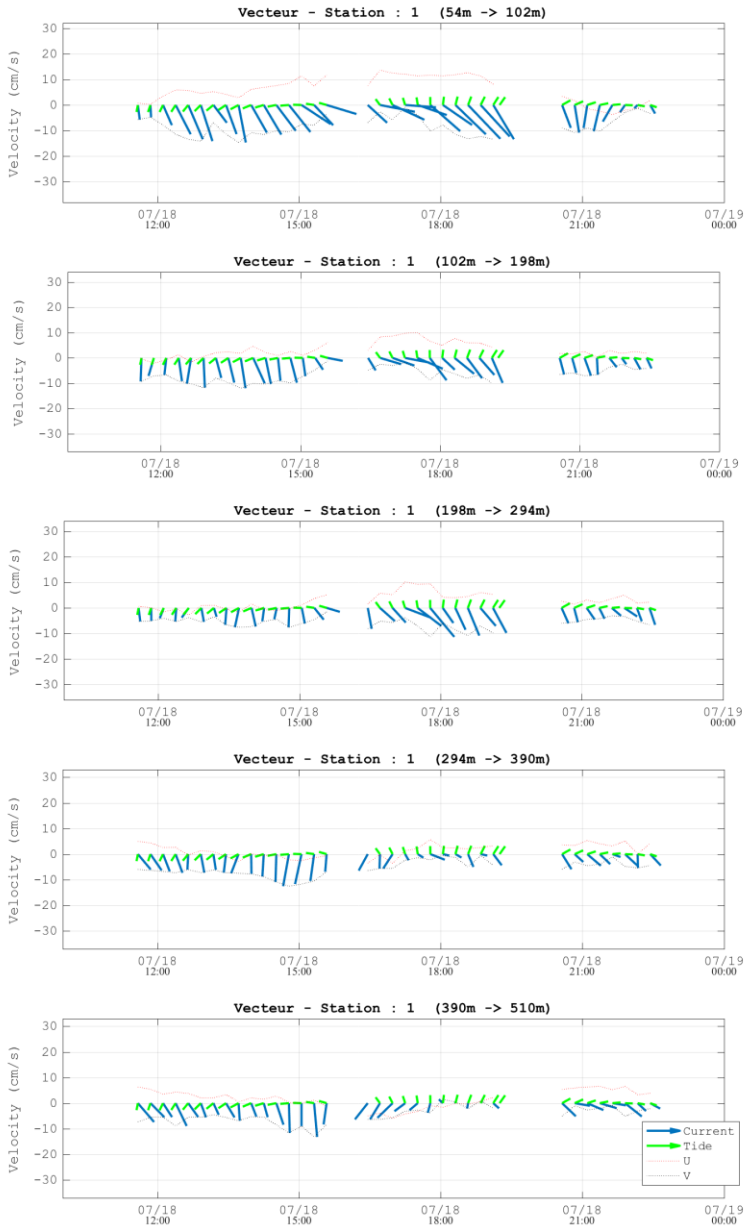
ADCP data


Filtrage temporel
0
-200
-400
-600
-800
-1000
-1200
z (m)
-500
0
500
VL Nord (mm/s)
VL Est (mm/s)

ADCP data

Current velocity and direction, averaged on the first 6 layers (≈ 100 m height) :

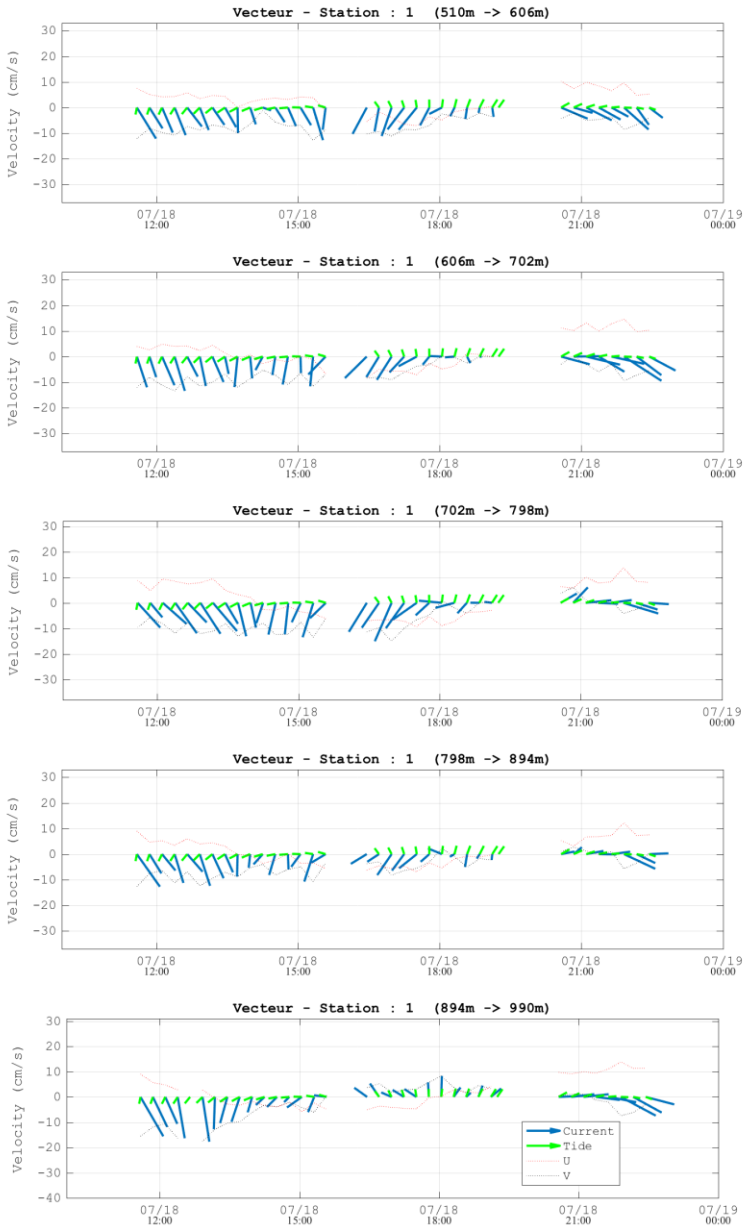
54 m to 510 m



ADCP data

Current velocity and direction, averaged on the last 6 layers (≈ 100 m height) :

510 m to 990 m



Cable models

Useful for

- feasibity studies

- real-time support to operations - predicting the response to a ship displacement for example.

Uncertainties

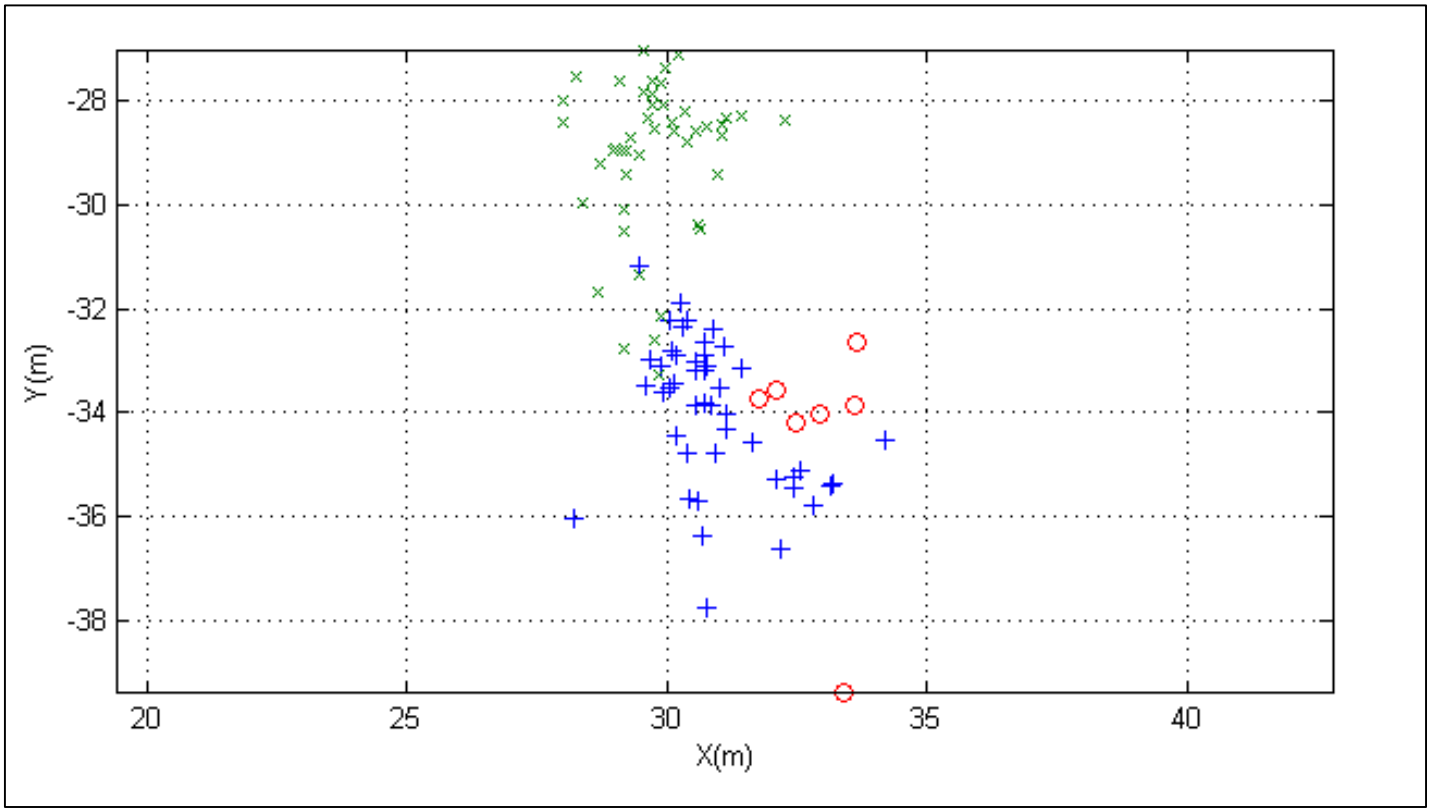
- Current profile
- Drag coefficient (Vortex Induced Vibrations)
  $Cd \in [1.2\ 2.3]$

Cable model validation based on MoMarSat experiments

Measurements :

- Ship position and attitude (heading)
- Cable paid-out length
- Acoustic beacon position (USBL)
  one beacon at bottom end
  second beacon 750m above bottom end.
- ADCP data

Dive 1/ July 18th 2017 station 1 (12')

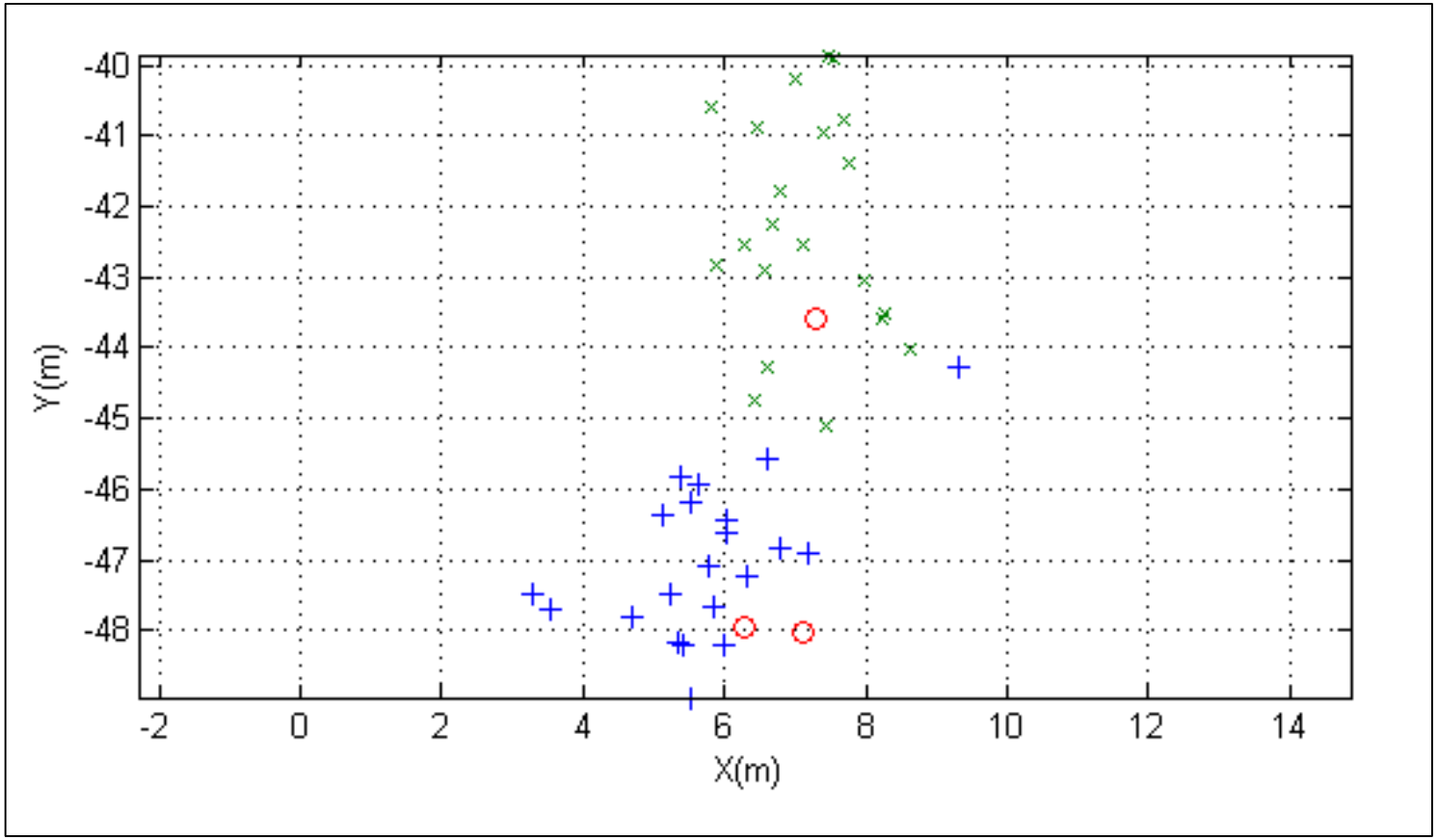


Cable length 750 m, Cd =1.5

x ship position, o cable end calculated position,

+ cable end USBL position

Dive 1/ July 18th 2017 station 3 (5')

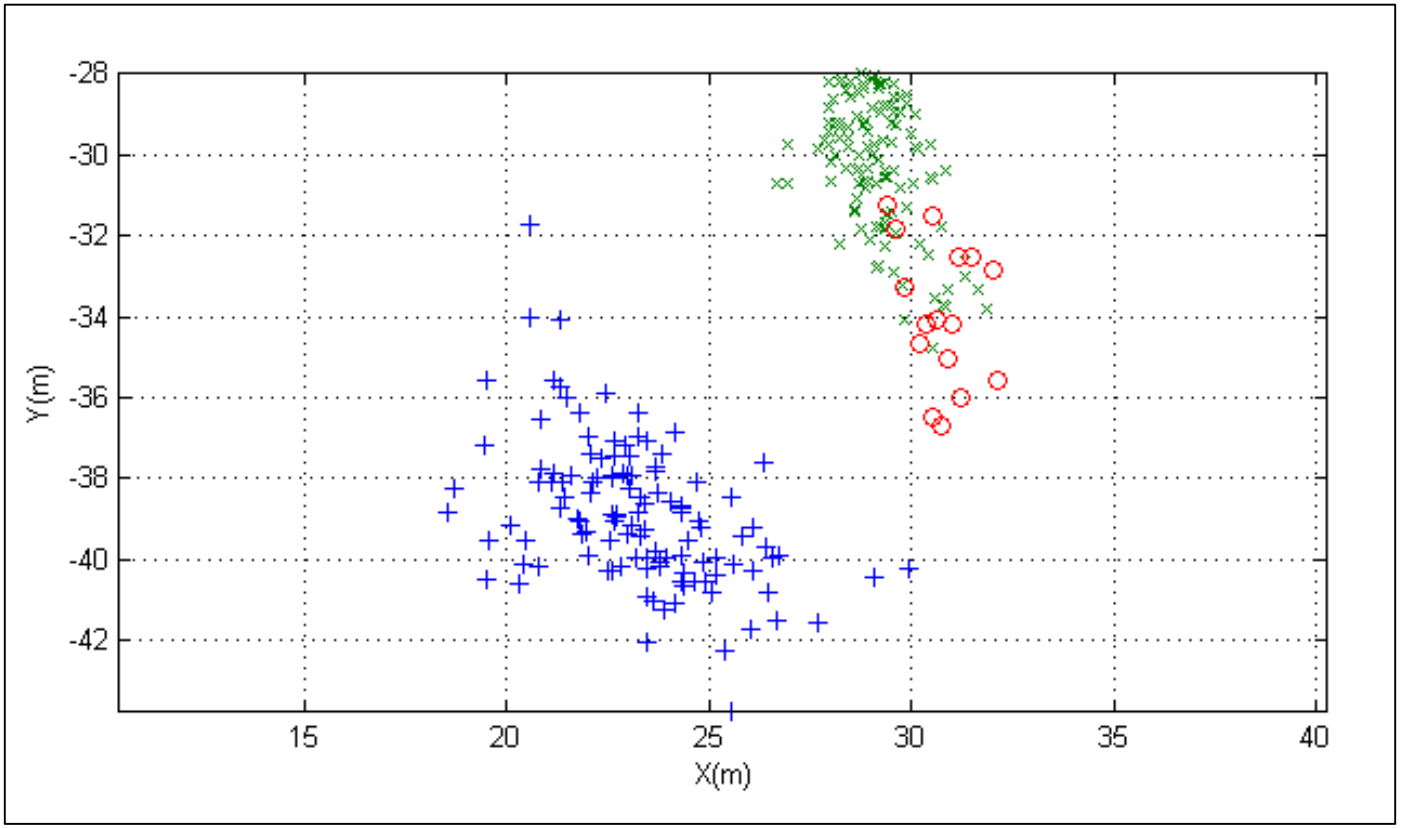


Cable length 750 m, Cd =1.5

x ship position, o cable end calculated position,

+ cable end USBL position

Dive 1/ July 18th 2017 station 2 (40')

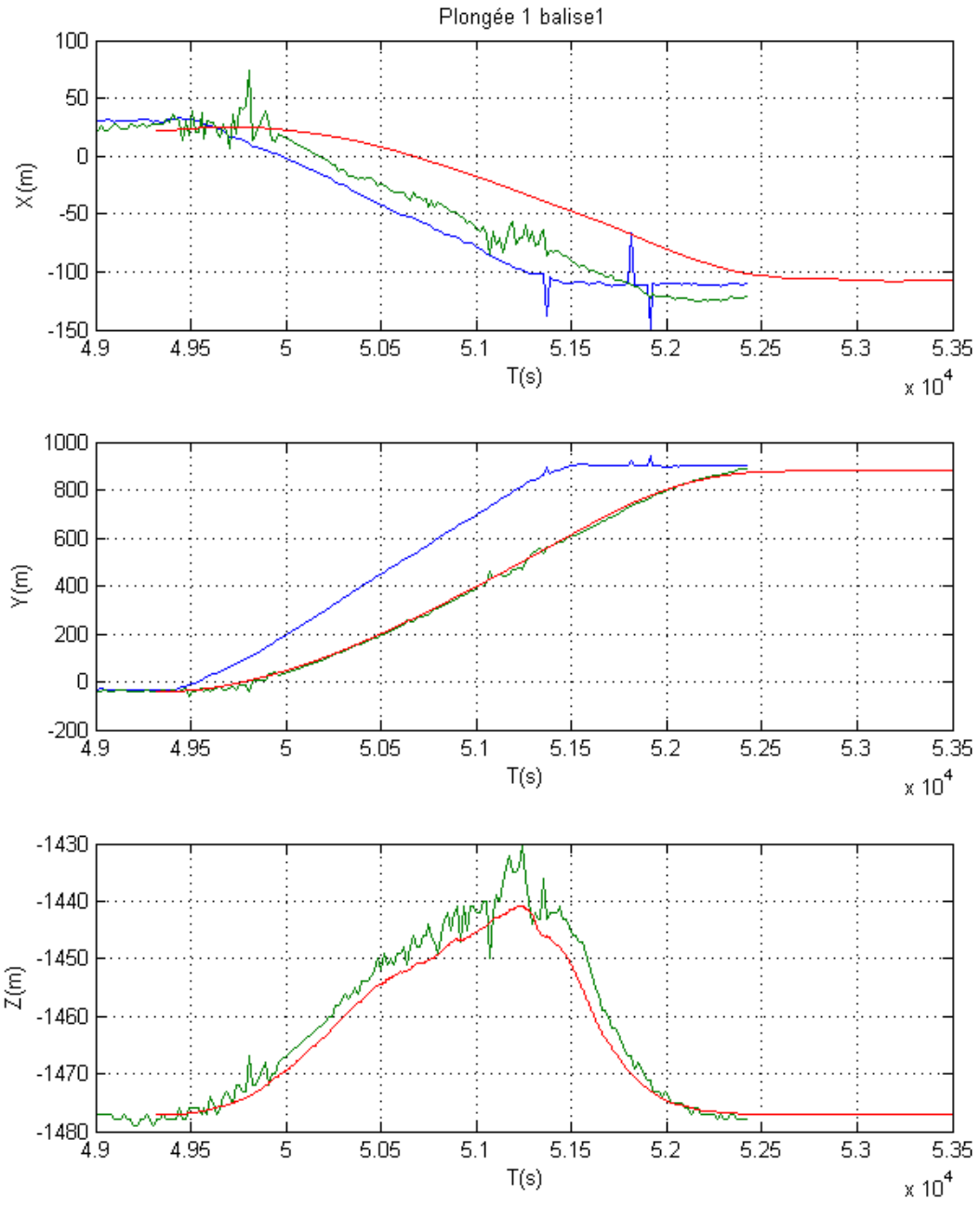


Cable length 1500 m, Cd =1.5

x ship position, o cable end calculated position,

+ cable end USBL position

Dive 1 displacement



Cable length 1500 m,
Cd =2.3

- blue ship position,
- red cable end calculated position,
- green cable end USBL position

Risk of contact : available cables

	unit	VICTOR	hydro_AT	dredging_AT	dredging PP
diameter	mm	20.5	9	19.5	21.52
mass/u.length	kg/m	1.451	0.54	1.688	2.004
weight in water/u.length	N/m	10.889	4.605	14.411	17.099
Cfd/pl		1.74	1.80	1.25	1.16
critical angle (1 knot)	°/vert	6.51	6.74	4.7	4.37

FDn normal component of the drag force per u. of length :

$FDn = Cfd\ Vc^2 \cos^2 \phi$ where $Cfd = 1/2\ \rho_{seawater}\ Cd\ Dia$

Pn normal component of the in-water weight per u. of length :

$Pn = pl \sin \phi$.

ϕc is solution of equation FDn-Pn = 0;

Two cables with the ratio Cfd/pl will have the same critical angle

Calculation of cable deflection :

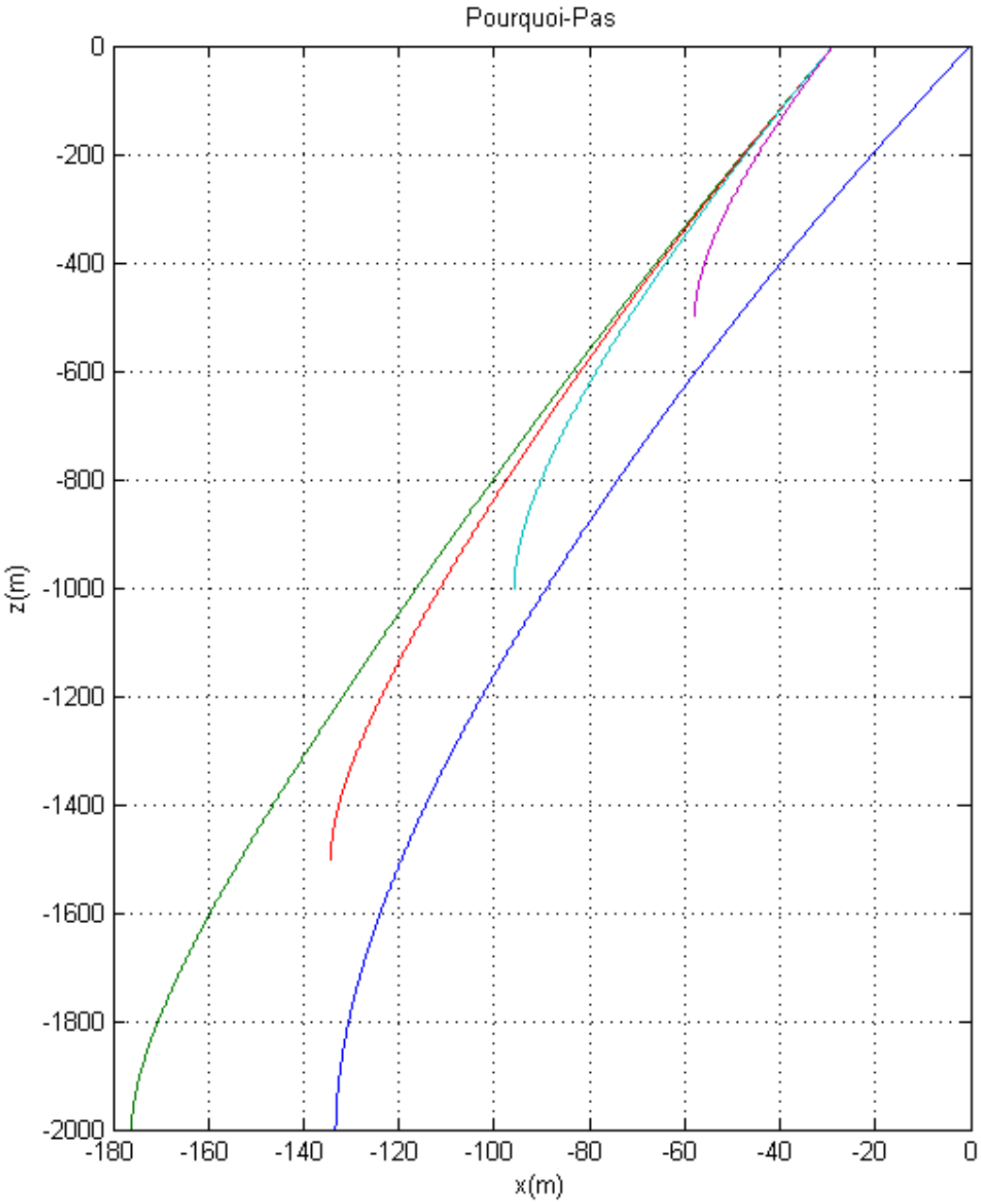
Blue : ROV tether

Other colours : Pourquoi-pas maneuvering cable

ROV on stbd beam

Deadweight Victor 1.2 t

Deadweight Dredging cable 0.5



Calculation of cable deflection :

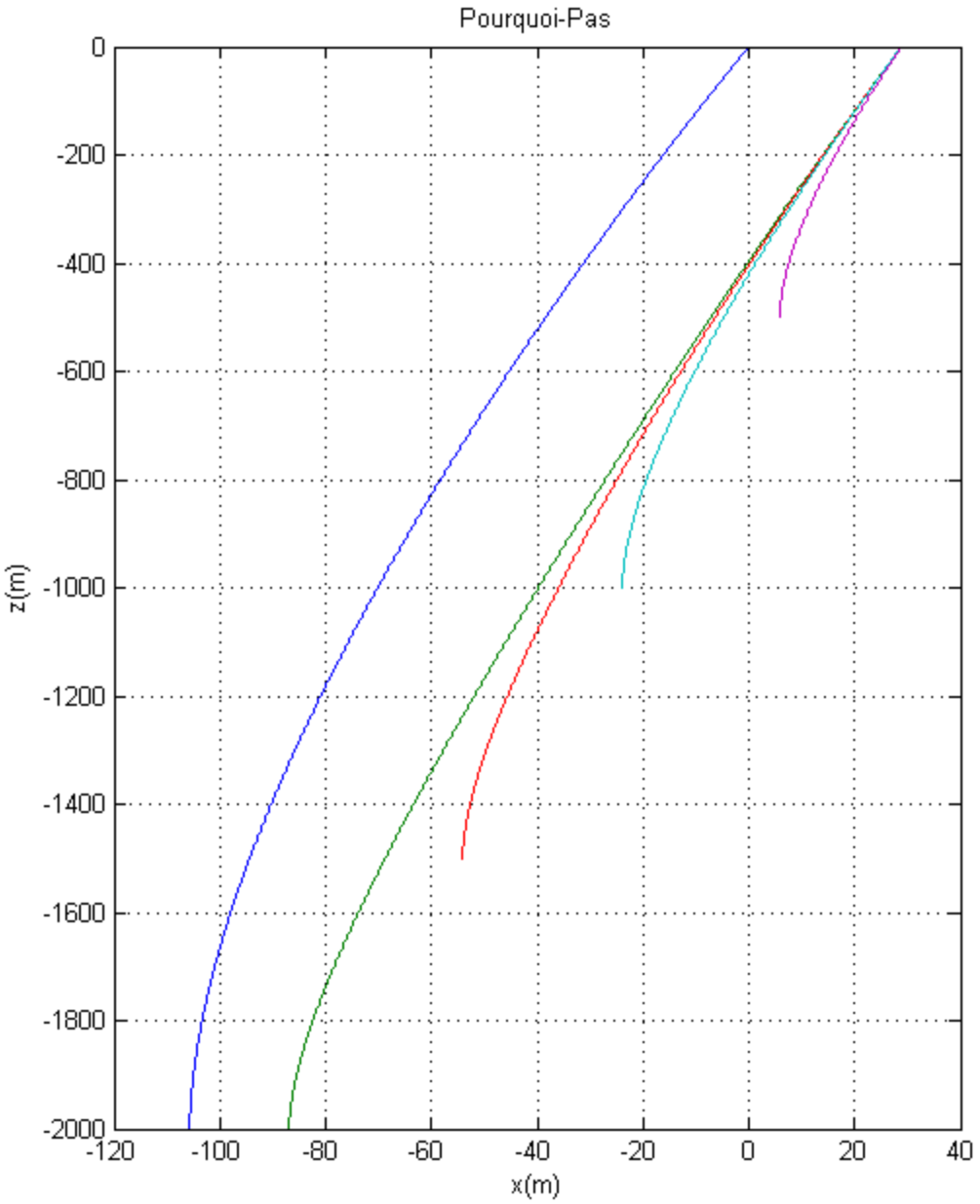
Blue : ROV tether

Other colours : Pourquoi-pas maneuvering cable

ROV on rear A-Frame

Deadweight Victor 1.2 t

Deadweight Dredging cable 0.5 t



Concluding remarks

- ADCP data are of little help due to their limited range
- cable models are relevant to predict response to ship maneuvers
- operation with 2 cables should not be performed on the Atalante due to unsufficient distance between A-frames and inadequacy of second winch/cable
- operation with 2 cables could be exceptionnaly performed on the Pourquoi-Pas, if metocean conditions are mild, only on a temporary basis : an active deadweight system is to be developed.
- USBL positioning may hopefully give an estimate of the global effect of the current on the cables to help manage the operation

Thank you for your attention.

Discussion ?