# Past and new technological developments at LOV for core and new BGC applications

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LOV

# Acknowledgements

**Technological developments are always a team work !**

- LOV : Antoine Poteau, Christophe Penkerc'h, A. Pierret, V. Taillandier, N. Alem, F. D'Ortenzio, H. Claustre

- Strong and good collaboration with Ifremer and NKE

Ifremer

nke INSTRUMENTATION

# Presentation Outline

Provor CTS4 : A float developed for the BGC core Argo mission

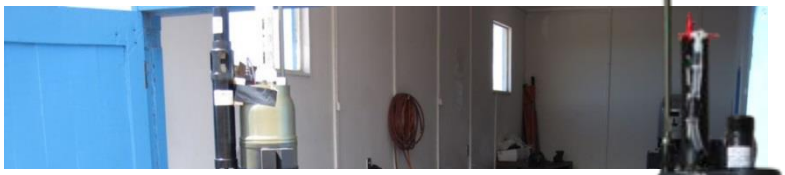
Provor CTS5 : A float developed for R&D and demanding application

- R&D facilities at LOV
- Past developments
- On going developments

Conclusion and perspectives.

# Development of the CTS4 profiler

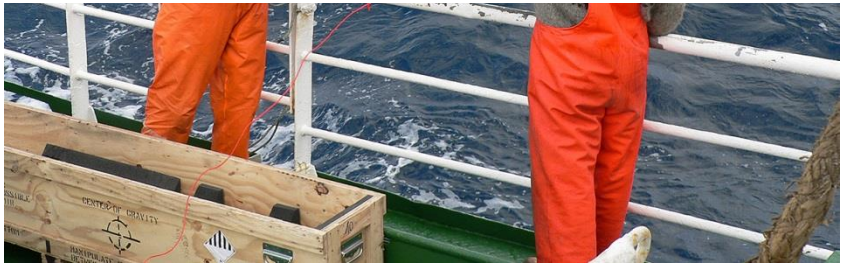
## Collaboration LOV – IFREMER - NKE



**Nice results:**

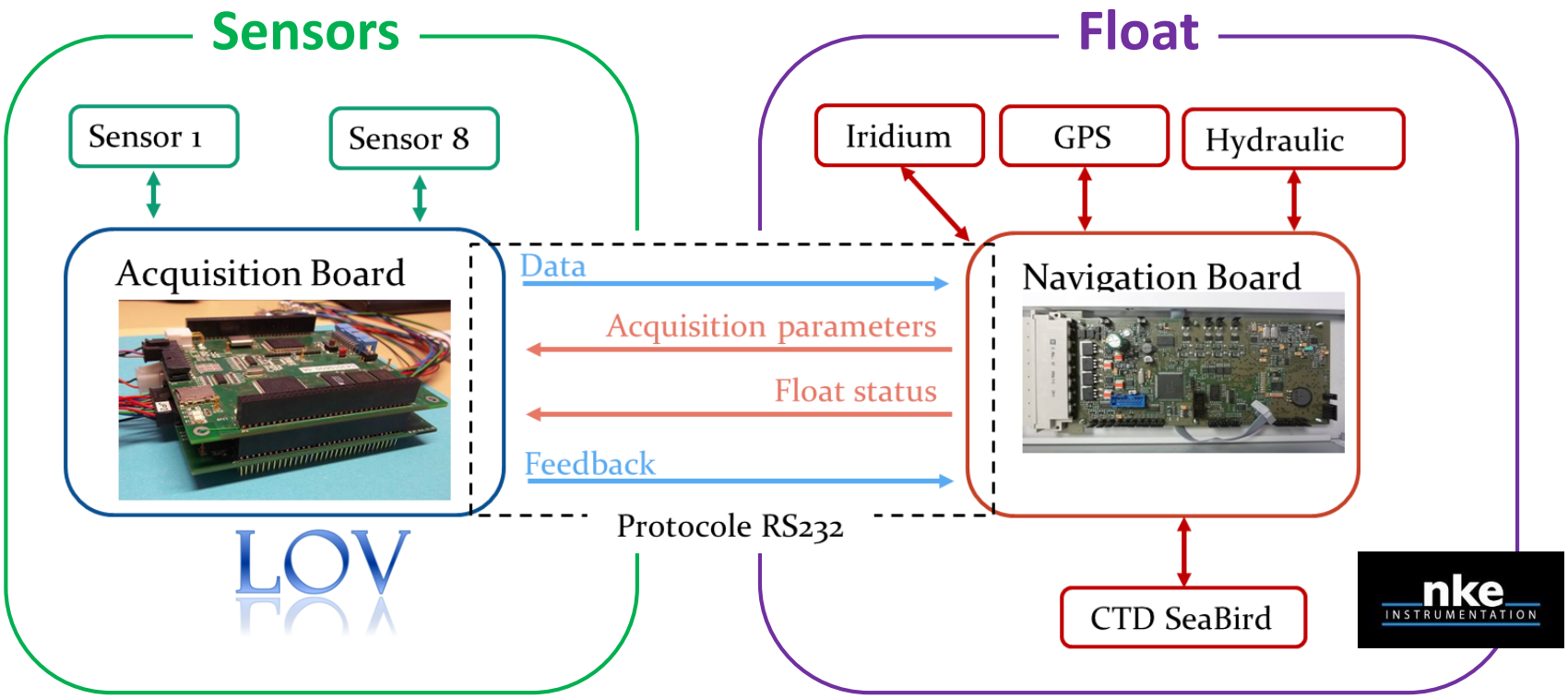
- **More than 200 floats**
- **First float "Full BGC" deployed**
- **Highly flexible BGC Argo float**

**➔ But not easy to explore new applications**



# Development of the CTS5 profiler

How to integrate safely, at LOV, new applications ?
➔ dual board strategy. The CTS5 support a protocol to communicate with a user electronic board.




**Modifiable at LOV = Flexibility**

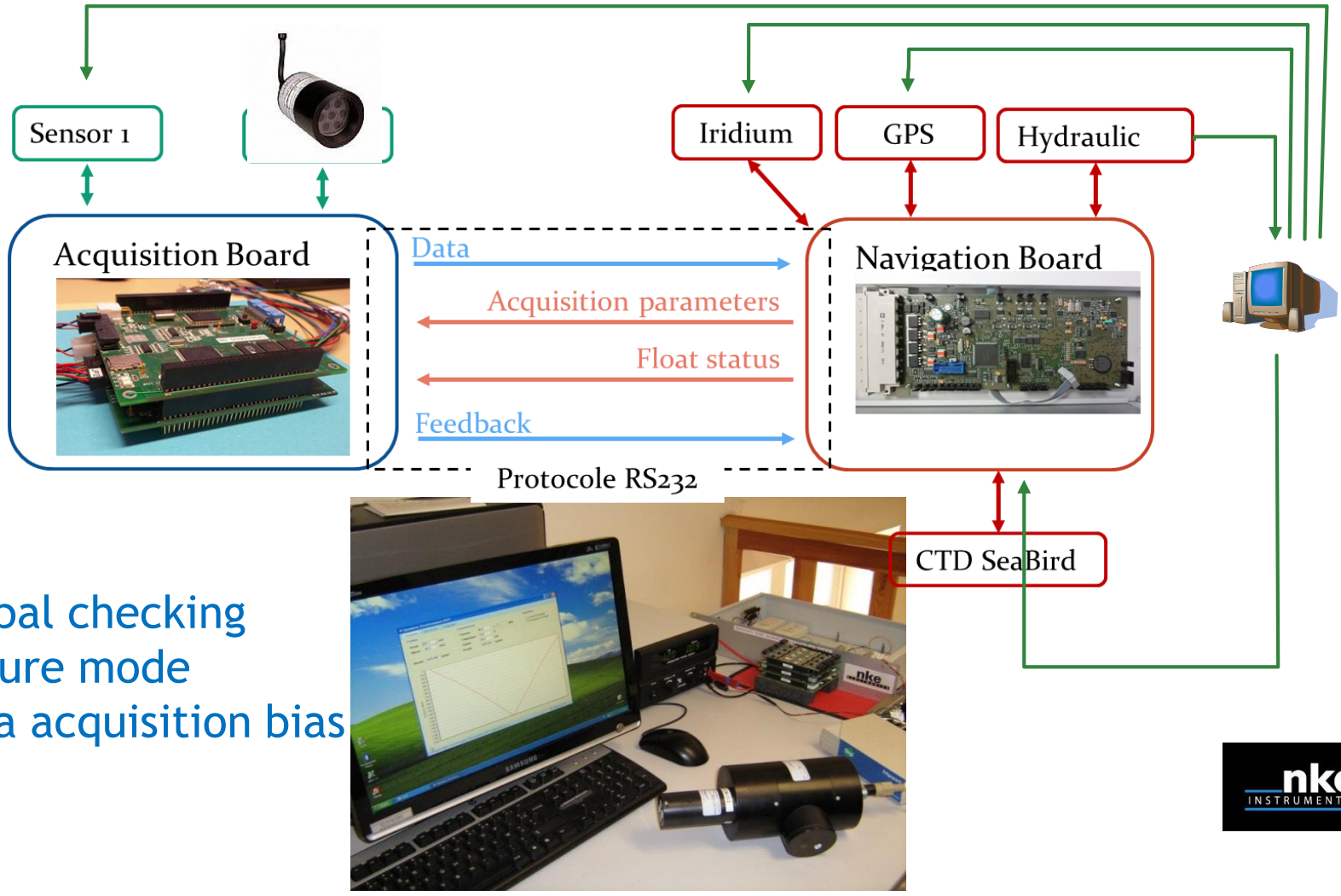
**Stable = Security**

Collaboration LOV - NKE

# Development of the CTS5 profiler

## How to test our development ?

## 1- Hardware Bench Simulator



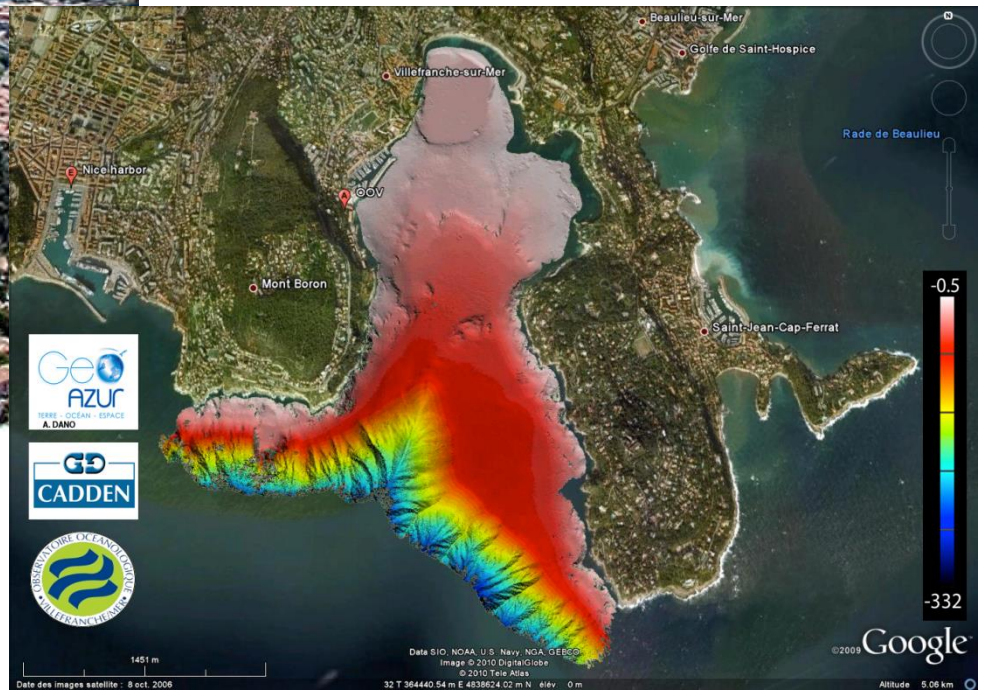

- ✓Global checking
- ✓Failure mode
- ✓Data acquisition bias

# Development of the CTS5 profiler

## How to test our development ?

## 2- In-situ testing at LOV

- ✓ 1 000 m depth at 4 nm
- ✓ 2000 m depth at 10 nm
- ✓ Good weather and predictable current for recovery

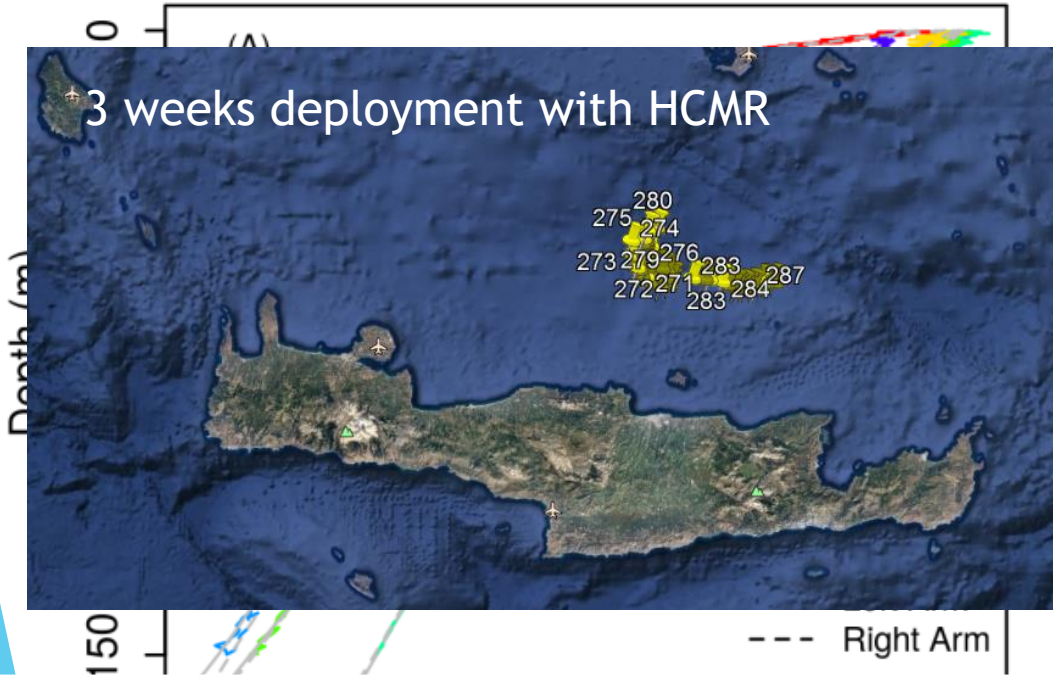


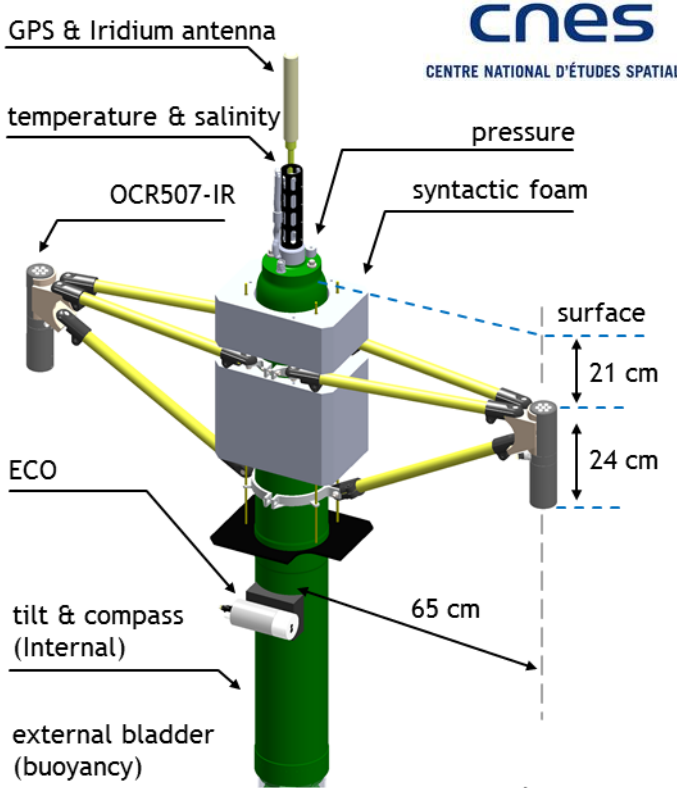
# CTS5 profiler
# Past and on-going developments

1. ProVal float
2. ProIce float
3. UVP6 sensor
4. Passive acoustic

# ProVal: A new float for radiometric measurements

- ✓ Irradiance (Ed) and radiance (Lu) at 7 wavelength [380 - 665 nm]
- ✓ Tilt and compass sensors
- ✓ Chla, backscattering, CDOM, CTD

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➔ Next : integration of Hyperspectral radiometer (EA-RISE)

Irradiance ($\mu W.cm^{-2}.nm^{-1}$)

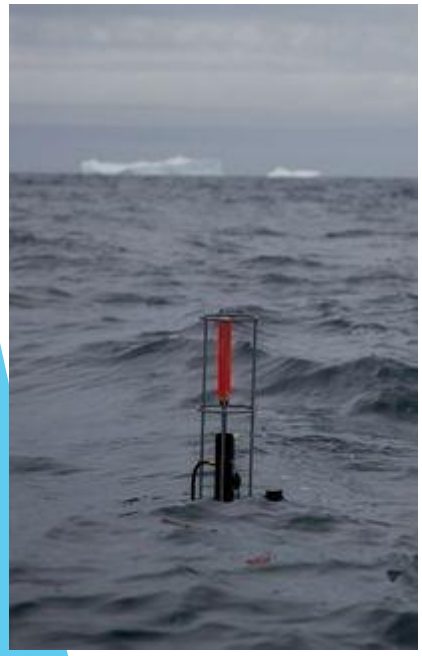
Already 3 floats and more than 600 profiles. *Frontiers in mar. Sc.*
https://www.frontiersin.org/articles/10.3389/fmars.2018.00437/full

# ProIce: A BGC float for arctic condition

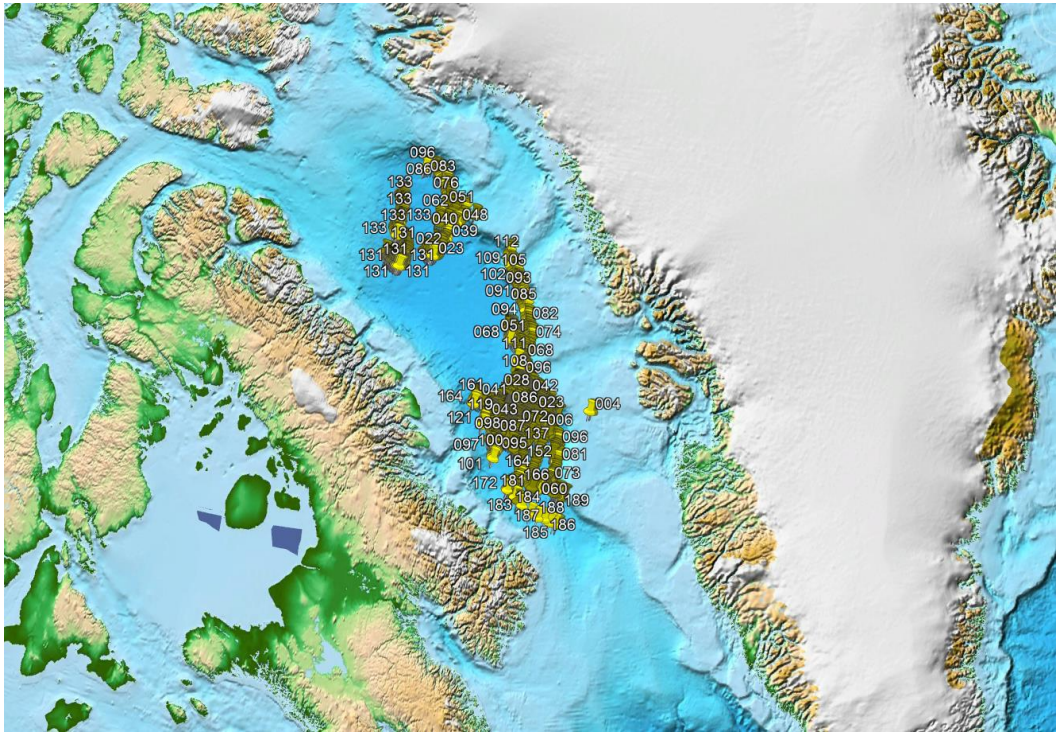
Joint work with C. Marec, J. Lagunas, E. Rehm and M. Babin from Takuvik

✓ Ice avoidance : ISA adapted to Baffin Bay, Altimeter and date criteria **programmed on the LOV acquisition board**

✓ Change of configuration under-ice (date criteria)



Crédit P. Bourguain



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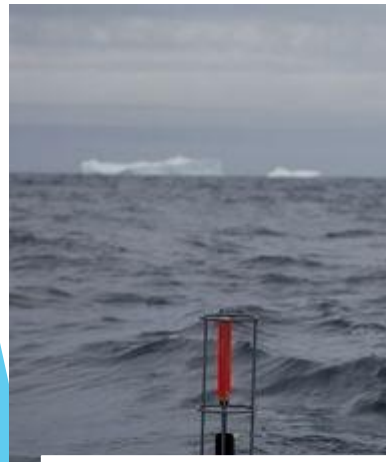

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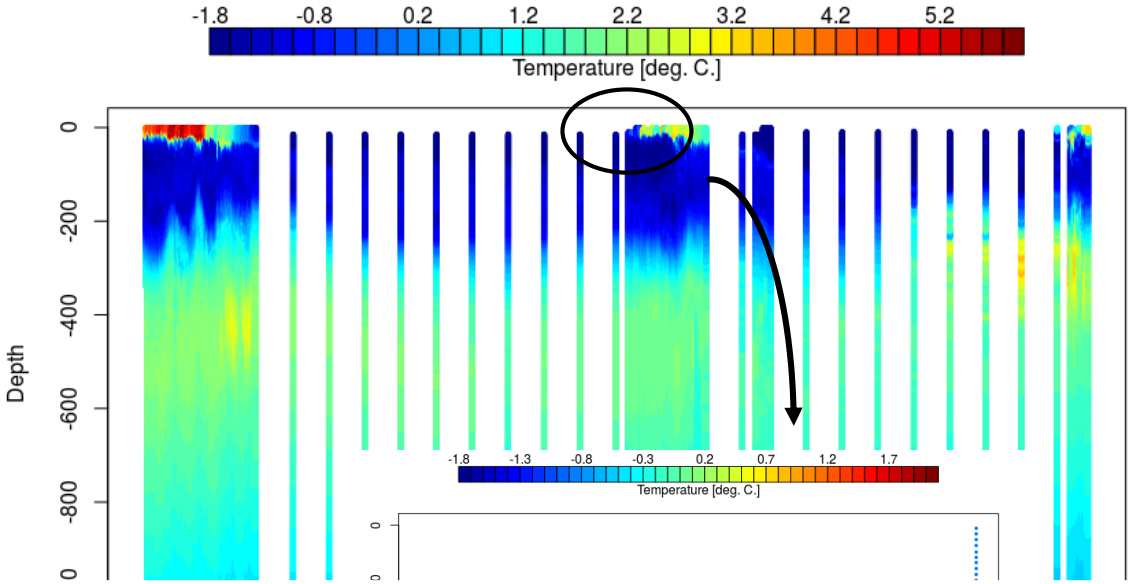
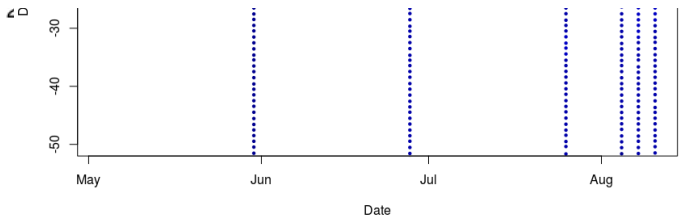
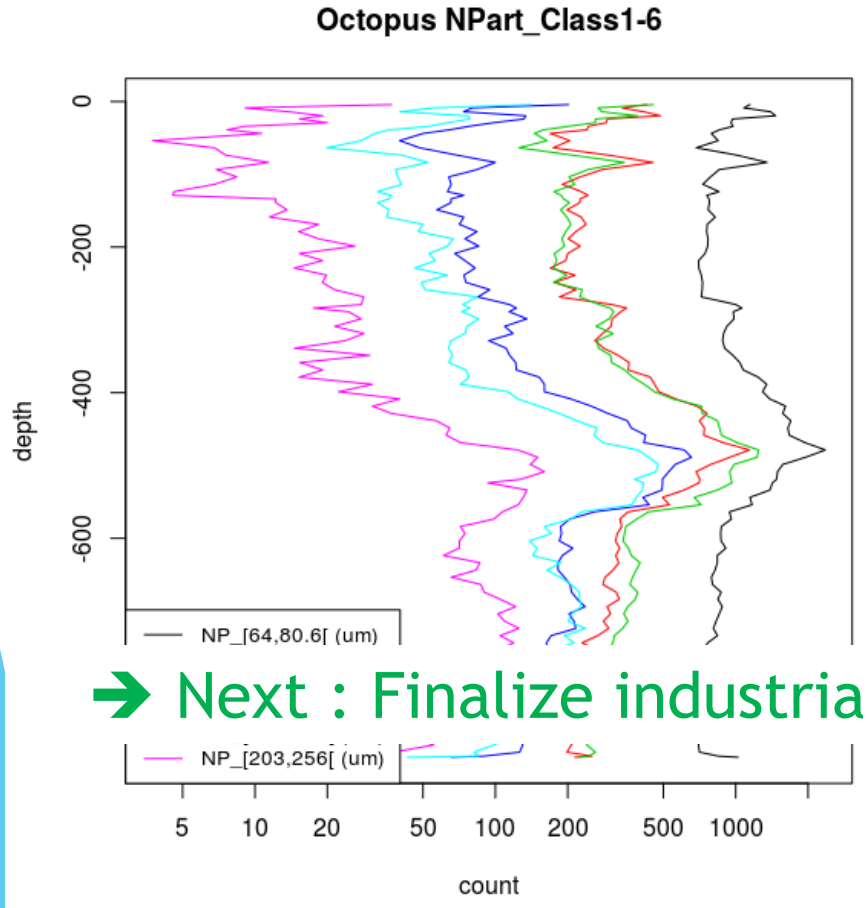


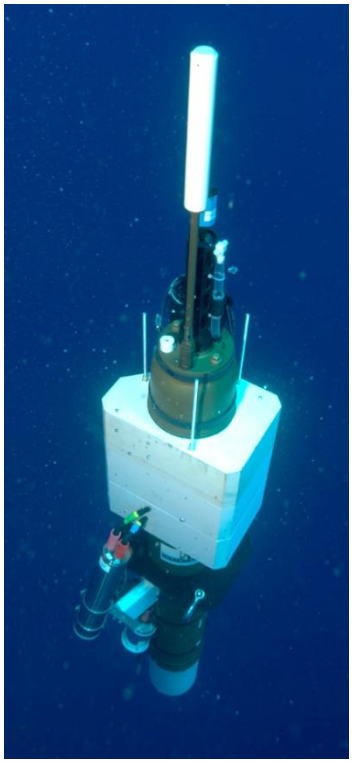

➔ Next : Move to a more industrialized version.



# UVP6-LP : Miniaturized Under Vision Profiler

Low power, image based, particle size counter (18 size class, 64 to 4100 µm)
Sensor developed at LOV M. Picheral *et al*.



➔ Next : Finalize industrialized version.

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BRINGING TOGETHER RESEARCH AND INDUSTRY FOR THE DEVELOPMENT OF GLIDER ENVIRONMENTAL SERVICES

**Projet GOPPI**

HYDROPTIC

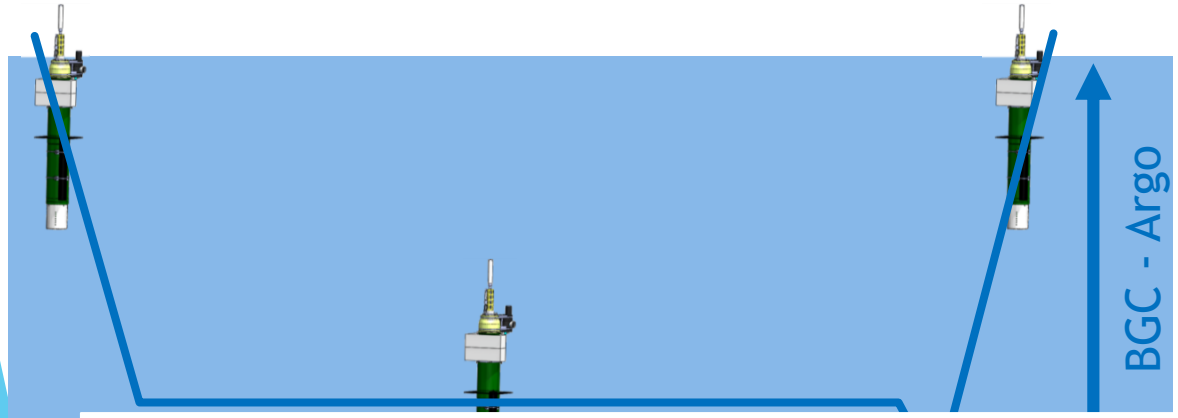
# Passive Acoustic Monitoring

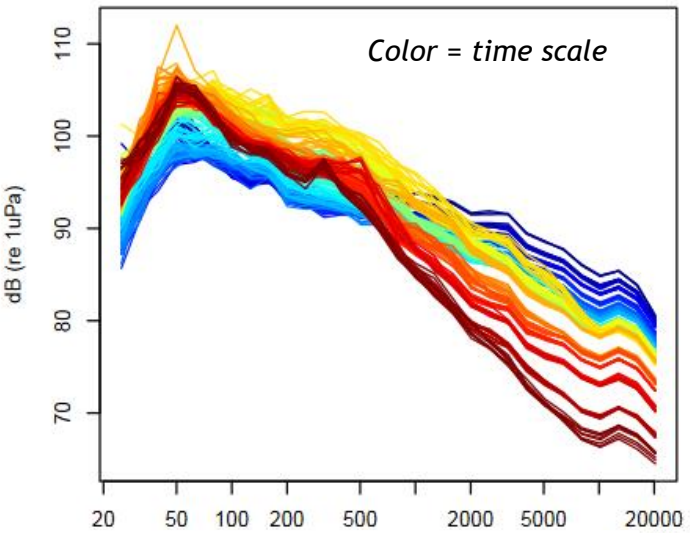
Joint work with J. Bonnel (Whoi) and D. Cazau (ENSTA)

➔ Estimate wind speed and rainfall from parking depth

✓ Passive acoustic recorder (RTSys) and transmission of 30 FFT bands (1/3 octave) per acquisition

✓ Several short deployments (1 week)




➔ Next : achieve longer deployments (ERC – REFINE)

acoustic monitoring

# Overview and future developments.

Conclusion on the acquisition board managed by LOV

- Created a lot of opportunities for testing new applications
- But difficulties when you want to industrialize these applications

## ➔ New Development with NKE : CTS5 - USEA

- Increased capabilities for BGC-Core Argo
  - ✓ Mission and sampling flexibilities
  - ✓ Increased Rudics speed
  - ✓ GUI configuration tools

- Room for new applications developed by LOV but with easier industrialization
  - ✓ New sensor
  - ✓ Advanced On-Board Processing

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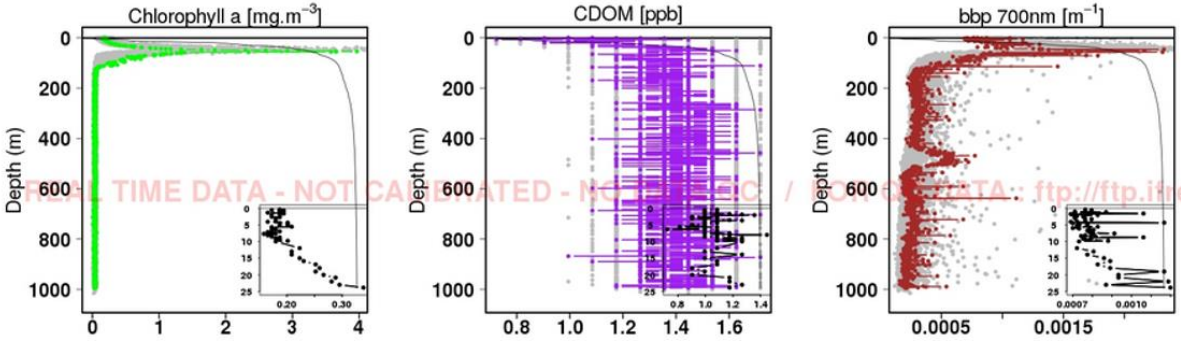
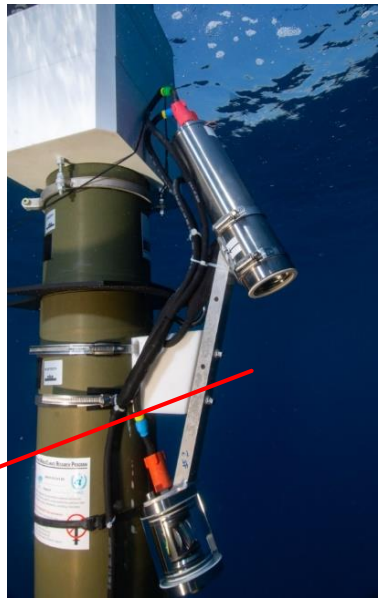
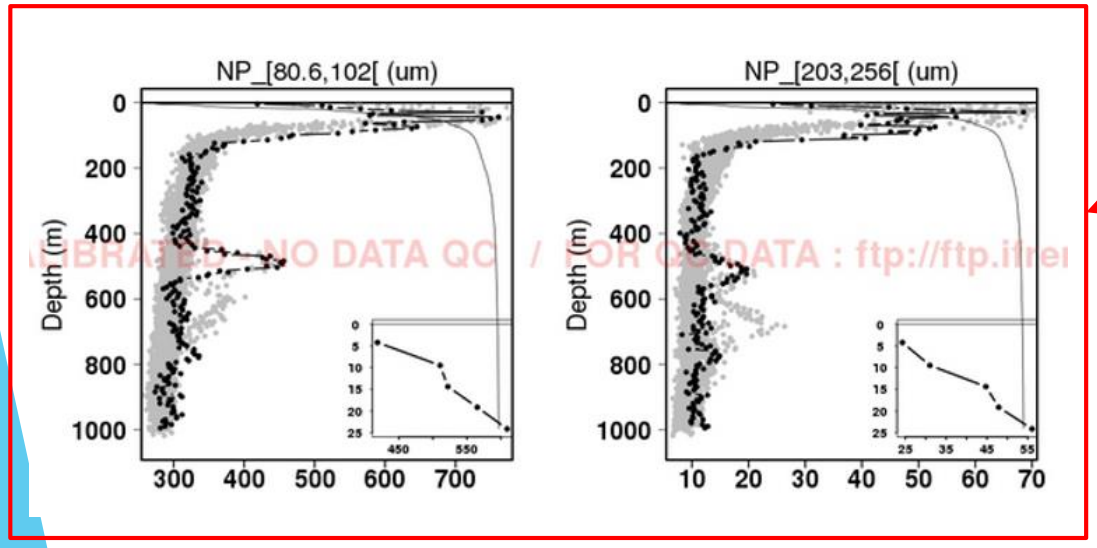
# CTS5 – USEA : First Results

## Integration of the UVP6 sensor as commercial product



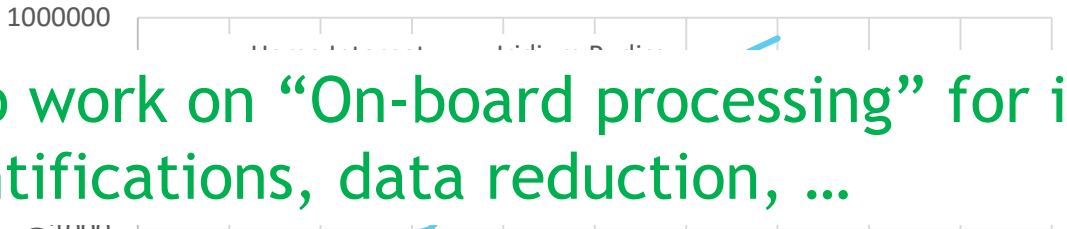





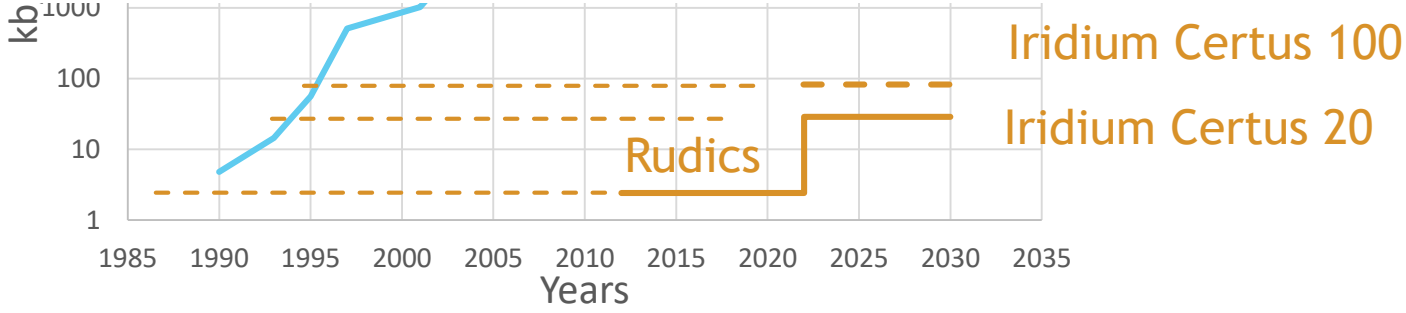

Thanks to C. Schmechtig, JP Rannou and T. Carval for data handling

# Perspectives

- A lot of new applications are waiting to be implemented on floats
- Very significant progress is being made to reduce sensor power consumption (ex. UVP ➔ 20 times less in 10 years) opening new applications for Argo floats
- The bottleneck for the next decade is the telemetry !




➔ Need to work on “On-board processing” for images, sound identifications, data reduction, …



# Merci