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Why measuring Nitrate?

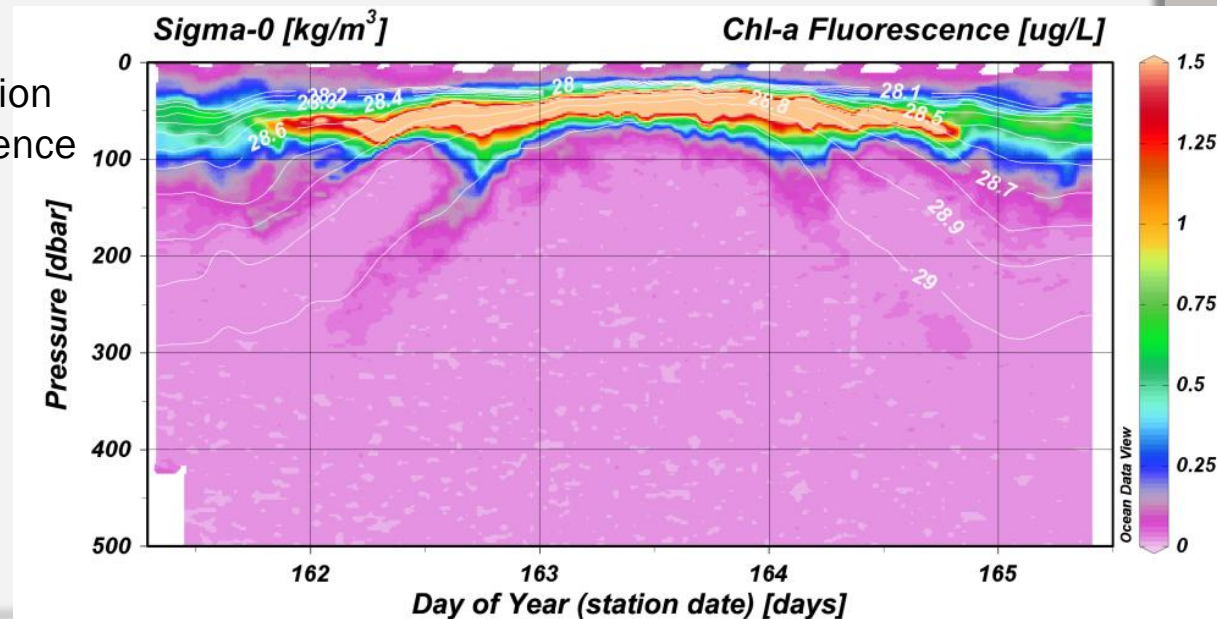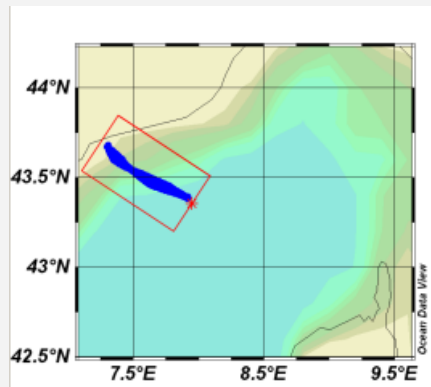NO3$^-$ is a key phytoplankton nutrient

➡ Limiting factor of primary production in much of the Ocean

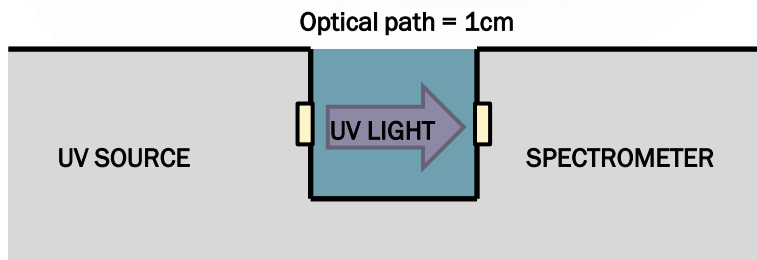➡ Nitrate injection from deep water control the phytoplankton growth

Integration on autonomous platforms:

- good spatial and temporal resolution
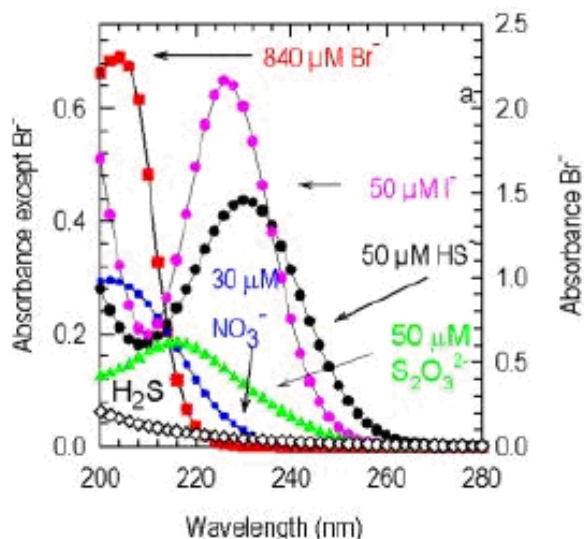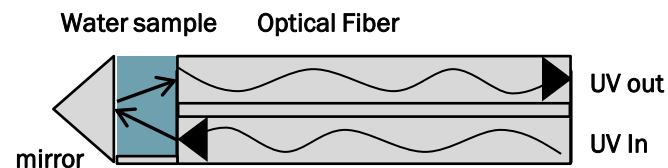- cross-analysis with CHl-a fluorescence

Measuring Nitrate with absorption spectrum

SUNA (SATLANTIC)

Optical path = 1cm

UV SOURCE   UV LIGHT   SPECTROMETER

ISUS (SATLANTIC)

Water sample   Optical Fiber

mirror   UV out   UV In

NO3- absorption band: 200-260 nm

Integration on autonomous platforms: Projects involved

Profiler floats: PRONUTS (LOV, IFREMER-TSI, Station- Roscoff, LMGEM)

➡️ One prototype with external mounted SUNA will be deployed soon
Deployment March 2011

Gliders: VASQUE (ACSA, IFREMER, ACRI, COM, CEDRE, LOV)

➡️ Hybrid glider VASQUE in development
Integration of SUNA or ISUS considered
Deployment: 2012-2013

➡️ Integration on Slocum Glider by Teledyne Webb Research
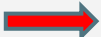Deployment March 2011

Sampling strategy

SUNA consumption in continuous mode ➡ > 6W !!

In comparison 3 Wetlabs EcoTriplets in continuous mode ➡ < 2.5 W

Necessity to operate the sensor in switched mode ON/OFF.

1 sample = 7 s boot time + 1 dark frame + 5 measurements = 10 seconds

Number of samples	SUNA on time	Total time	Duty cycle	Average consumption
60	600 s	6600 s	10%	600 mW

➡ The average consumption is the same as an ECO Triplet

Sampling strategy (2)

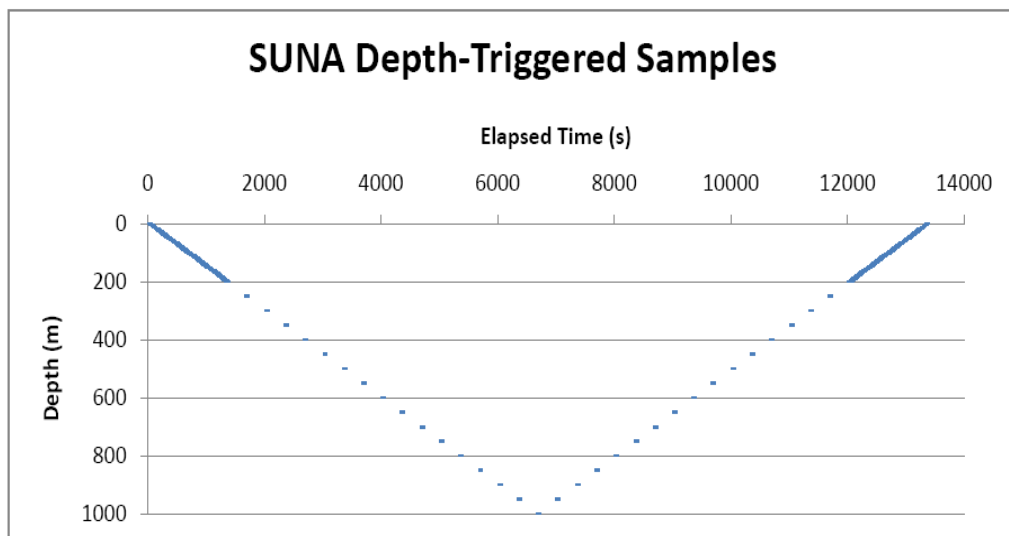Definition of different zones for sampling frequency

- 0 – 200 m : sample every 4 m
- 200 - 500m : sample every 50 m

Acquisition mode different for each sensor

- SUNA: Discontinuous mode
- CTD, Oxygen and fluorometers: continuous mode

Depth-triggered instead of time triggered

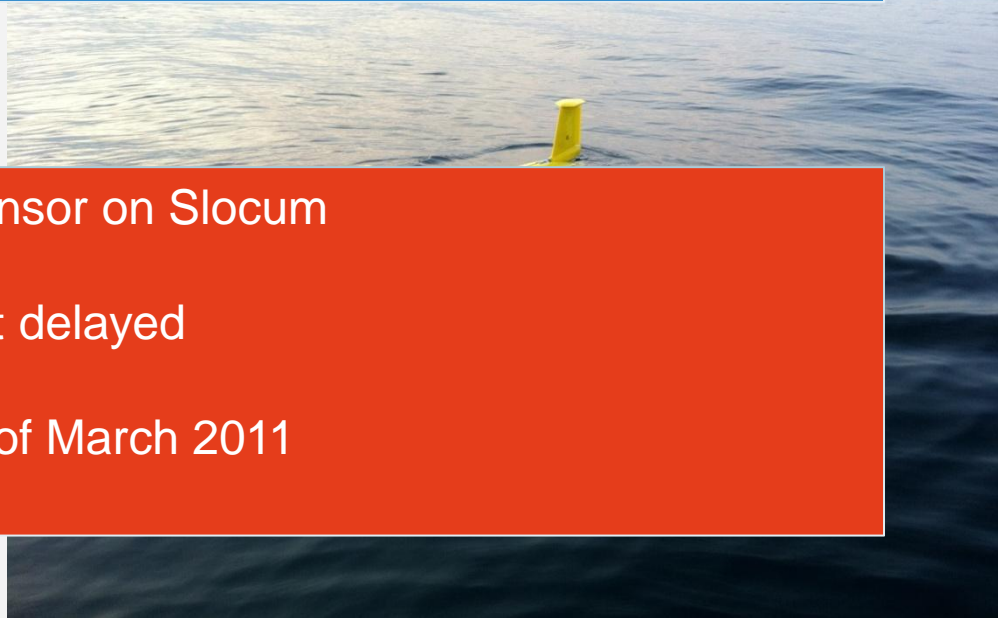- Intersample_time re-calculated from intersample_depth every 4s

SUNA Depth-Triggered Samples

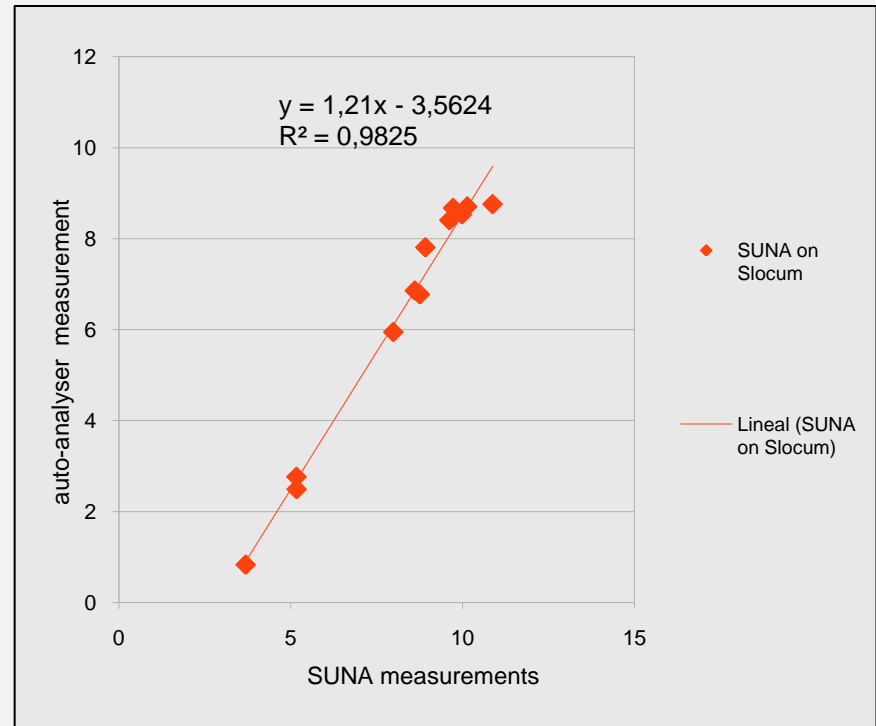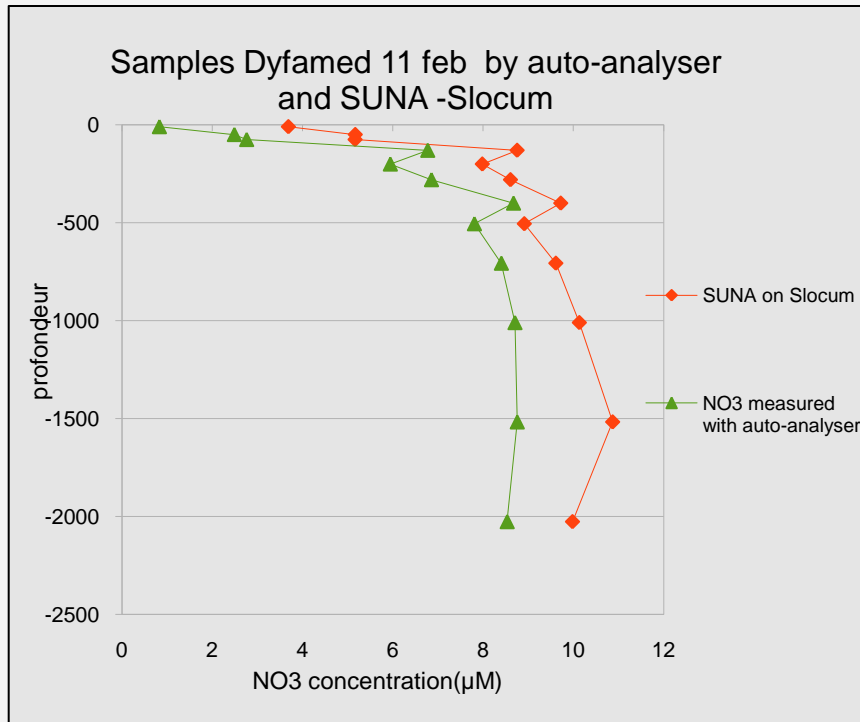From Webb Research simulation

Originally scheduled February 2011:

• Pre-bloom deployment of a Slocum Glider, and a profiler float Pronuts at Boussole Site

• Water sampling and Nitrate concentration analysis

• Intercalibration of sensors

• No datas from the SUNA sensor on Slocum

• PRONUTS float deployment delayed

• deployment scheduled end of March 2011

Sensor calibration

Heloise Lavigne, pers. Com.

Samples Dyfamed 11 feb by auto-analyser and SUNA -Slocum

- SUNA on Slocum
- NO3 measured with auto-analyser

$y = 1,21x - 3,5624$
$R^2 = 0,9825$

- SUNA on Slocum
- Lineal (SUNA on Slocum)

Damien Malardé, Ifremer Brest ⟹ ISUS and SUNA dependance on temperature, salinity and turbidity

Development of an embedded vision system for Jellyfish detection

Embedded vision system on autonomous platforms

Smart Camera + flash light

- Mononochrome images/ Monochrome flashing
- Observed volume : up to $1m^3$
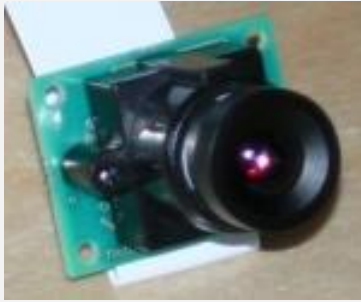- Frame rate: 0.1 to 3 images/sec

Shape recognition algorithm

- Absence/presence of Jellyfish
- ROI saving on media card
- jellyfish density estimation

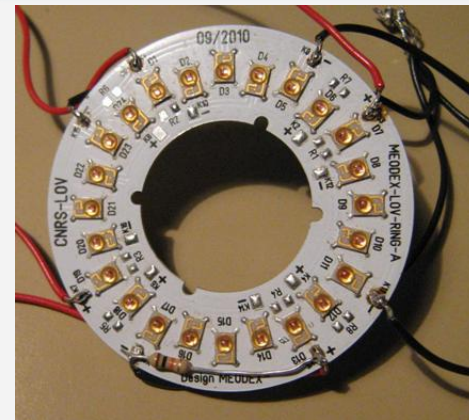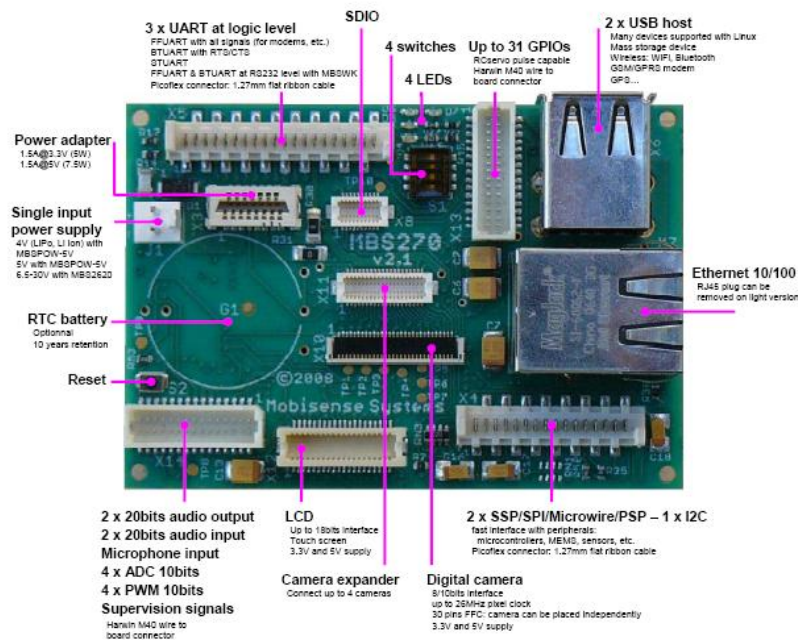## Integration on autonomous platforms (gliders, profiler floats)

- low consumption: <1.5 W in continuous mode
- mechanical design: puck like design
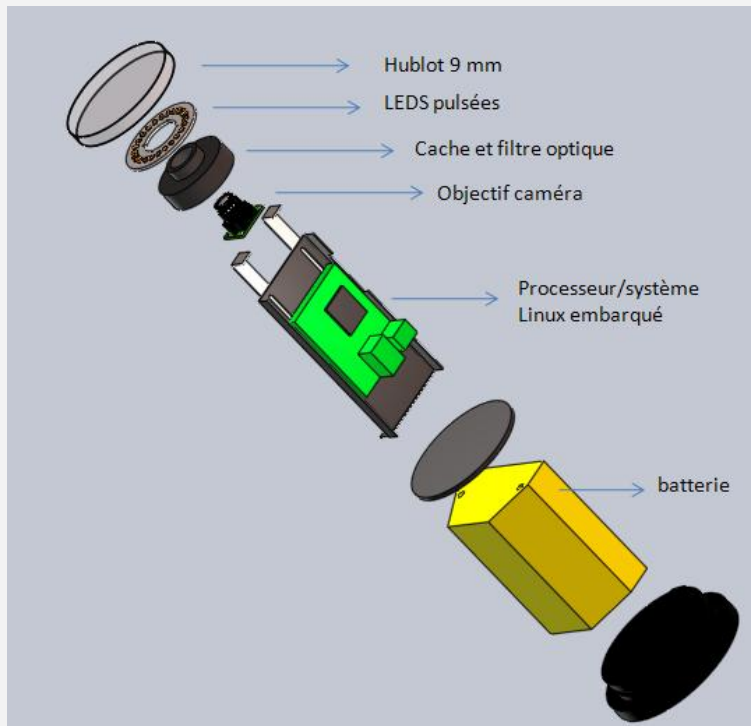- data transfer from sensor to glider

Components

- Aptina CMOS sensor monochrome
- resolution wvga 0.3 Mpixels
- low power
- 1.3 Mpixels soon

- LED Luxeon Rebel
- red: 610-630 nm
- 12 with optics or 24 without

- Mobisense board MBS 270
- processor Marvel Xscale 520 MHz
- low consumption < 1W
- Embedded Linux operating system

December 2010: prototype

Hublot 9 mm
LEDS pulsées
Cache et filtre optique
Objectif caméra
Processeur/système Linux embarqué
batterie

• Next step: integration on a profiler float for next summer...
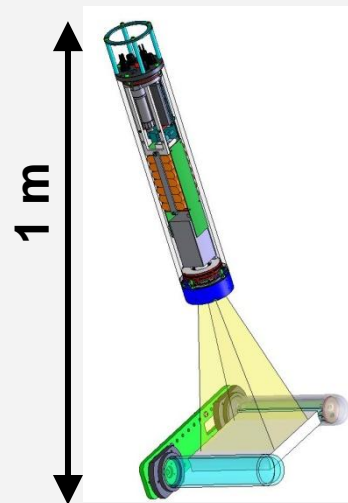
First pictures…

Miniaturization of UVP

Underwater Video Profiler: Gaby Gorsky, Marc Picheral, Lars Stemman...

In-situ imaging system for size particles analysis and Zooplankton recognition.

UVP3 1992

1 m

UVP5 2010

Integration on autonomous platforms

Science Payload

UVP6 ...

Thank you for your attention