tmoos tecnología marina oceanografía operacional y sostenibilidad

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Synergy between glider and coastal altimetry: case study in the Balearic Sea

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OSTST Meeting **Seattle, 22-24 June 2009**

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Outline

- Objectives
- Glider Missions
- Data Sets
- Methodology
- Area of Study
- Results: April 2008 mission
- Summary and Future Work

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Objectives

GENERAL OBJECTIVE:

To characterize of coastal fronts combining altimetry and glider data

SPECIFIC OBJECTIVES:

- To explore the use and limitations of altimetry data in the coastal area
- To test the feasibility of the gliders technology usage

Framework:

– **ECOOP / MyOcean EU project / OSTST proposal**

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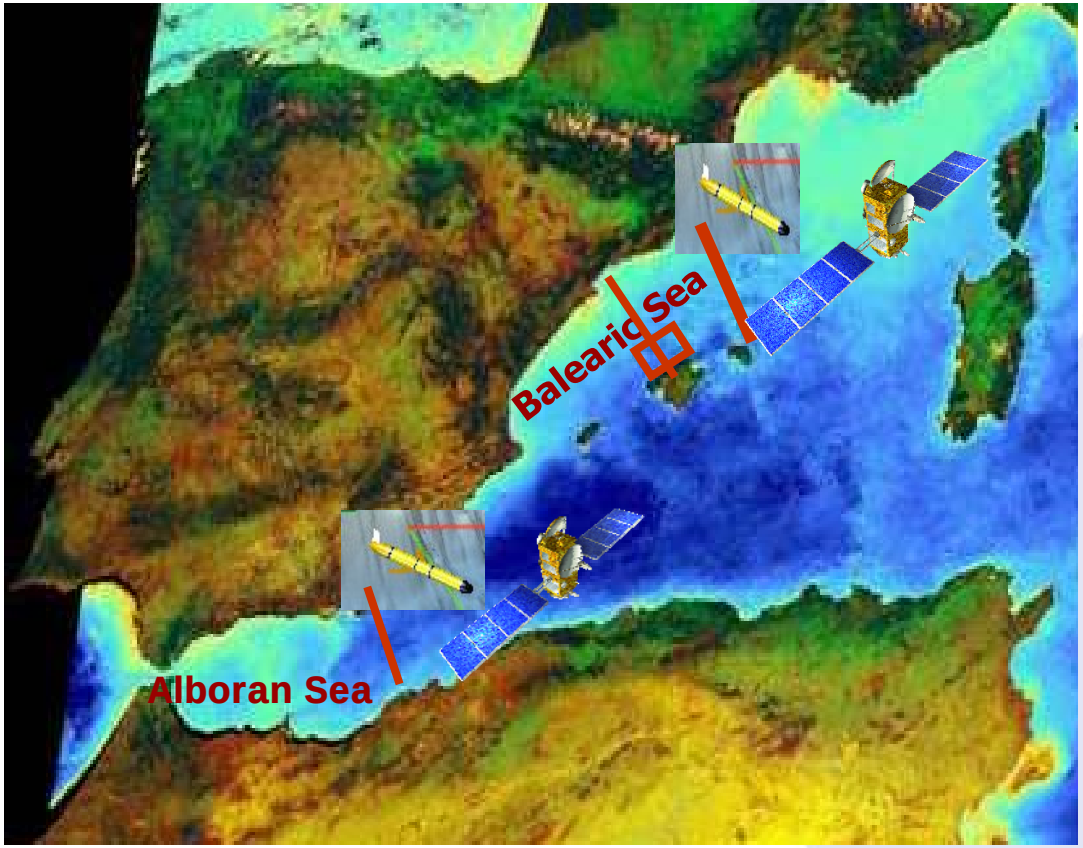
Glider Missions Background

We have carried out **9** glider missions from July 2007 to June 2009 in the Western Mediterranean Sea following altimeter tracks



6000 full CTD casts + oxigen, chlorophyll turbidity (180 m)

- **ENVISAT:**
  - **Balearic S** S observations 70 days): 6 missions up to now
- **JASON-1/2:**
  - **Alboran S** (July Jason-2: 0 & 1
  - **aric Sea**: T-70 (August 2008). Cycles Jason-2: 4 & 5
- **JASON-1 (new orbit):**
  - **Balearic Sea:** T-70 (May 2009). SINOCOP experiment: Great challenge: 2 gliders covering an area of 50 x 40 km2

THIS PRESENTATION

Poster: Ruiz et al.

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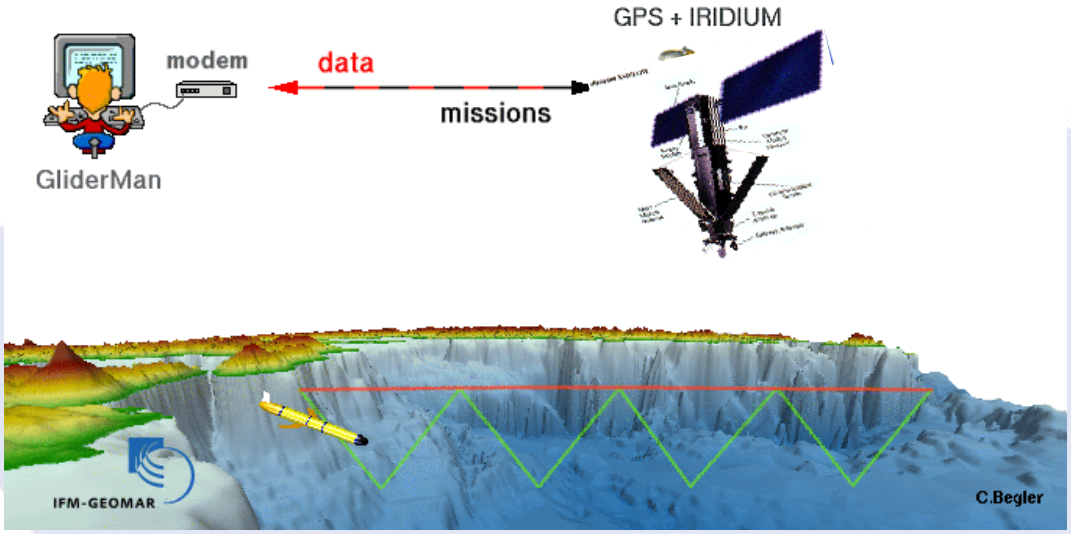
Data Sets

Glider

- **Variables:**
  - P, T, S, oxig., chl., turb.
  - Depth averaged GPS currents
- **Vertical extension:**
  - 10-180 m
- **Horizontal resolution:**
  - 400 m

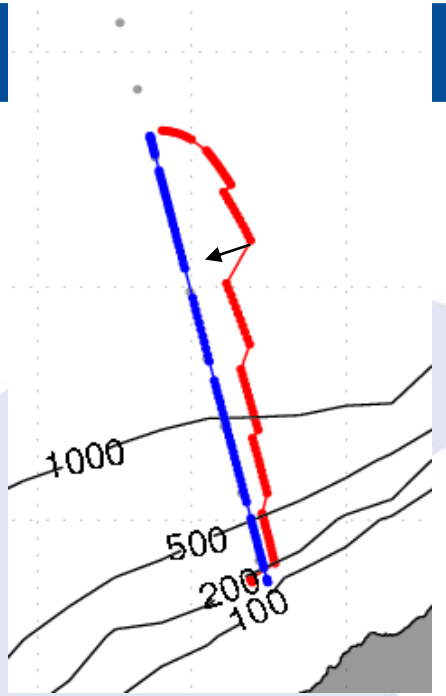
Envisat

- Along track SLA (1 Hz / 20 Hz)
  - Horizontal resolution: 7 km / 500 m
- Corrections:
  - Tides, HR HF barotropic motion (DAC), …
- Gridded products
- MDT: Mean Dynamic Topography (Rio et al. 2007)
- ADT = SLA + MDT



Glider Data Processing

- Dynamic height (DH) computed from P, T, S profiles with a ref. level 180 m.
- Projection of the glider observation position onto the closest track point.
- Different filters (lanczos, loess, Powen-Leben) are used for the computation of surface geostrophic velocities (Vg surf 180) from DH.
- Computation of absolute geostrophic currents by combining Vg surf 180 and depth averaged GPS currents:



$$Vg_{abs} = Vg_{surf_{180}} + Vg_{180_{bottom}}$$

GPS currents — DH profile — unknown — mog2d model — Ekman + cyclostrophic

$$\overline{Vabs} = \overline{Vg}_{180} + Vg_{180_{bottom}} + V_{bar\ wind} + \overline{Vag} + \varepsilon$$

$\overline{\quad}$ denotes vertical average over the upper 180 m (glider vertical extension)

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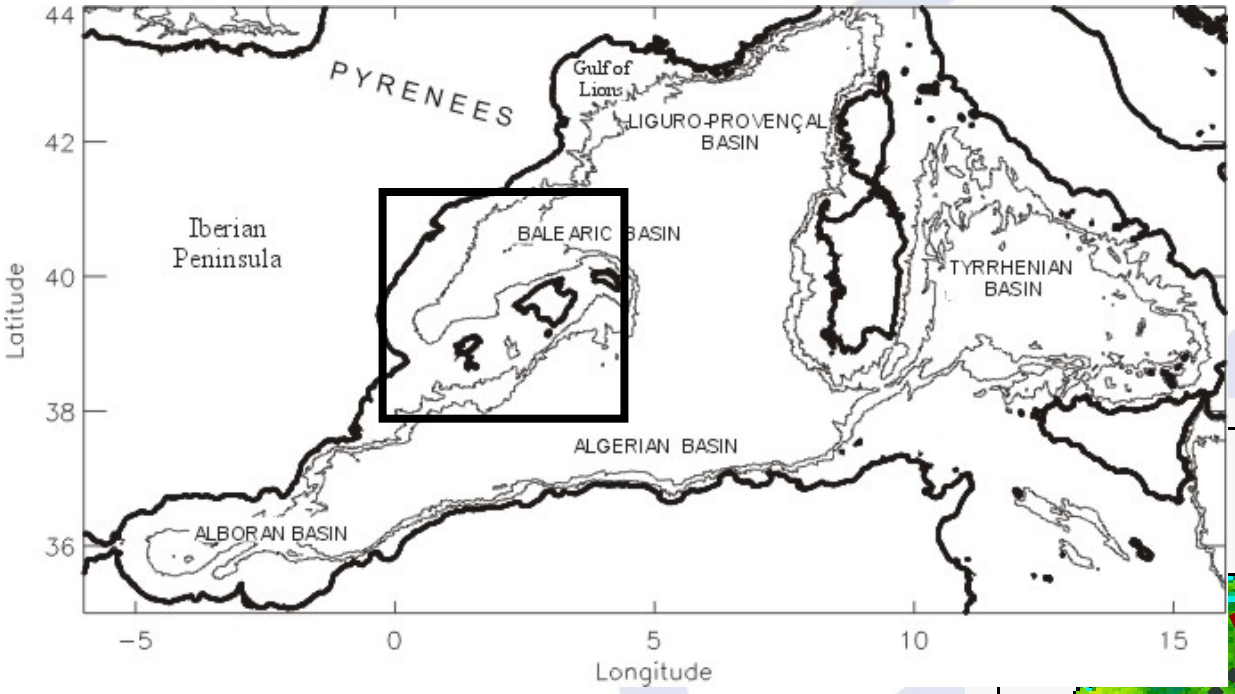
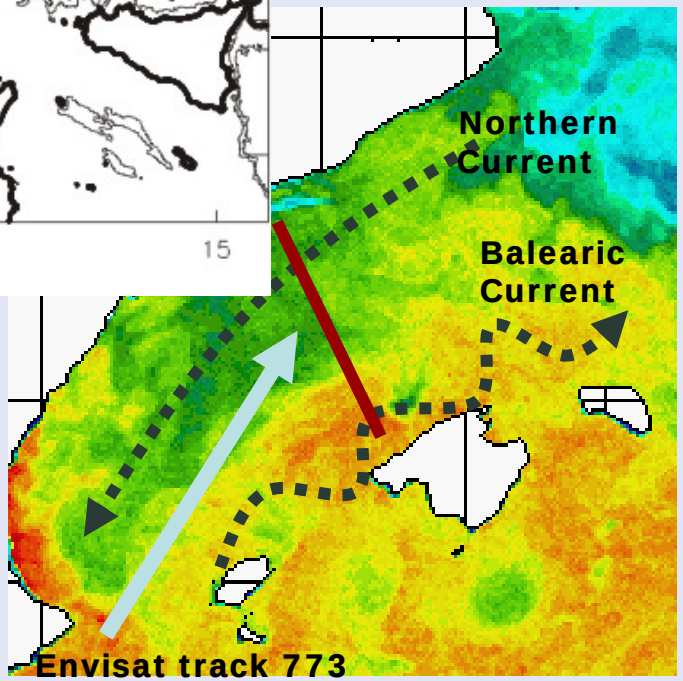
Area of Study: Balearic Sea





Catalan Front

Balearic Front

Glider mission simultaneous
to Envisat passage along track 773
(perpendicular to the Balearic front)

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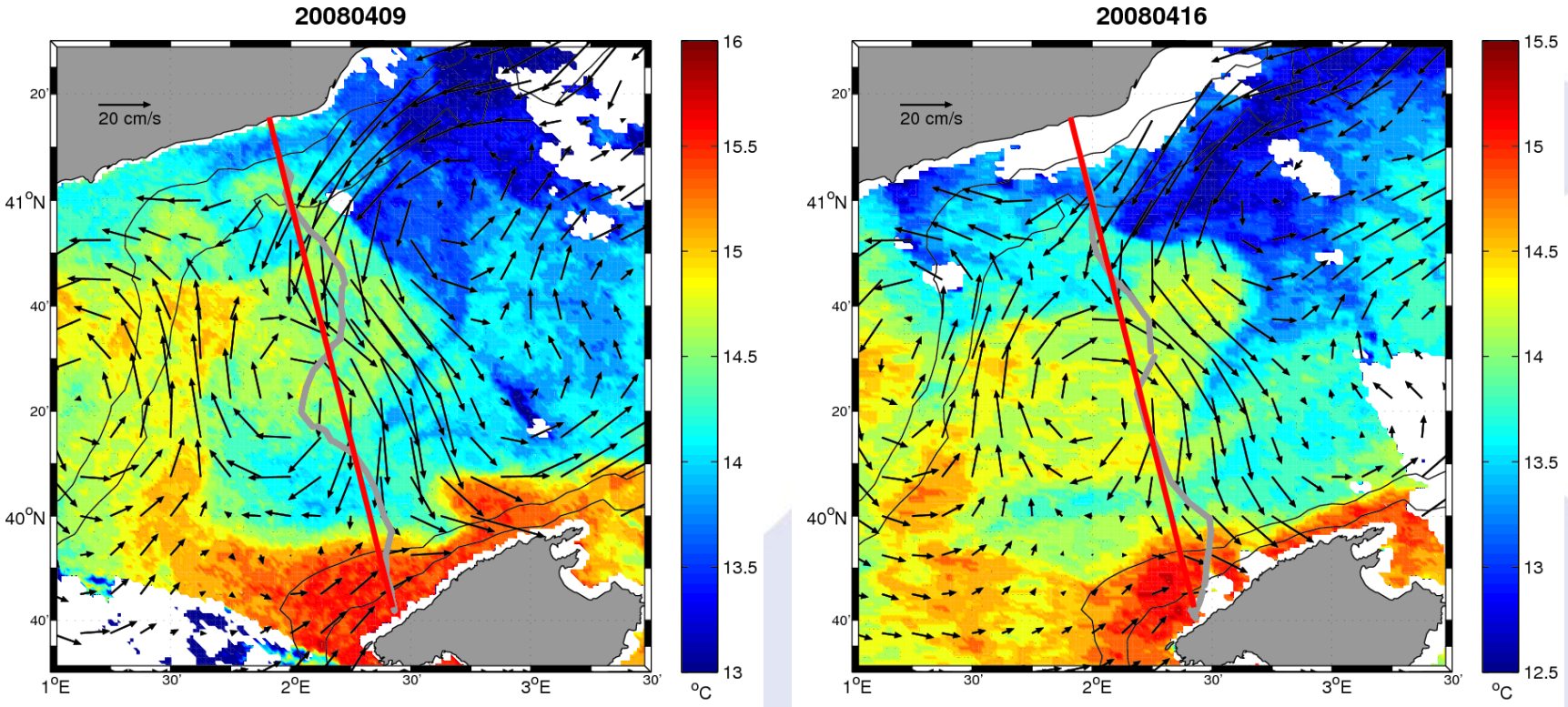
April 2008 mission: an intense eddy

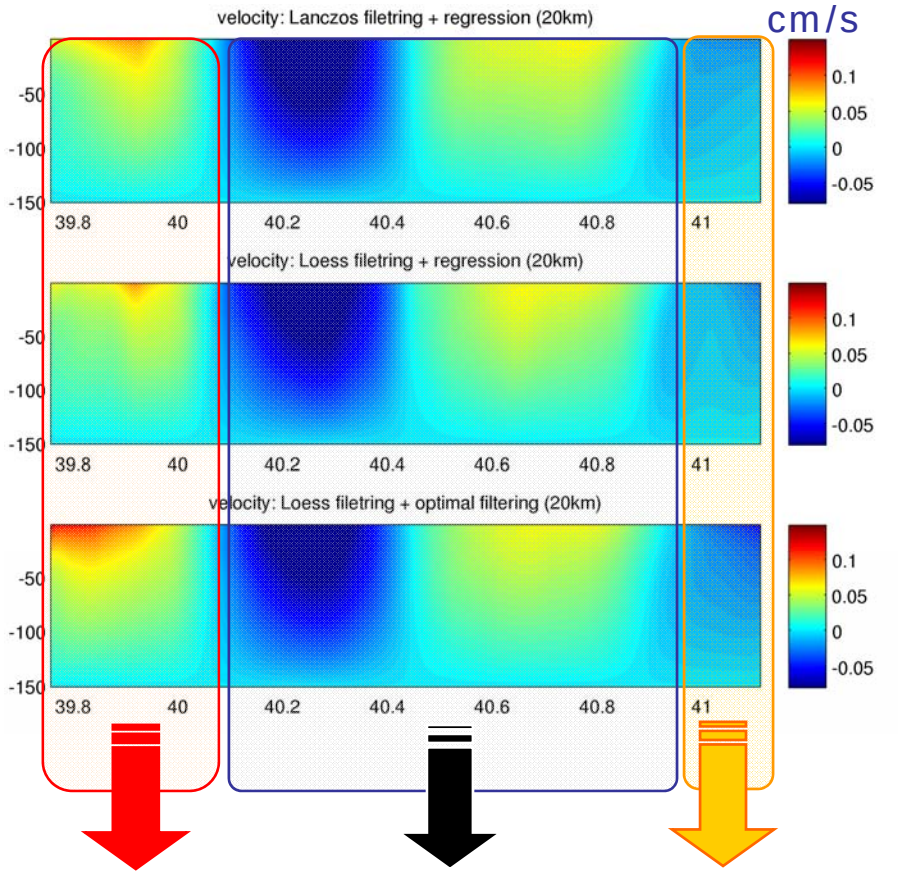
Sinoptic view from remote sensing data

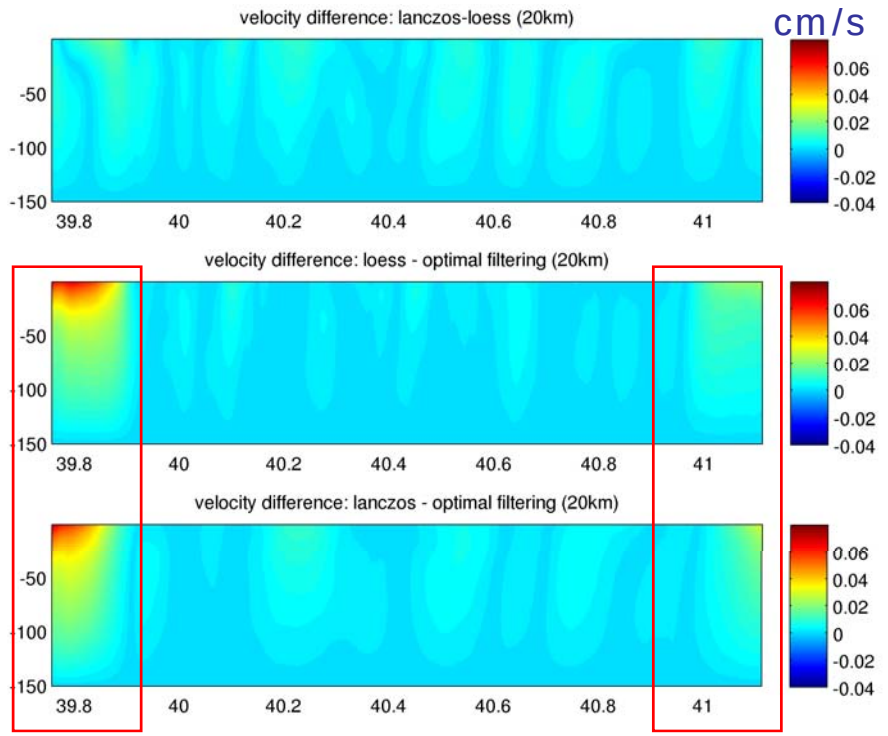


Color: SST. Source: ICM.
Vectors: Absolute geostrophic currents from DT merged altimeter gridded fields. Source: AVISO.

Glider results: geostrophic velocity calculation

- **Slope calculation: standard vs Powell et Leben (2004)**





Balearic current

Eddy

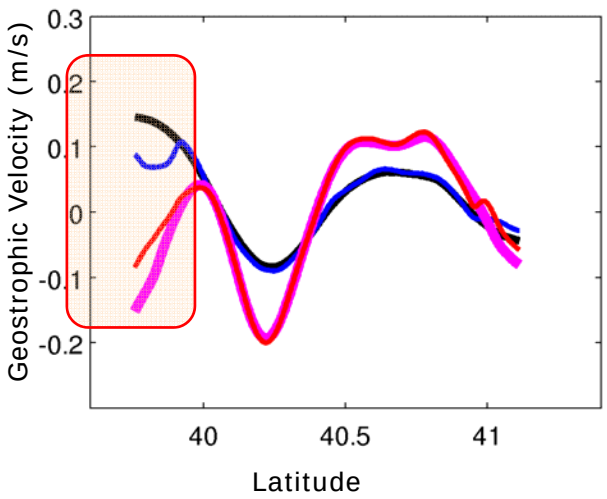
Nothern Current

- Main dynamical patterns observed with the 3 methods
- Significant differences in the balearic and Iberic coastal zones (resp 6 and 3 cm/s)

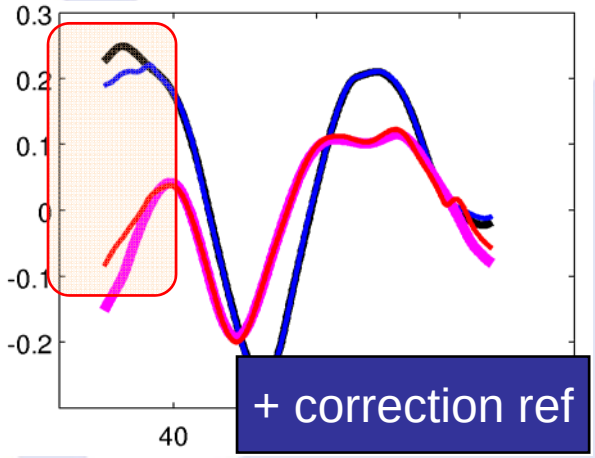
Glider vs altimetry currents

1 Hz data

Altimetry **vs** Glider



- Correlation: 0.76
- Rms diff: 6.2 cm/s
- Err var: 127 %



- Correlation: 0.71
- Rms diff: 10.4 cm/s
- Err var: 50 %

• Reasonable good agreement but **huge disagreements (>20cm/s) in the Balearic coastal zone and less amplitude in the glider.**

• "Correction ref" allows to have more intense glider signals but even larger than in altimetry and less well-phased than without applying this correction.

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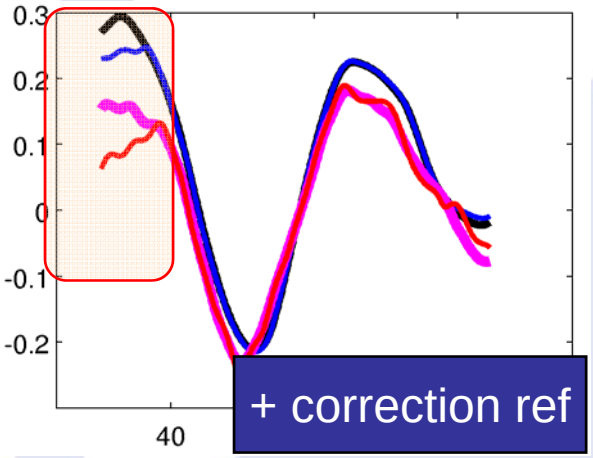
Glider vs altimetry currents

20 Hz data

Altimetry **vs** Glider



- Correlation: 0.97
- Rms diff: 4.0 cm/s
- Err var: 5 %

• Disagreements in the Balearic coastal zone are still significant but smaller than with 1 Hz. MDT related?

•20 Hz improves the overall comparison between altimetry and glider velocities.

Summary & Future Work

- Gliders are useful platforms for exploring limitations of coastal altimetry.
- New methodology and data processing in the velocity computation improves the altimetry-glider comparisons.
- The impact of usig HF along track altimetric data is tremendous in the coastal zone (correlation = 0.97, error variance = 5%).
- Future work:
  - Dedicated mean dynamic topography
  - Multi-sensor approach experiments
  - Data assimilation into numerical models to better understand coastal and mesoscale dynamics (collaboration with J. Zavala – Univ. Rutgers).