# Variability in transports in the Balearic Sea region, new data from glider missions

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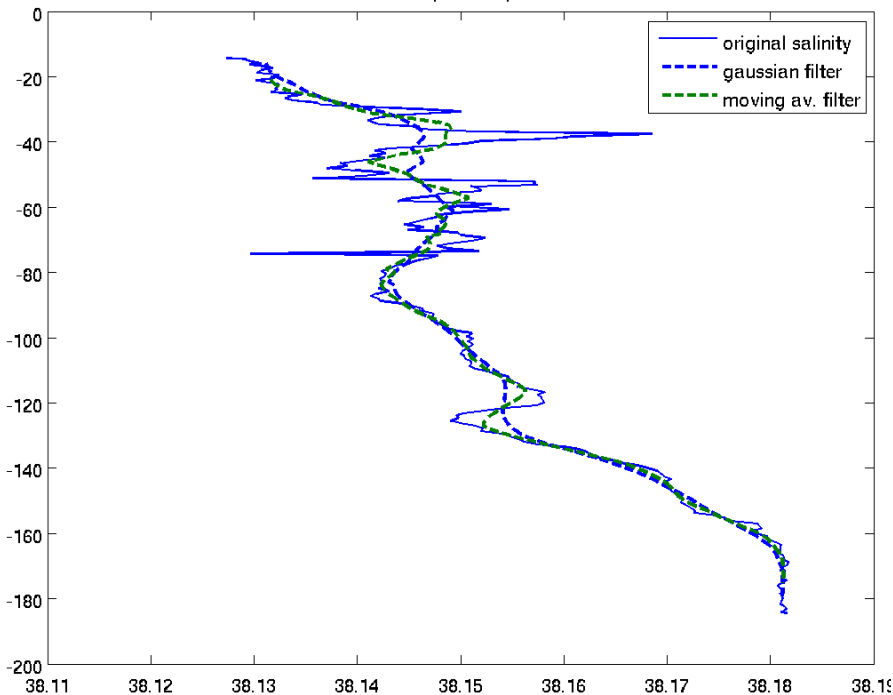
# Contents

- Salinity – Slocum glider data
  - Issues
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  - Analysis
- Geostrophic Transports – Ibiza Channel
  - Balearic Sea Circulation
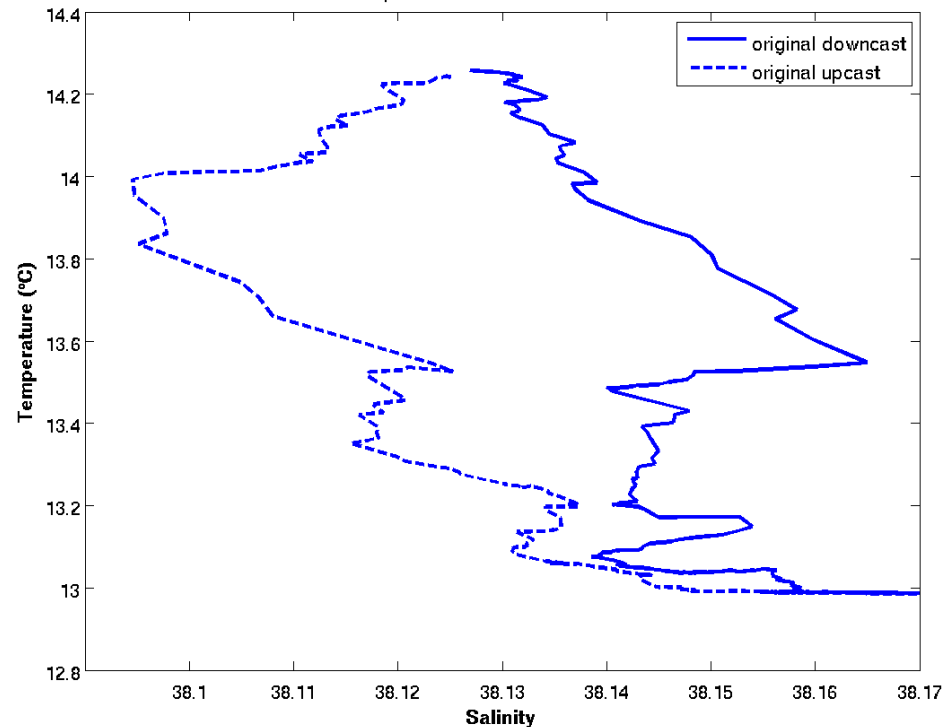  - Recent Missions
  - Geostrophic transports

# Salinity Correction – Why?

- Spikes in salinity and hysteresis between upcast and downcast

- Caused by temporal misalignment in T

# Causes of Error

- Studied by Lueck 1990, Lueck and Picklo 1990, Morison et al 1994, Johnson et al 2007

- 3 sources:

    1. Sensor Response Lag: the time lag in response of the thermistor and the conductivity sensor
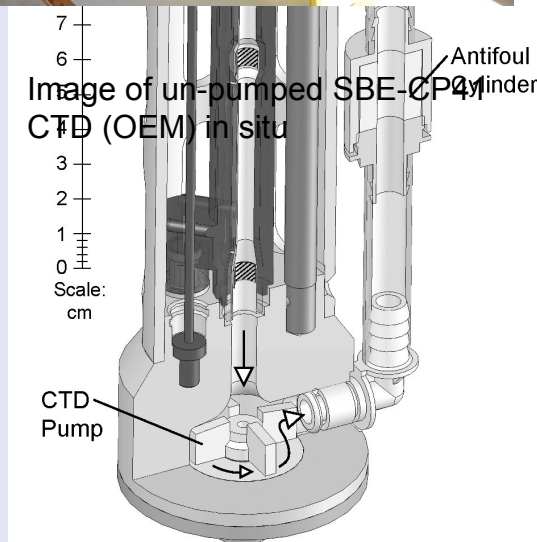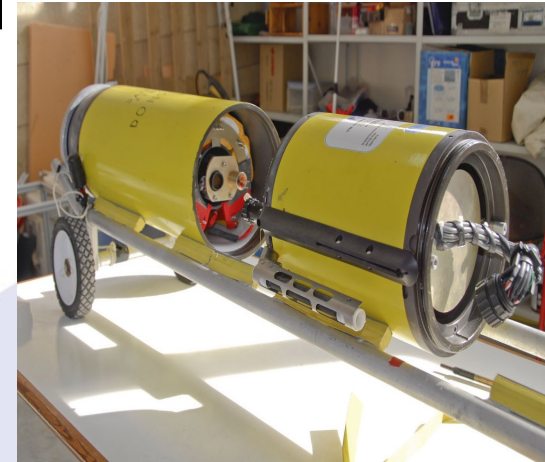


Image of un-pumped SBE-CP41 CTD (OEM) in situ



7
6

Antifoul
Cylinder

3
2
1
0
Scale:
cm

CTD
Pump

Diagram pumped SBE-CP41 from Johnson et al (2007)

# Correction Analysis

- Developed with and building on work of Garau et al (2011)

- Pre-processing
  - Standard Sea-Bird Electronics low-pass pressure filter
  - Recover T and C measurements without timestamp

# Corrections Analyzed cont.

- Thermal Lag
  - Indicated as the source of the largest error Johnson et al (2007)
  - Lueck and Picklo (1990) derived formula for SBE-9

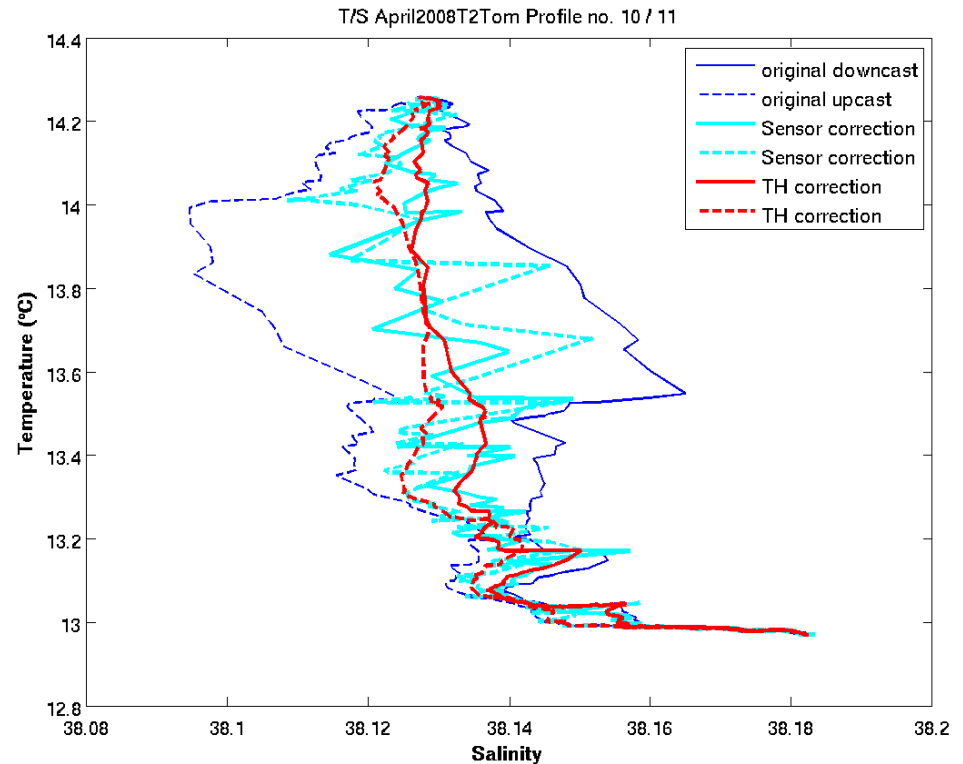  $$T_{cor}(n) = -b\, T_{cor}(n-1) + a[T(n) - T(n-1)]$$
  $$a = 4fn\alpha\, \tau/1 + 4fn\tau$$
  $$b = 1 - 2a/\alpha$$

  - Morison et al (1994) found the correction coefficients $\alpha$ and $\tau$ through comparing up and
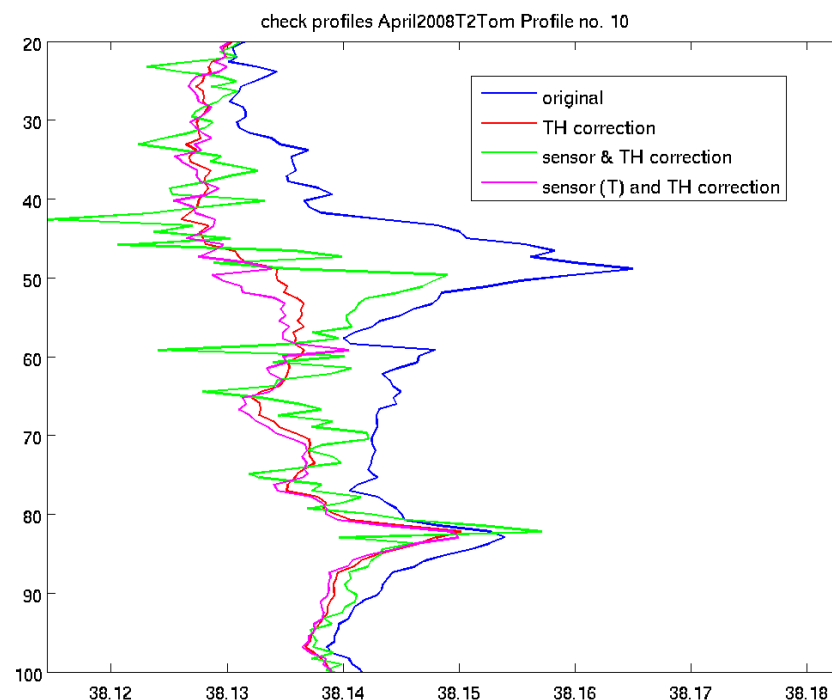
- ## Derived τT similar to SBE values, τC large



T/S April2008T2Tom Profile no. 10 / 11

Legend:
- original downcast
- original upcast
- Sensor correction
- Sensor correction
- TH correction
- TH correction

|  | Sensor |  |
| --- | --- | --- |
| **Previous Studies** | τ Temp | |
| Lueck & Picklo (1990) | | |
| Morison et al (1994) | | |
| Kerfoot et al (2006) | 1 | |
| Johnson et al (2007) | 0 | |
| Bishop (2008 unpublished, MSc. Project ) | 1 | |
| Merckelbeck (unpublished, internal doc.)** | 0 | |
| Kerfoot et al (2010) | 1 | |
| | | |
| **IMEDEA Missions** | | |
| 200804T2 * | 0.62 | SBE-41CP unpumped |
| 201101Canales * | 1.43 | 2.79 SBE-41CP unpumped |

mixes sensor and thermal lag

tecnología marina
oceanografía operacional
y sostenibilidad

- Salinity corrected
with sensor and
thermal lag
(derived and SBE)
and thermal lag



check profiles April2008T2Tom Profile no. 10

Legend:
- original (blue)
- TH correction (red)
- sensor & TH correction (green)
- sensor (T) and TH correction (magenta)

| | Thermal Lag | |
|---|---|---|
| Previous Studies | α (°C) | τ (s) |
| Lueck & Picklo (1990) | 0.280 | 10.0 |
| Morison et al (1994) | 0.025 | 9.5 |
| Garau et al (2011) | 0.182 | 17.0 |
| IMEDEA Missions | | |
| 200804T2 | 0.269 | 11.6 |
| 201101Canales | 0.245 | 11.6 |

correction
increases spikes in

# Summary of new findings & ongoing work

- Indicates the thermal lag correction, after Garau et al (2011) and with pre-processing, for the moment offers the 'best' solution

- Glider Toolbox – available, requires up and downcast pairs
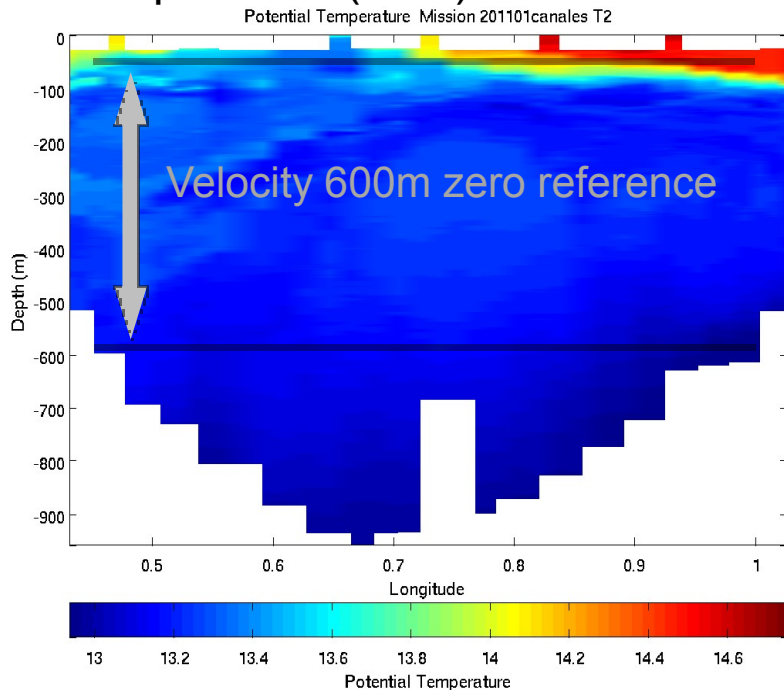
- Future experiments:

# Transport variability - Ibiza

Iberian Peninsula

NC

BC

Menorca

Mallorca

Ibiza

AW

**: Main surface currents**
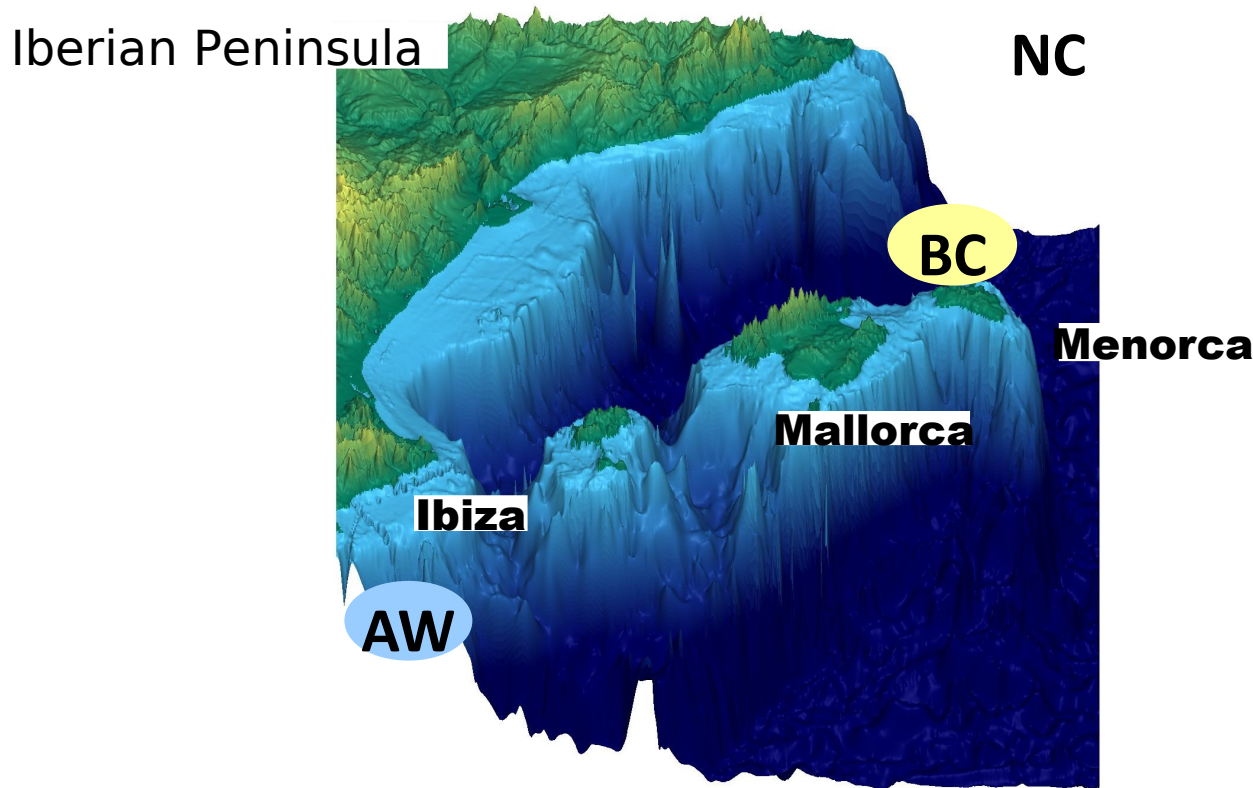
- Important exchanges and impact on biology
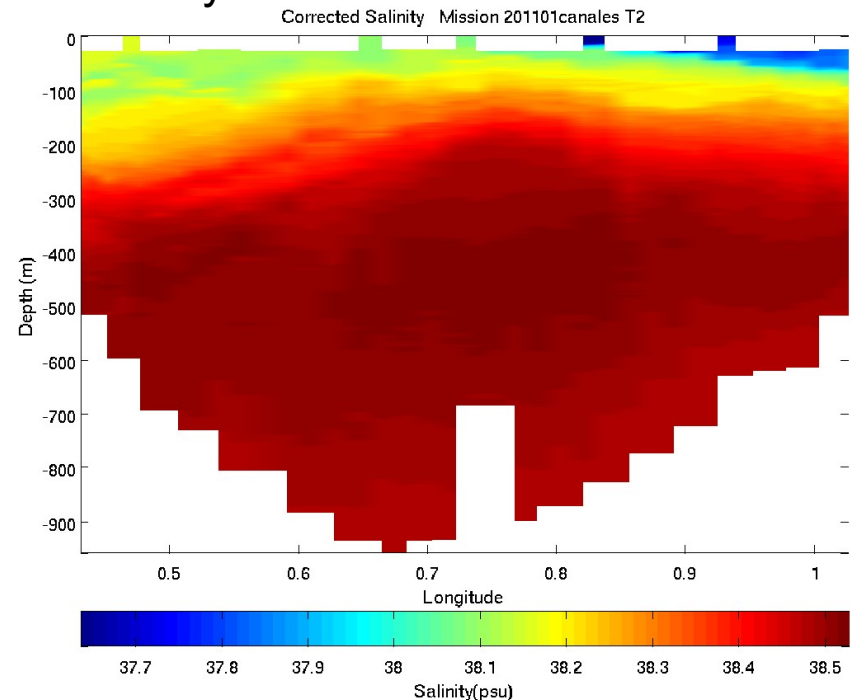- Previous studies; NC

# New deep glider missions - SOCIB

- 6 channel transects in Jan 2011
- NC and BC outflows/inflows visible in T and S
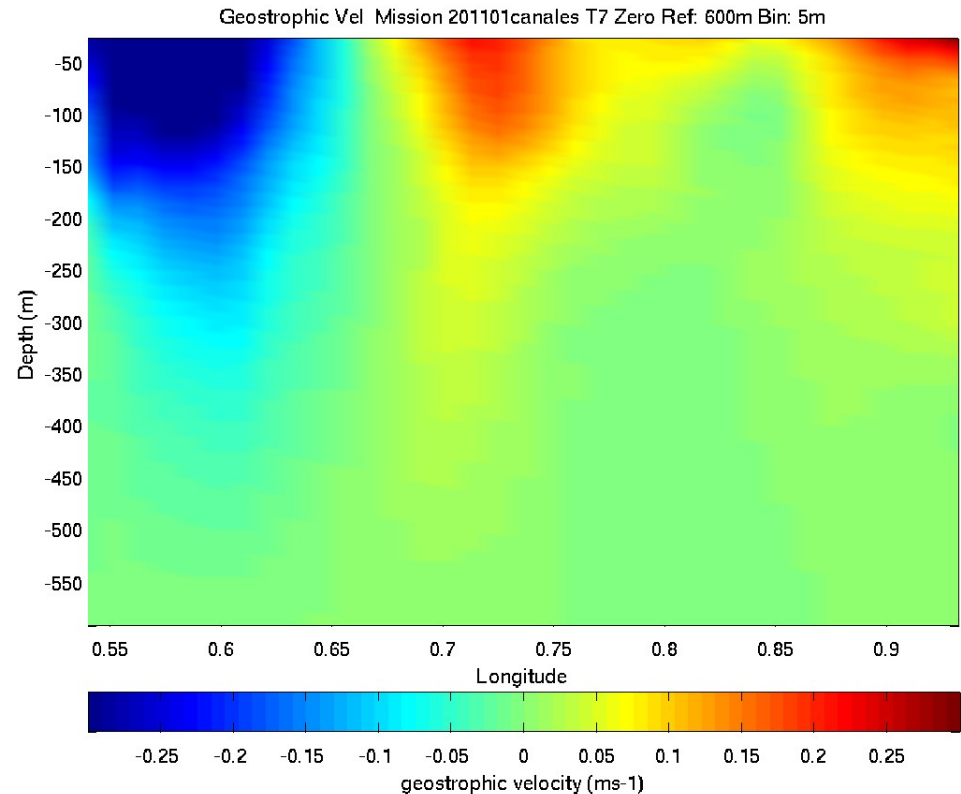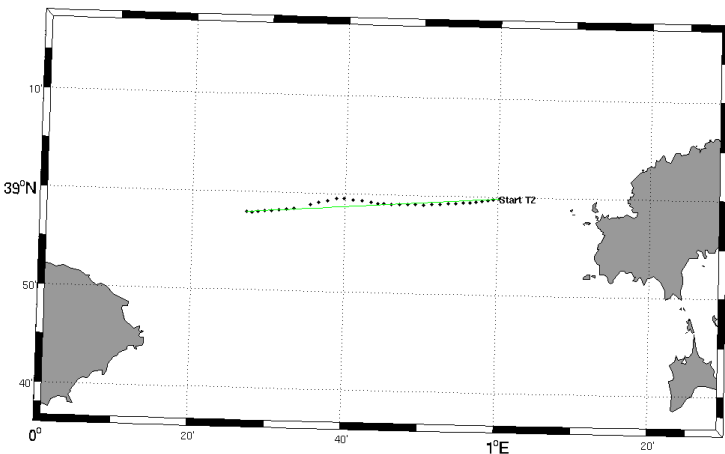
Temperature (θ °C) Transect T2



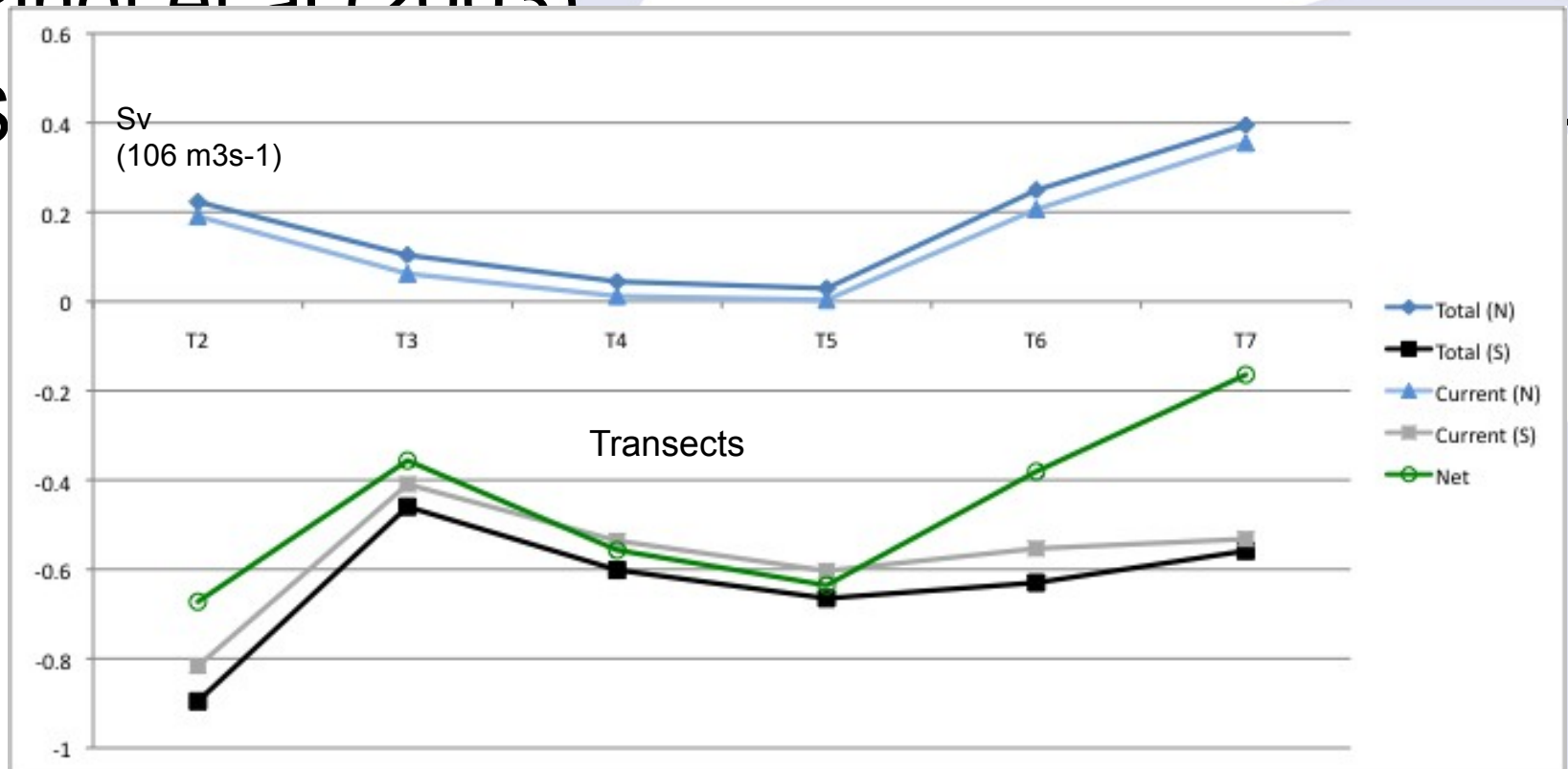Salinity

# Results 1 – geostrophic current variance

- Geostrophic current estimates, transect approx. 3 days

- Variability in str... BC inflows



Geostrophic Vel Mission 201101canales T7 Zero Ref: 600m Bin: 5m

geostrophic velocity (ms-1)

# Results 2 – transport estimates

- Values consistent with previous studies, e.g. Pinot et al (2003)

- S ... 0

# Preliminary Findings & Next Steps

- Variance in transports is higher than anticipated within one month and between transects

- Develop timeseries of transports for Ibiza and Mallorca channels and investigate variance and the causes

- Interesting and exciting application of the gliders ability to deliver increased temporal resolution