The LLWBCs of the Solomon Sea

depicted by altimetry

L. Gourdeau[1], A. Melet[2], W. Kessler[3], R. Dussurget[1], and R. Davis[4]

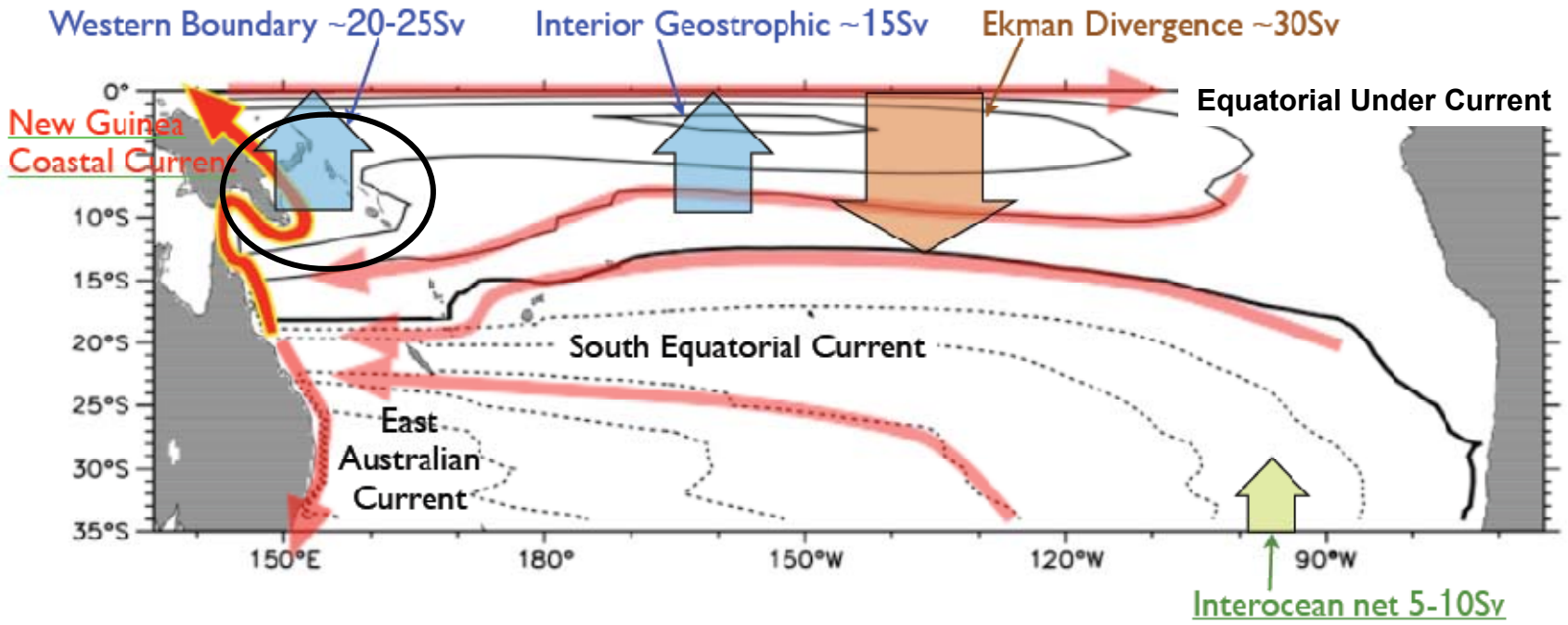
1) IRD/LEGOS, Toulouse, France

2) LEGI, Grenoble France

3) NOAA/PMEL, Seattle, USA

4) Scripps, San Diego, USA

South Pacific mean circulation (Sverdrup transport)



Solomon Sea:

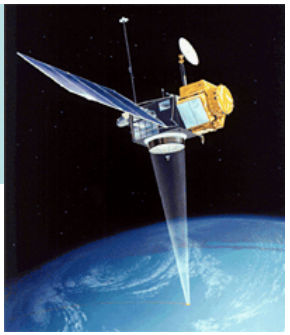
Transit zone for tropical/subtropical waters feeding

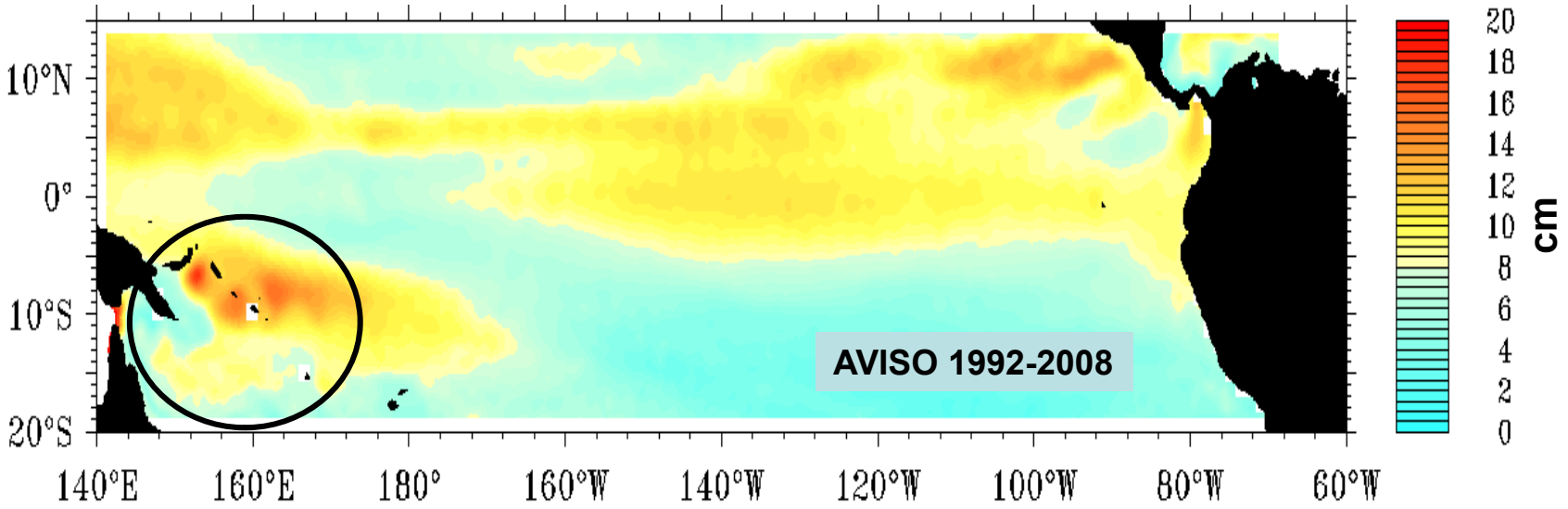
The western Pacific warm pool and **the EUC**

via the LLWBCs (NGCC).

Implication for **ENSO and its low frequency modulation**

Sea level variability





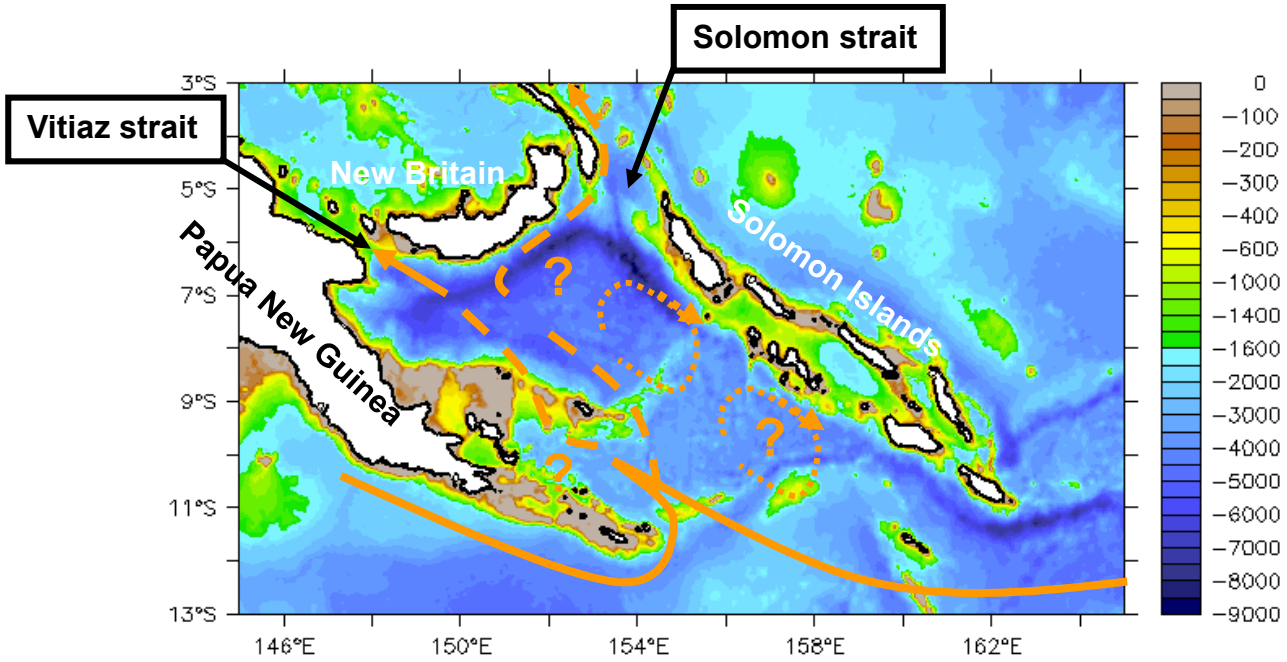
Solomon Sea:

The highest SLA variability of the south tropical Pacific

Solomon Sea

Unusual western boundary geometry:

→ 5° latitude barrier in front of continental boundary
→ WBC transport may be limited by narrow straits

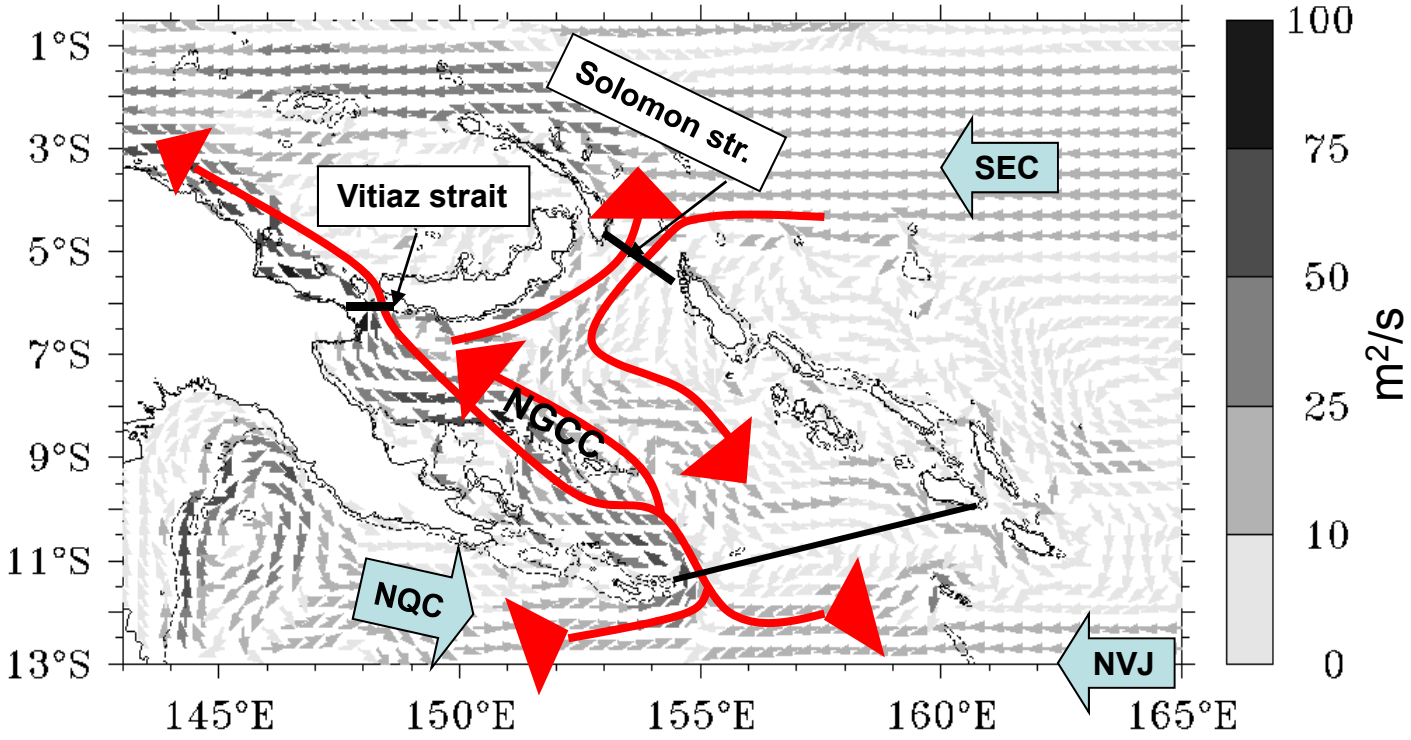


An ongoing effort to understand the Solomon Sea circulation and its variability:

- **High resolution modelisation** (Melet et al, 2010a)
- **In situ observation** (glider experiments)
- **Altimetry**

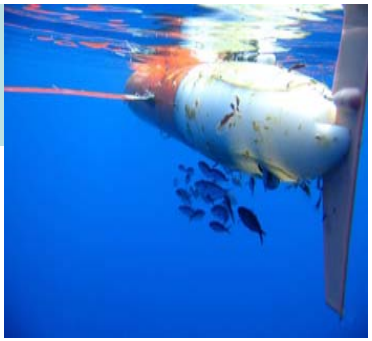
Modelisation (1/12°) (Melet et al, 2010a)

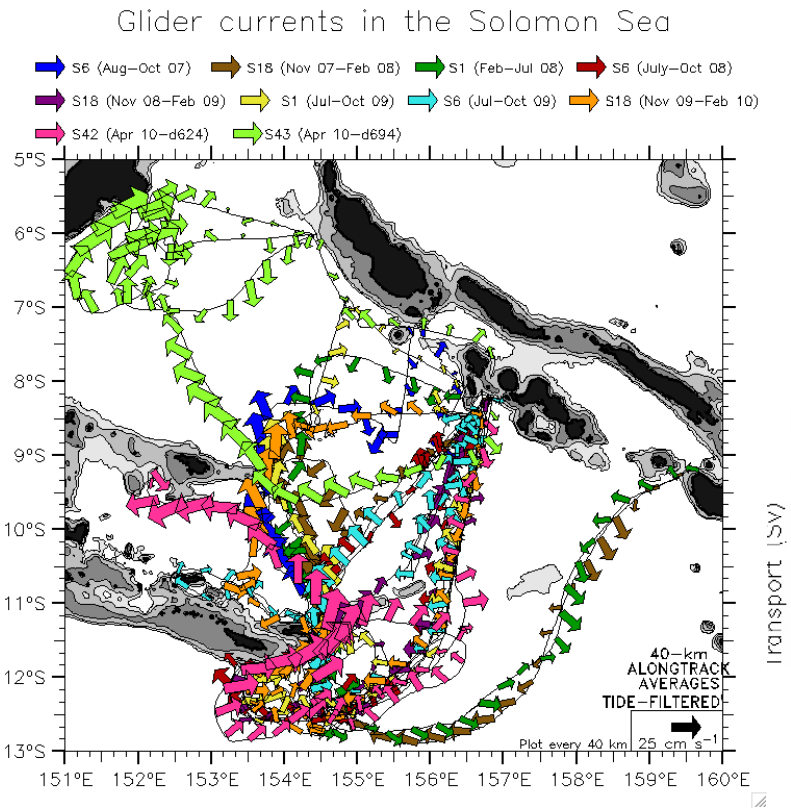
Mean circulation in the surface layers

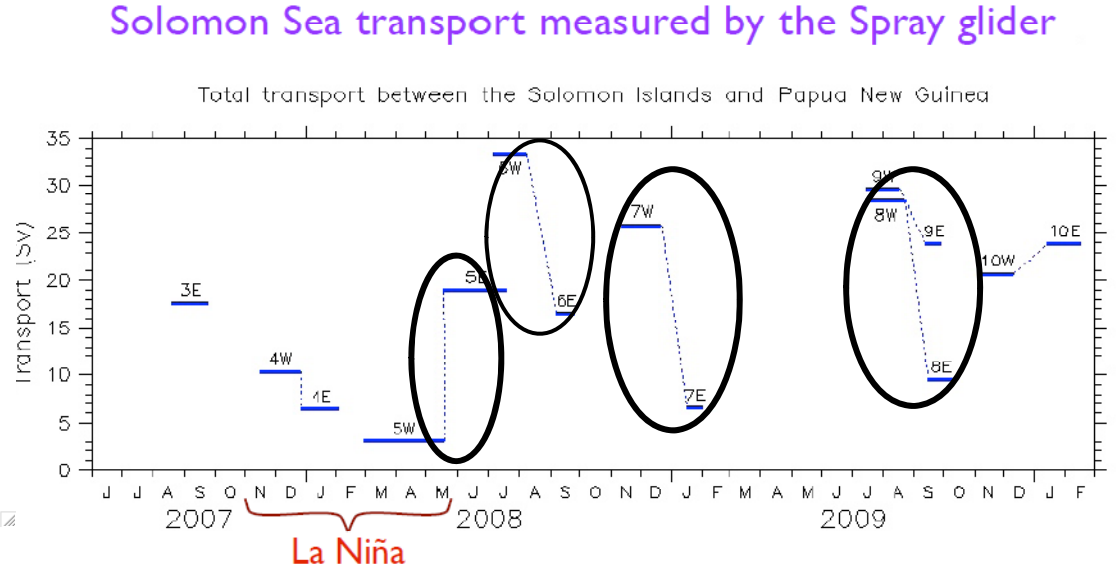


A complex circulation pattern

A monitoring of the Solomon Sea by gliders





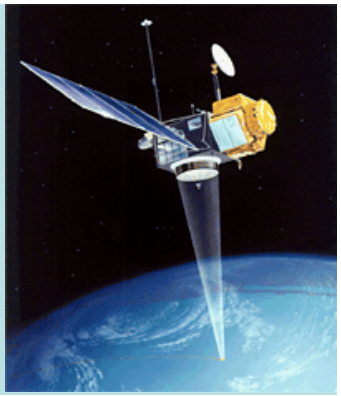


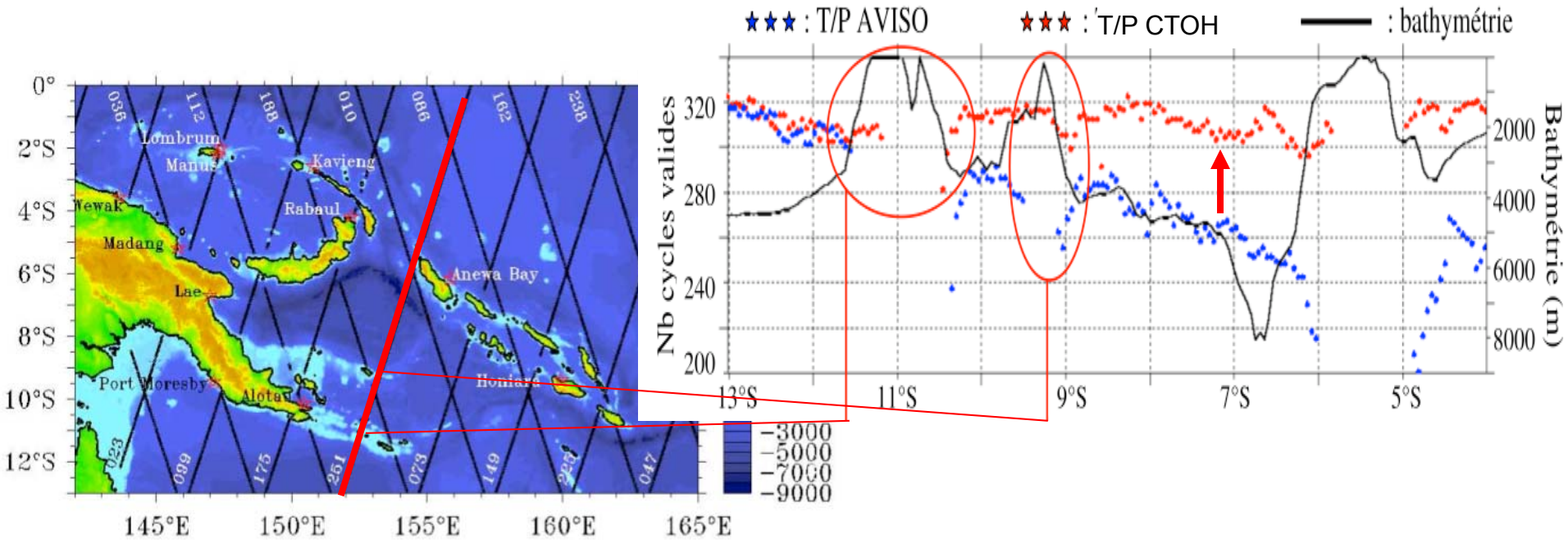
Interannual and large short-term transport changes

→ **Real difficulty to interpret the observed variability**

Two altimetric products:

- Gridded MSLA/MSSH AVISO data
- **Along track T/P data**
  A specific CTOH/LEGOS processing

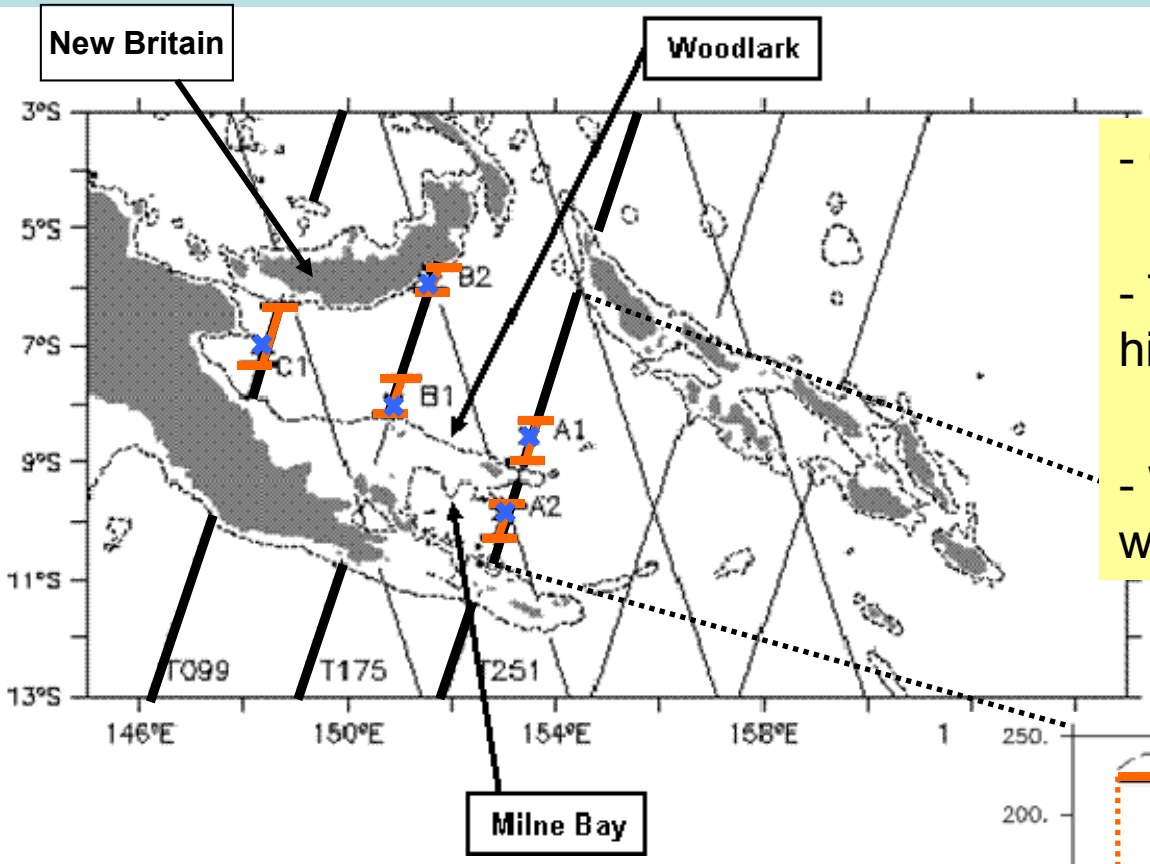




Compared with the classical GDR data:

- more cycles
- data gained at the coast

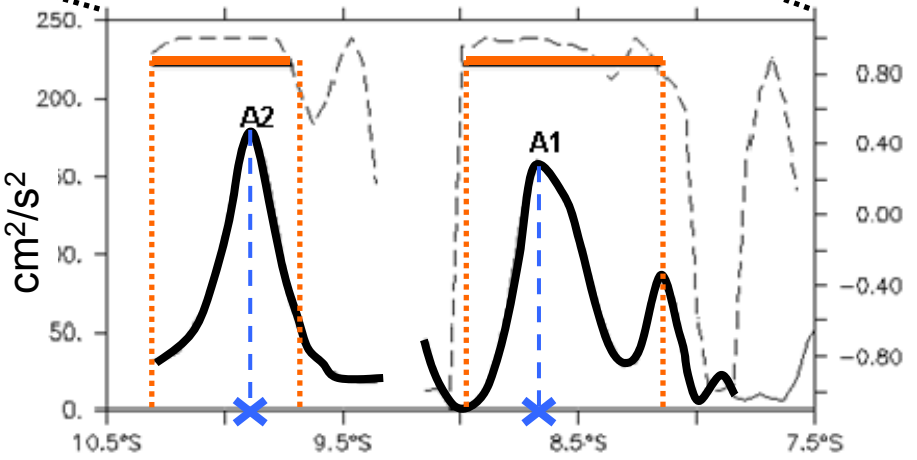
Along track signature of the LLWBCs



- Cross track geostrophic current

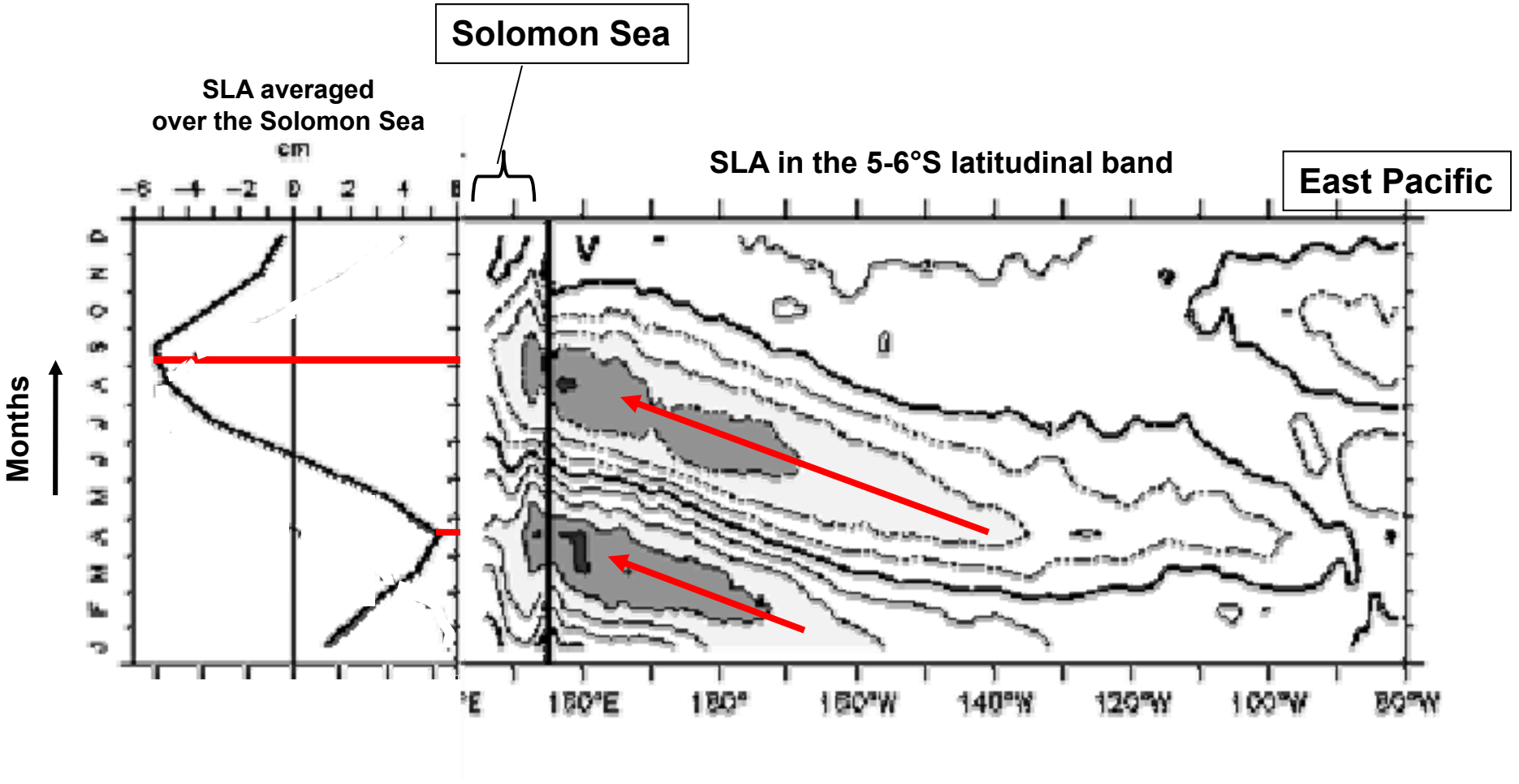
- The point near the coast with the highest variability

- WBC: all the points surrounding it with a correlation > 0.85



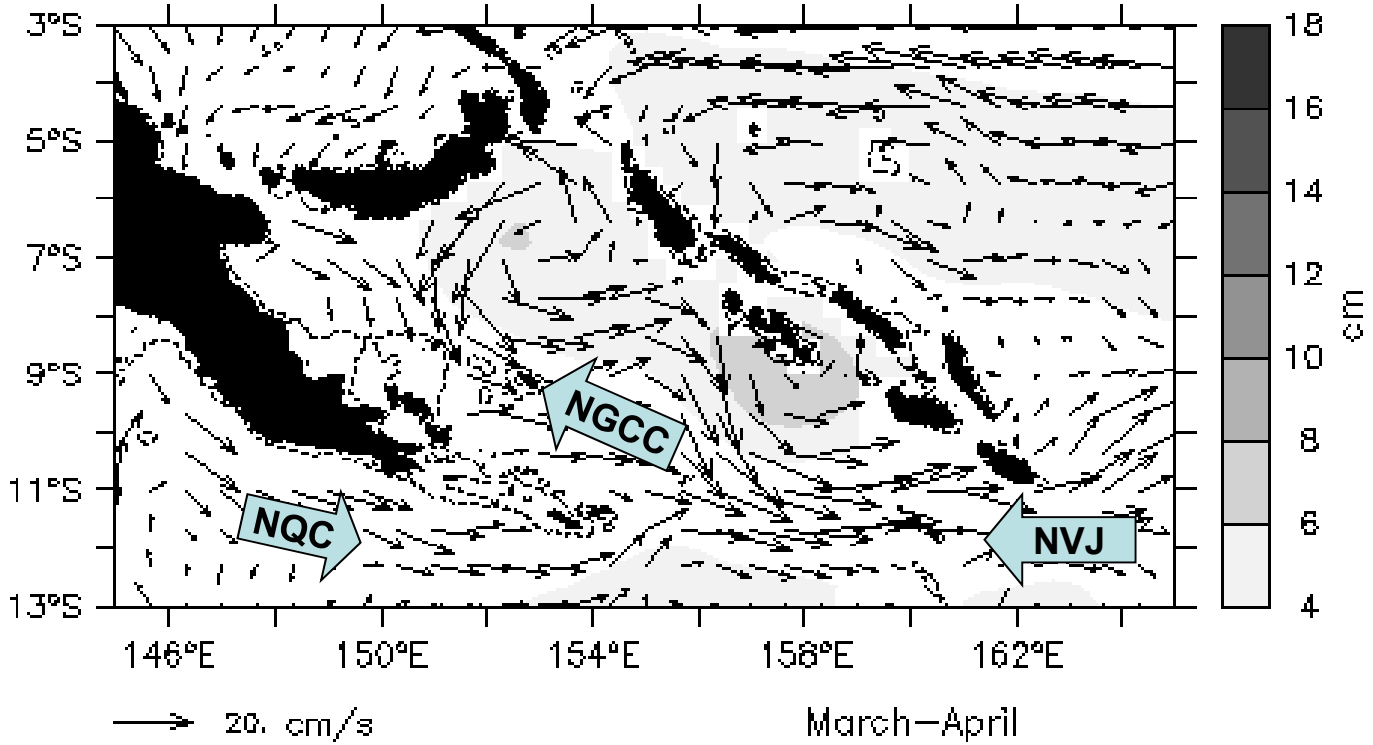
LLWBC signatures:
- In Milne Bay
- Along the Woodlark
- At Vitiaz strait
- Along New Britain

Solomon Sea: Annual cycle



SLA is phased with Rossby waves arriving at Solomon strait

Solomon Sea: annual cycle

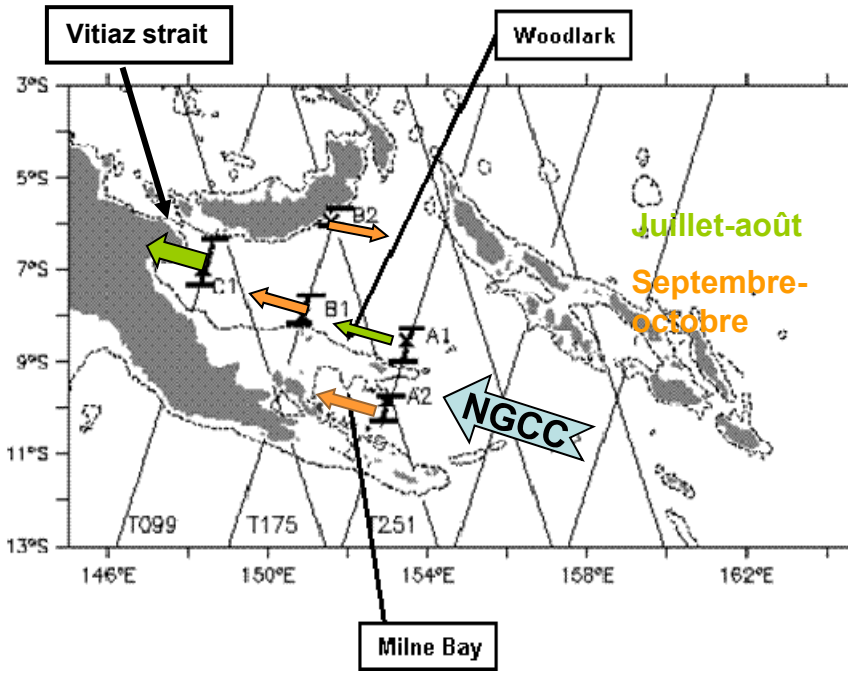


Surface geostrophic current anomalies :

→ In march-april, draining of the Solomon Sea : NGCC ↘ ; NVJ ↘; NQC ↗

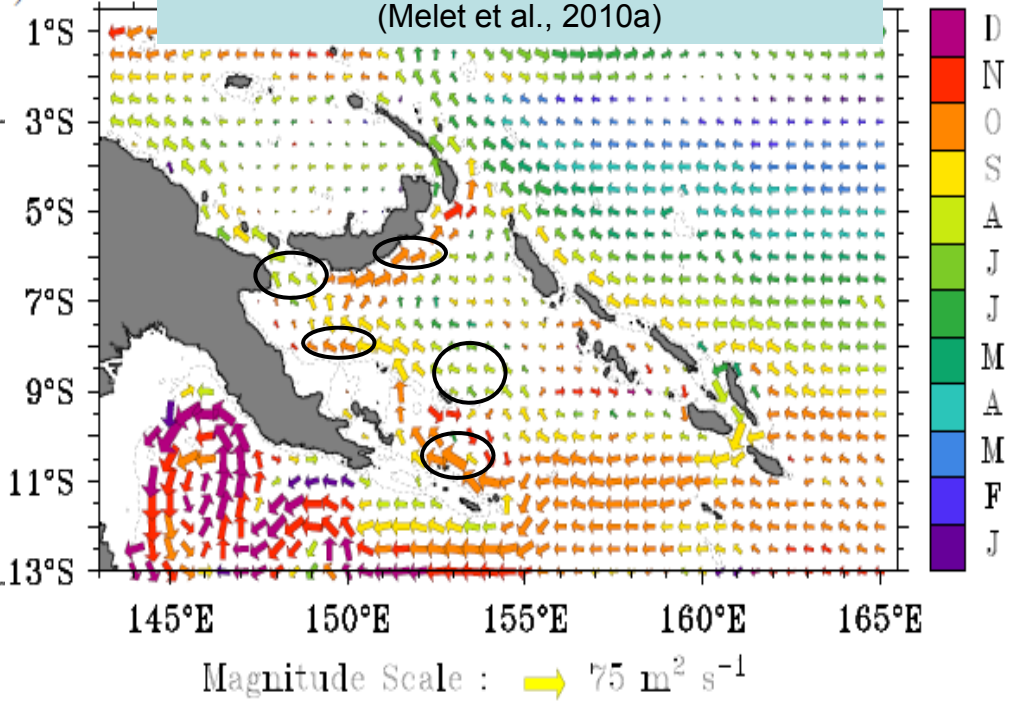
Western Boundary Currents: annual Cycle

Altimetry (CTOH): surface



Model (1/12°): thermocline

(Melet et al., 2010a)

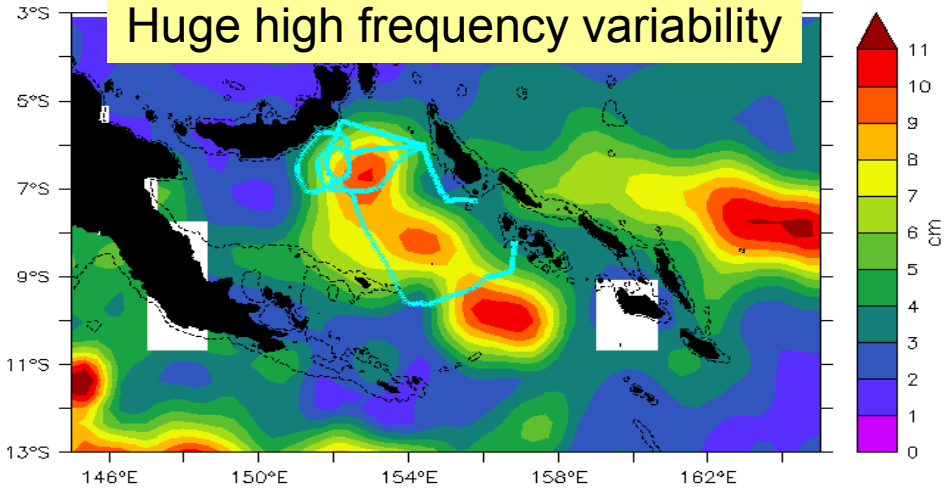


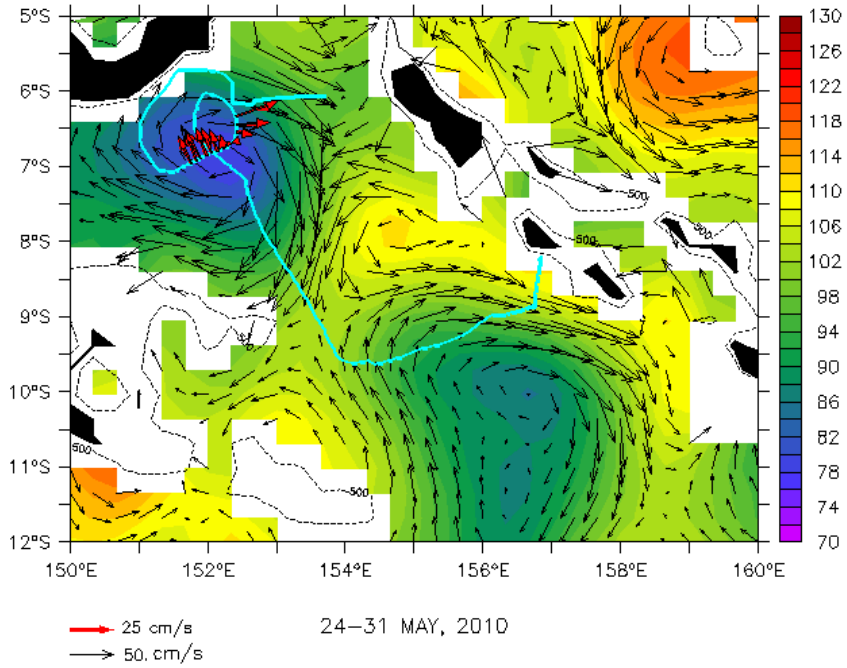
- Different phase relationships between the LLWBCs at the surface
- Consistent with model results at thermocline level (Melet et al., 2010a)
- A dominant first baroclinic mode

Mesoscale variability:
What does a glider really observe?

SLA rms during the 5 months glider mission
(Mission 12: 04/19/2010 → 09/13/2010)

Blue line: the trajectory of the glider



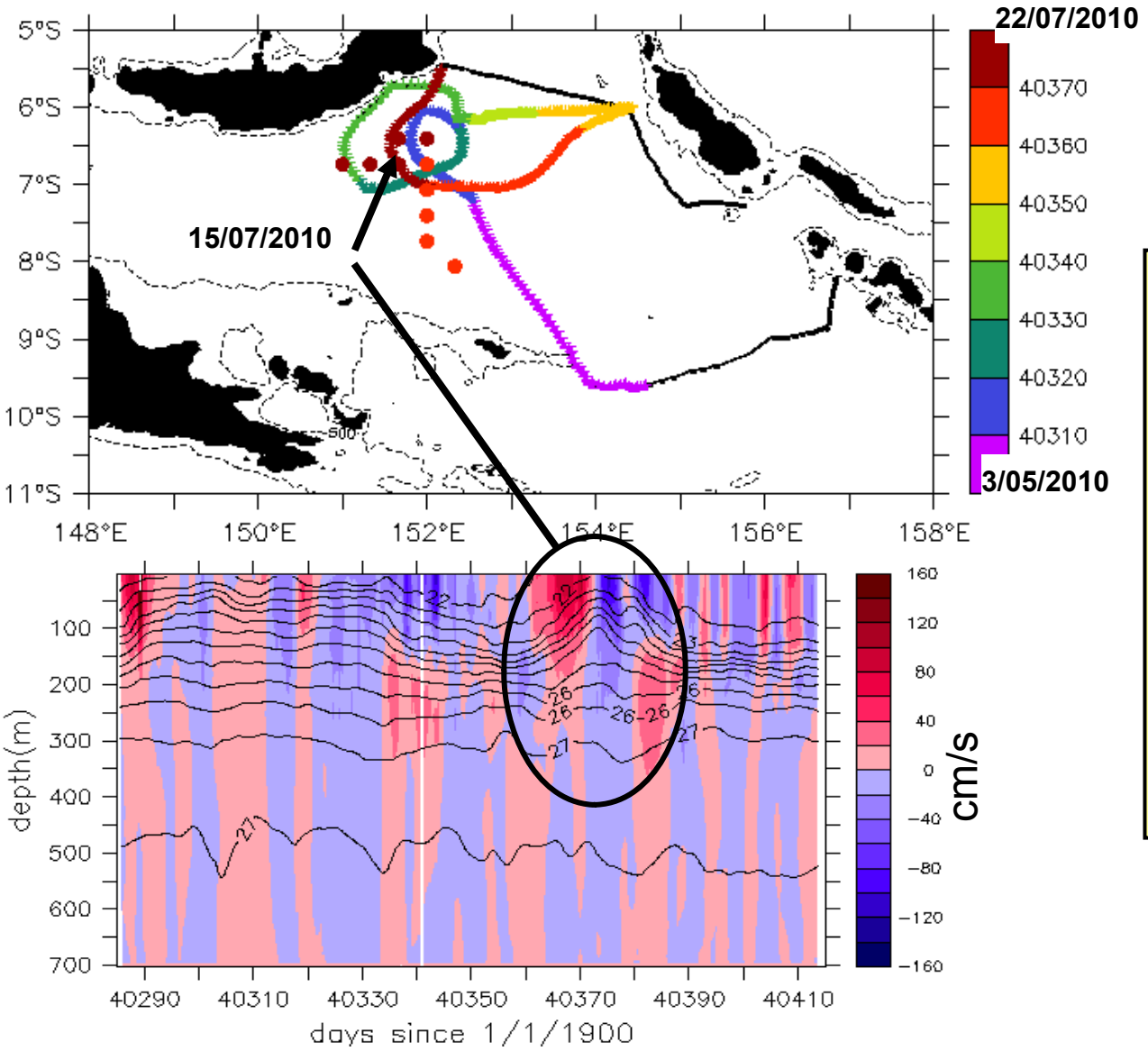


Absolute surface geostrophic current

⇩

Coherent pictures between glider and altimetry estimates

Mesoscale activity depicted by altimetry during the glider mission



Cross track geostrophic velocity (positive to right of track, shaded)
Potentiel density (minus 1000, contoured)

Tracking of the eddies:

- 3 cyclonic eddies
- Life time > 25 days

Their signature in the glider data:

- upwelled water from 250 m depth
- shear of the current

Conclusion

Altimetry used to describe the variability of the Solomon Sea

A specific CTOH/LEGOS along track data processing

WBCs are documented:

- The main routes are detected
- At annual time scale, importance of Rossby Waves at the latitude of Solomon Strait.
- Results are coherent with the modelling study by Melet et al., 2010a

High mesoscale activity:

- A joint analysis of glider and altimetric data
- Altimetry to quantify the mesoscale activity in the Solomon Sea
- Altimetry is a unique way to understand what a glider observes

Most of these results are detailed in the paper:

Melet A., L. Gourdeau, and J. Verron (2010): Variability in Solomon Sea circulation derived from altimeter sea level data, *Ocean Dynamics*, doi 10.1007/s10236-010-0302-6.

Melet A., L. Gourdeau, W. Kesser, J. Verron and J.M. Molines (2010a): Thermocline circulation in the Solomon Sea: A modeling study, J. Phys. Oceanogr., 40, 1302-1319.