Glider observations of the western boundary current in the Solomon Sea

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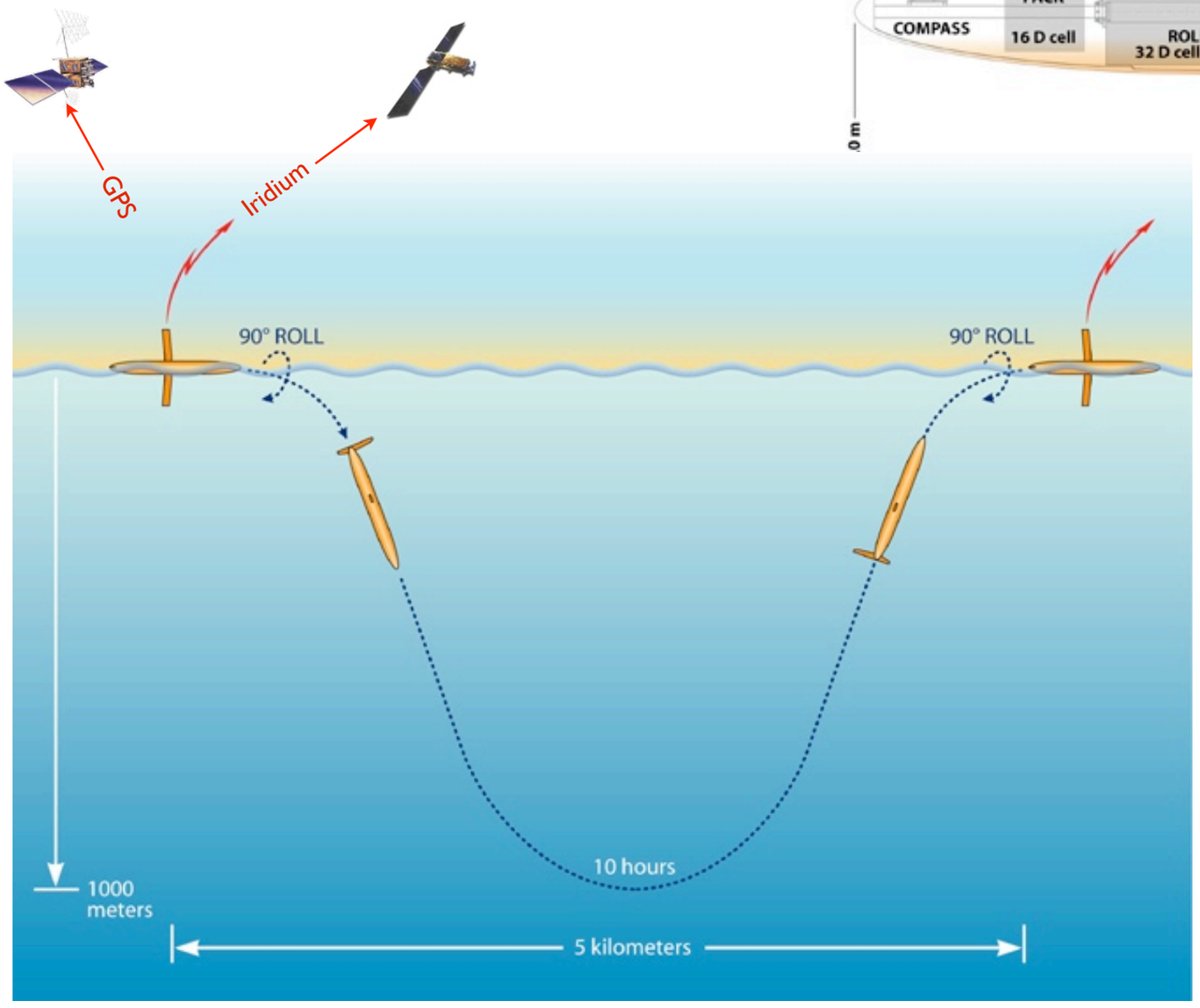
2 meters long, weighs 50kg
⇒ Work from small boats near shore, much cheaper than a ship.

The Spray glider is essentially an Argo float with wings and movable batteries

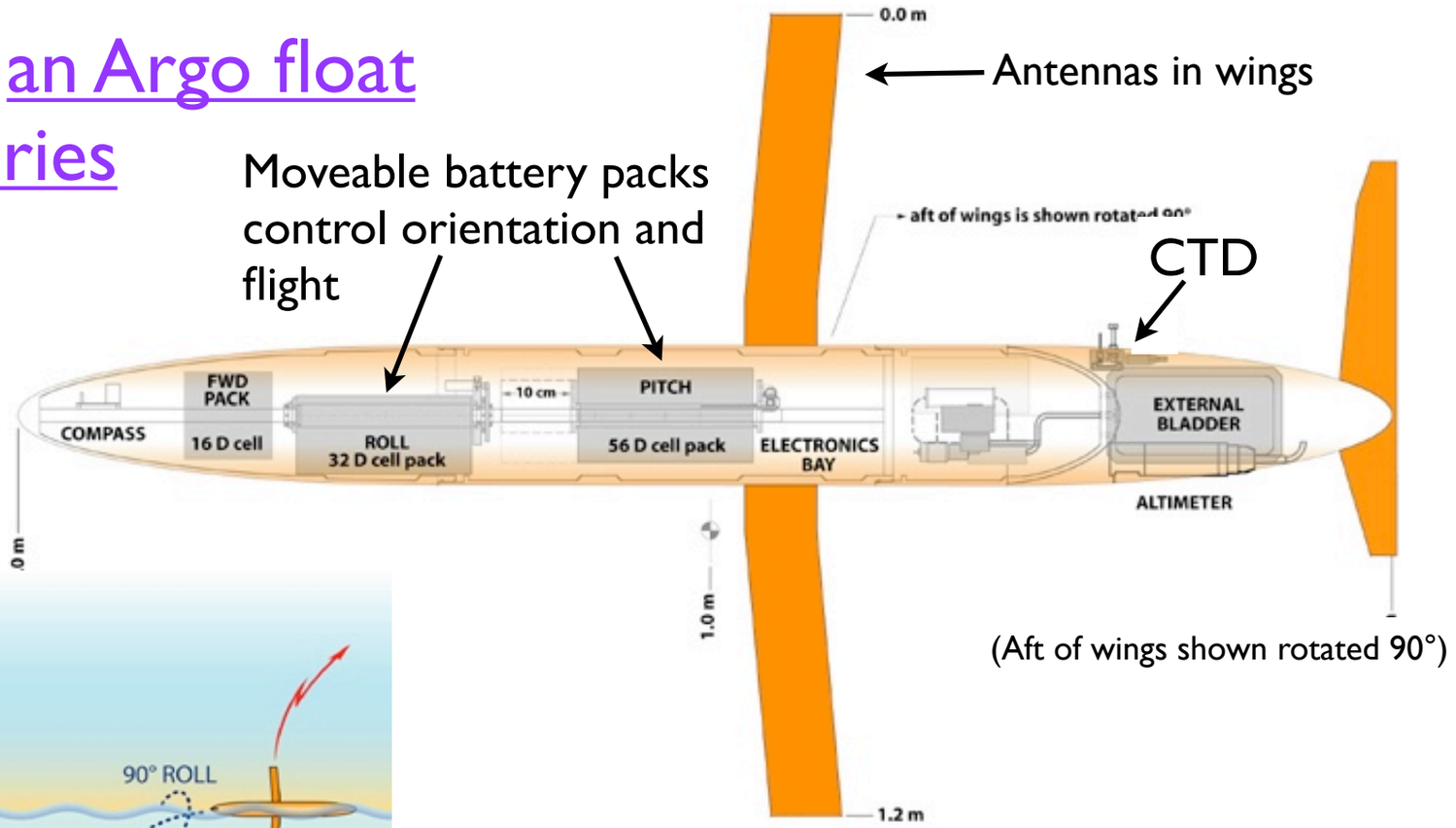
The Spray glider is developed and built by the Instrument Development Group at Scripps.



500-1000 m

← 3 km (3-4 hr) →

Range 4-5 months at 20 cm/s = 2000+km

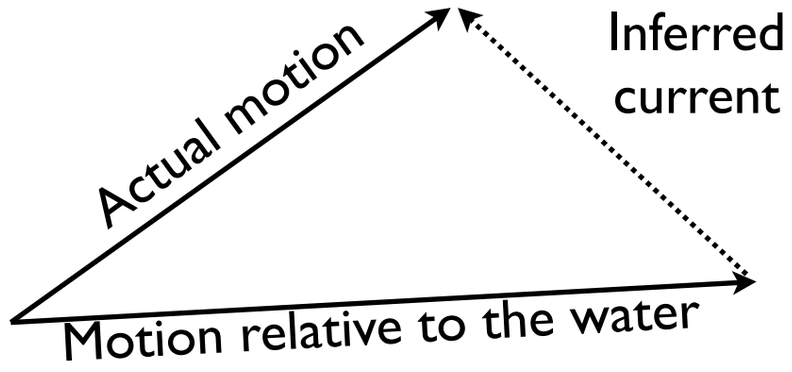


(Aft of wings shown rotated 90°)

Very dense sampling (~ resolve tides)

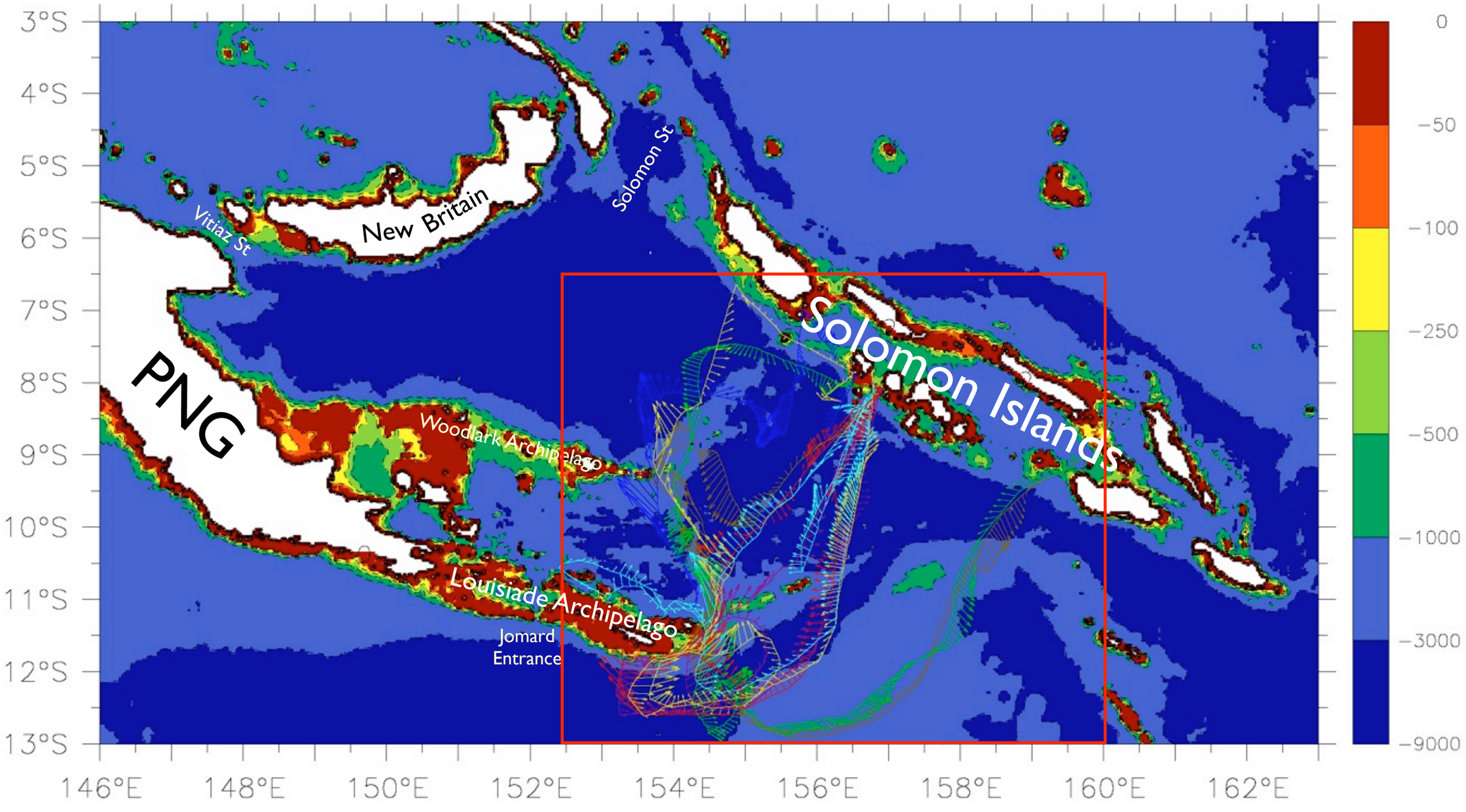
Argo-comparable T-S profiles:
geostrophic relative currents

Infer vertical-average absolute currents by the glider's drift:

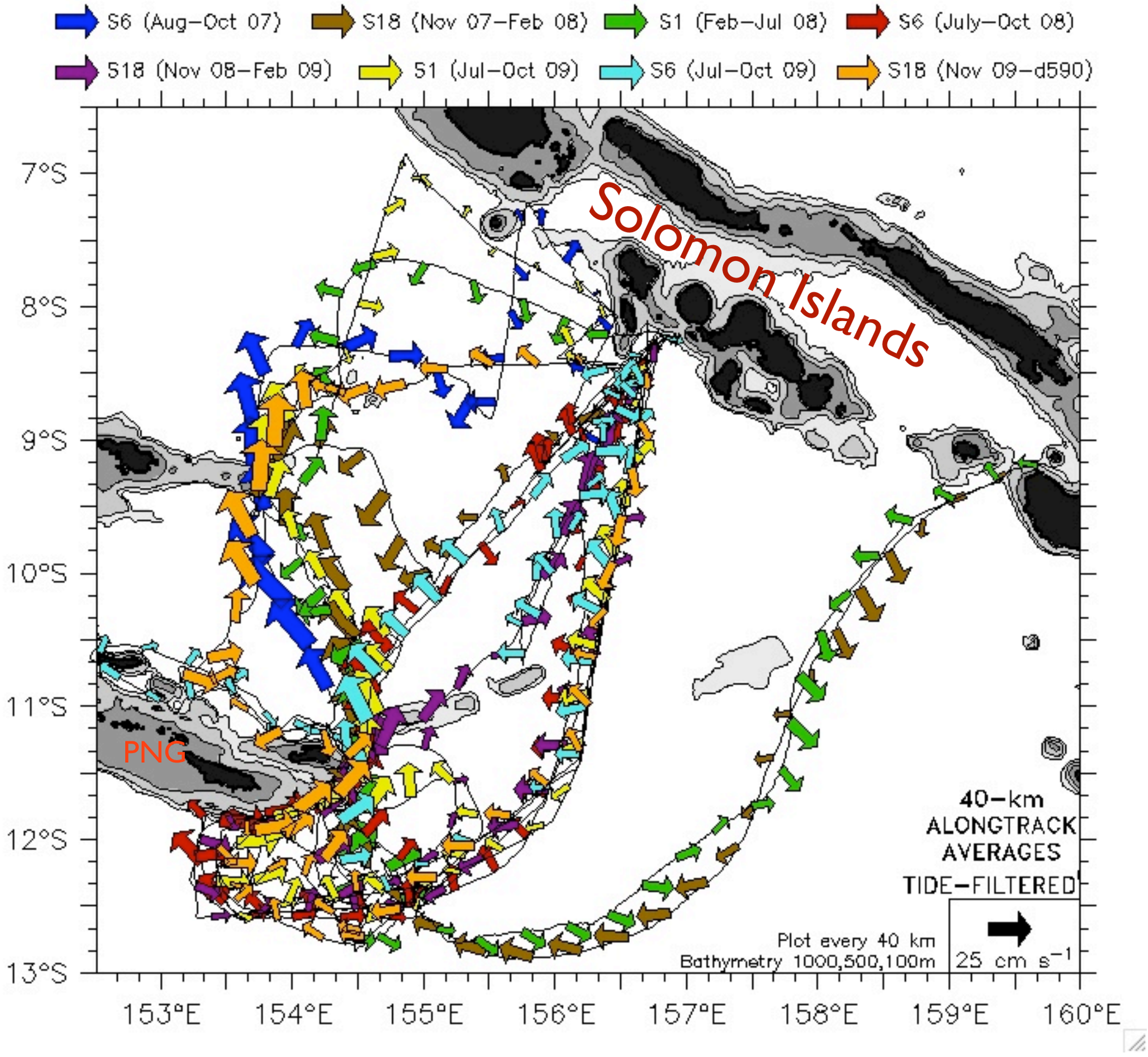


Bathymetry of the Solomon Sea

Showing glider operations area: Solomons to tip of the Louisiade Archipelago



Vertical-average absolute velocity. Jul 2007-Feb 2010



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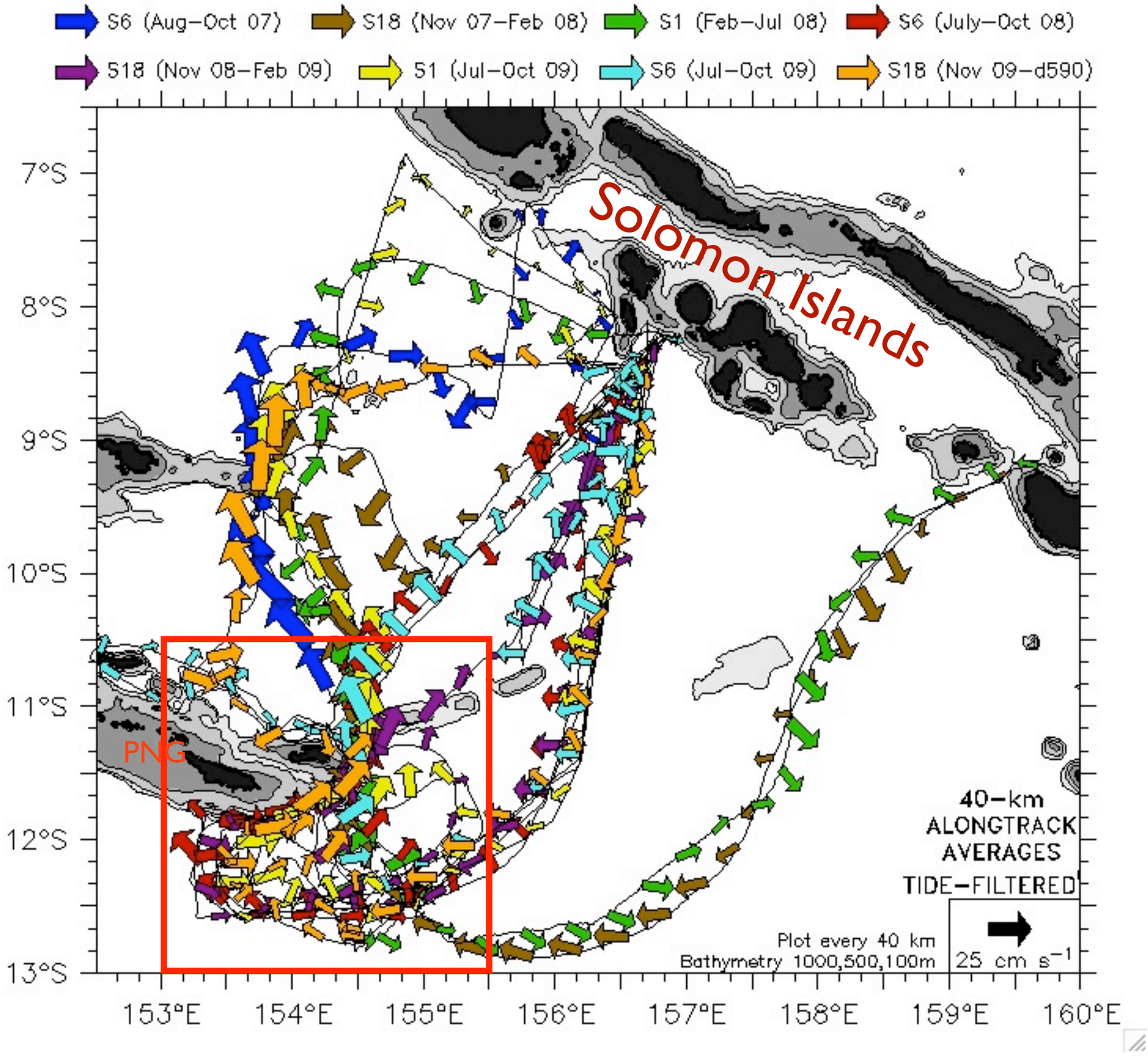

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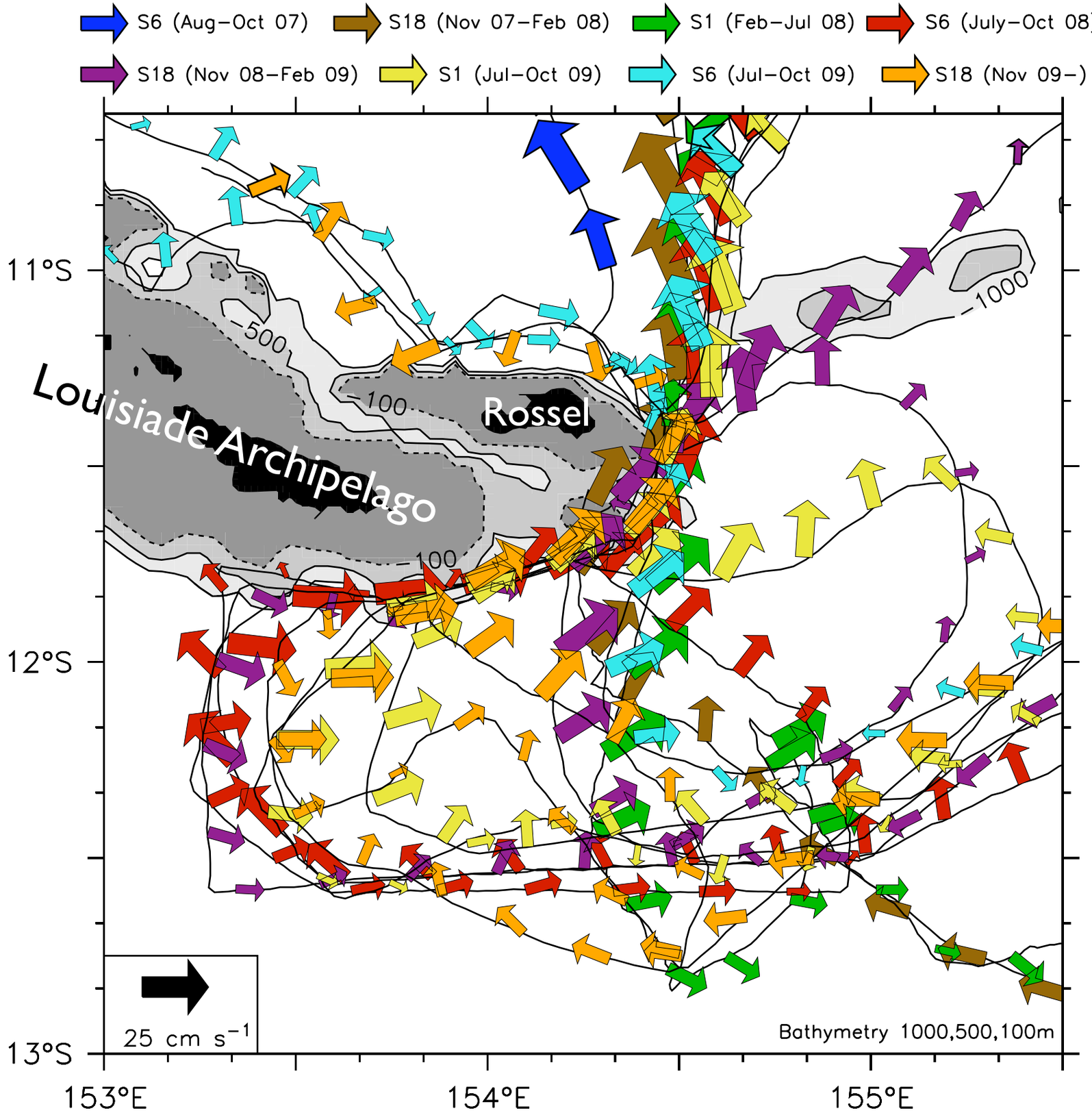
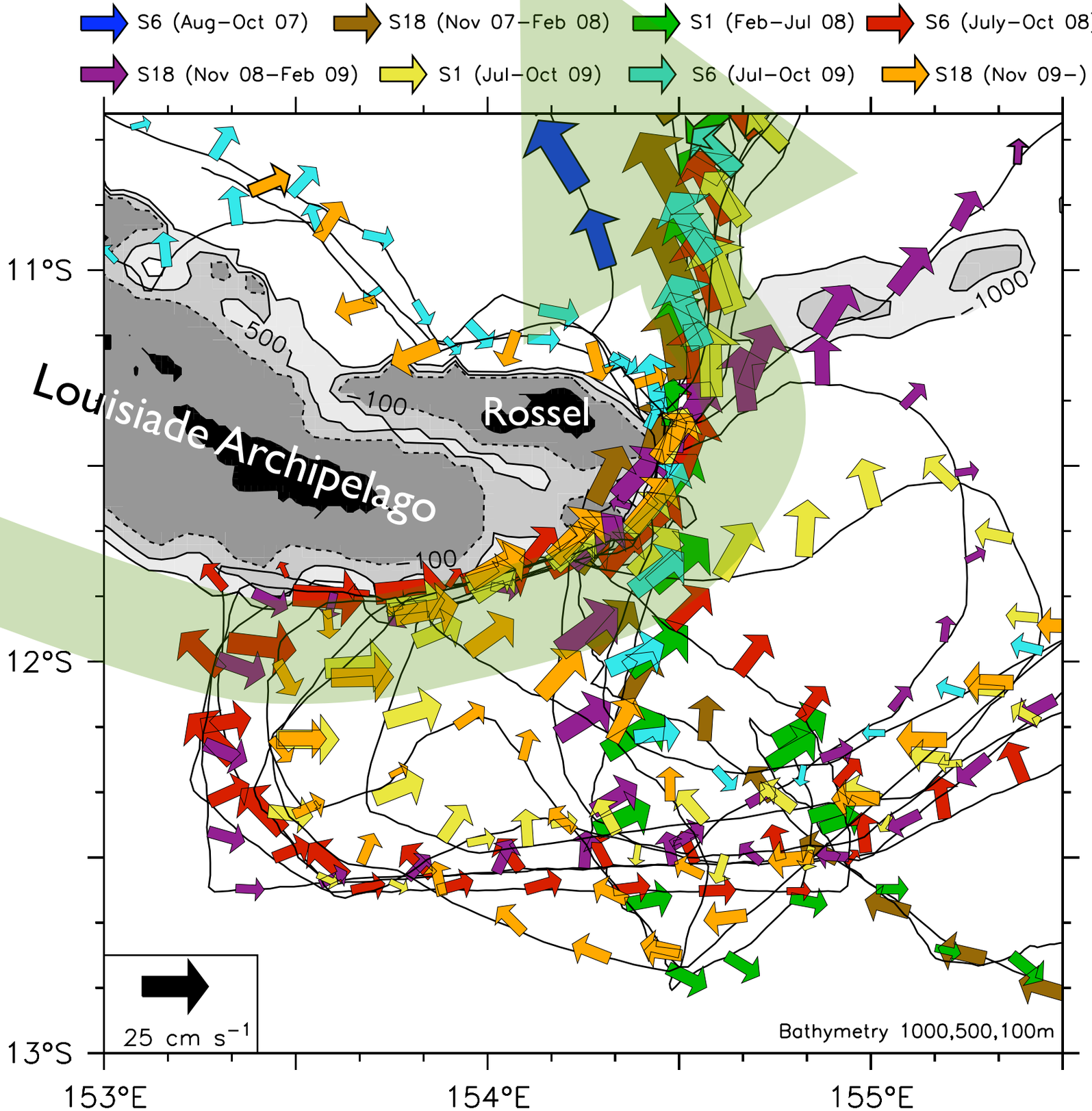


The most consistent observation is a strong boundary current at the tip of the Louisiade Archipelago.

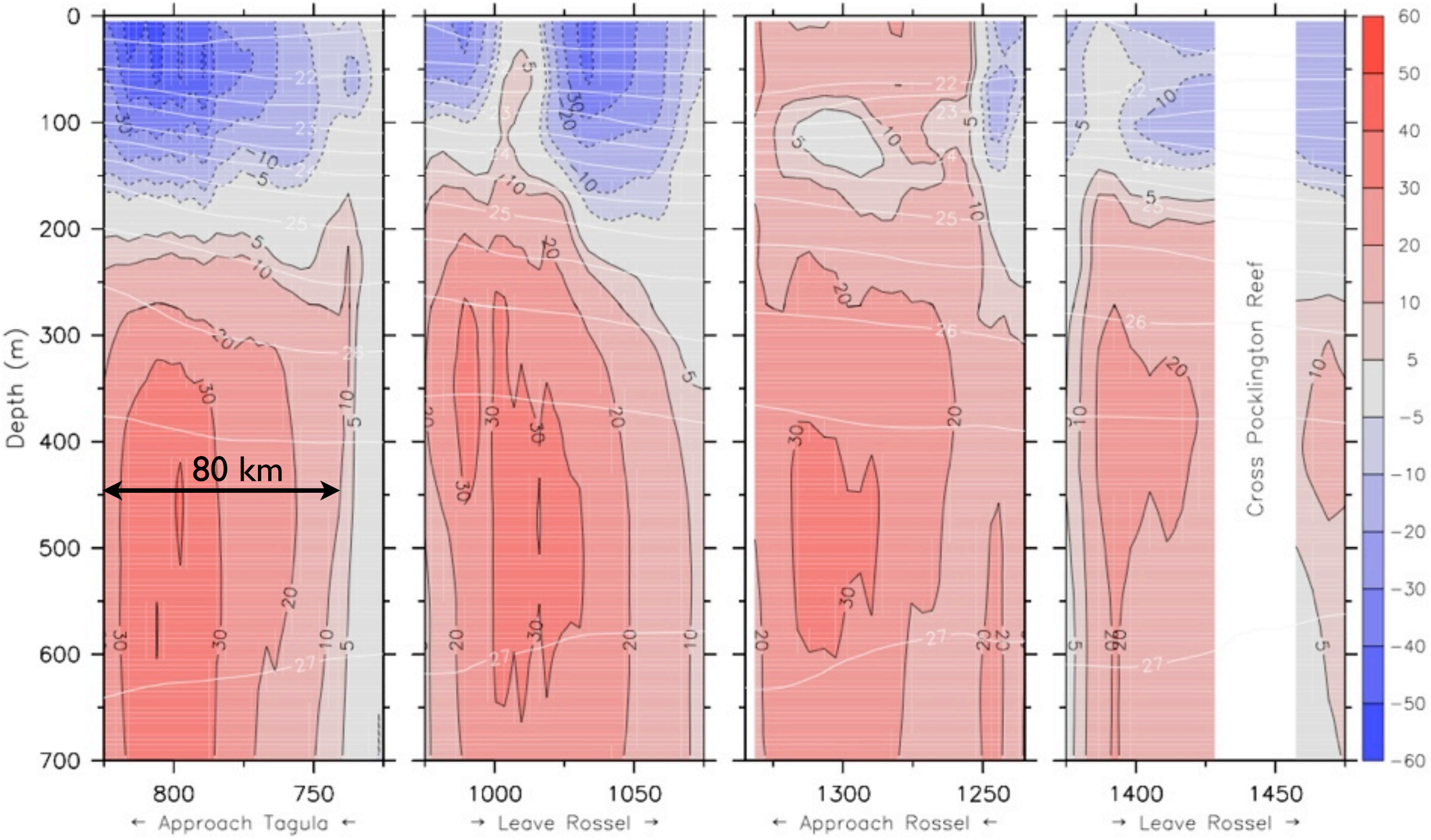
Vertical-average absolute velocity. Jul 2007-Feb 2010



The most consistent observation is a strong boundary current at the tip of the Louisiade Archipelago.

Absolute crosstrack geostrophic velocity in the NGCU

Positive equatorward. Coast on the left



Each section shows 100km from the coast on the left. Glider obs Dec 08-Jan 09

Velocity and salinity profiles in the NGCU

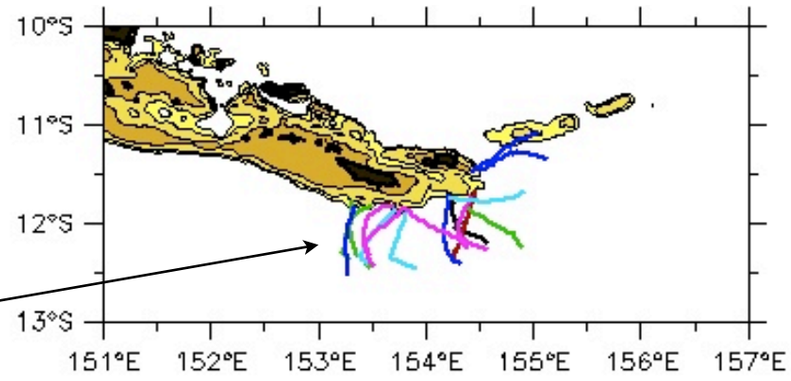
Speed vs depth (left), density (right)

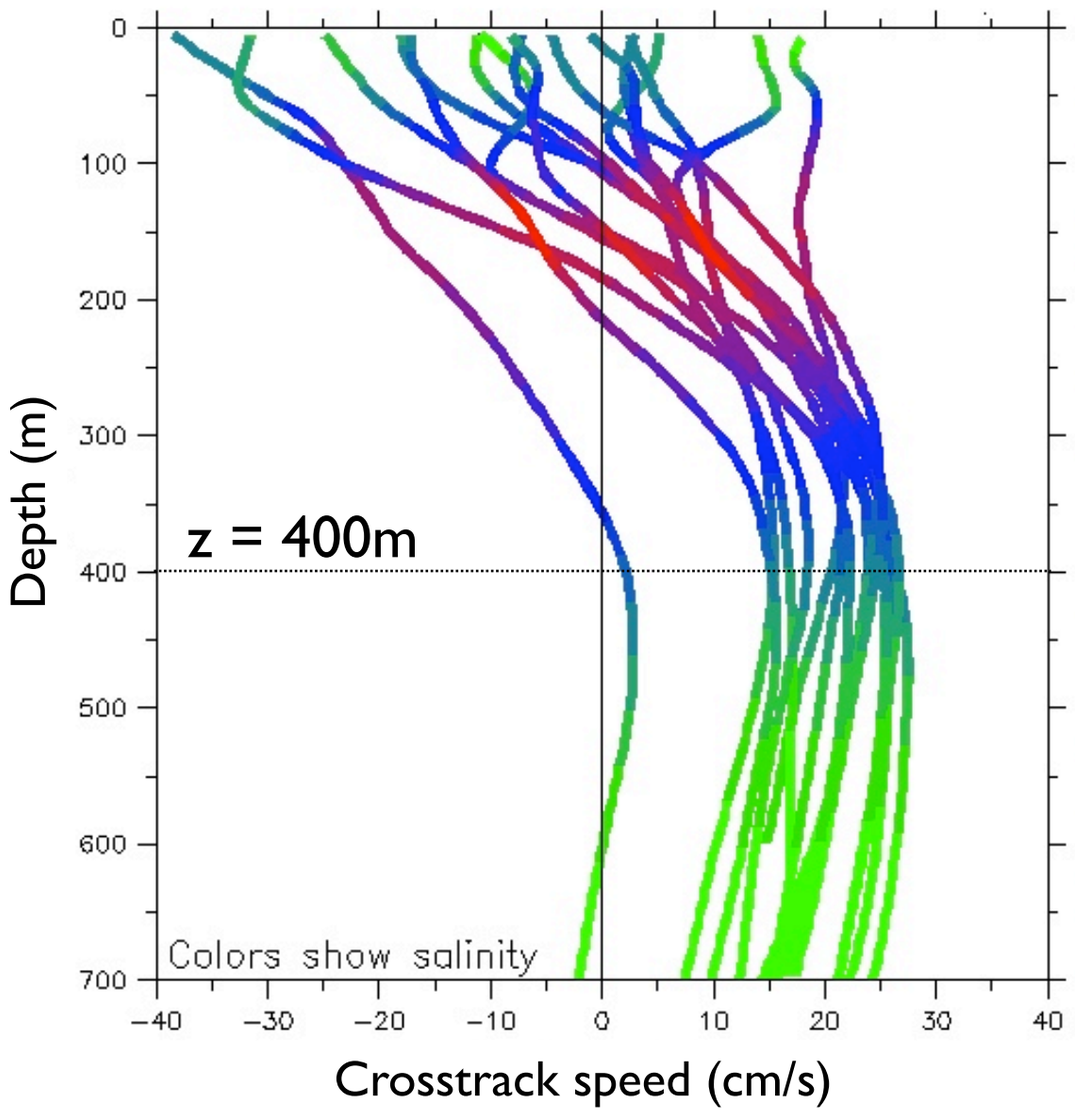
Colors show salinity

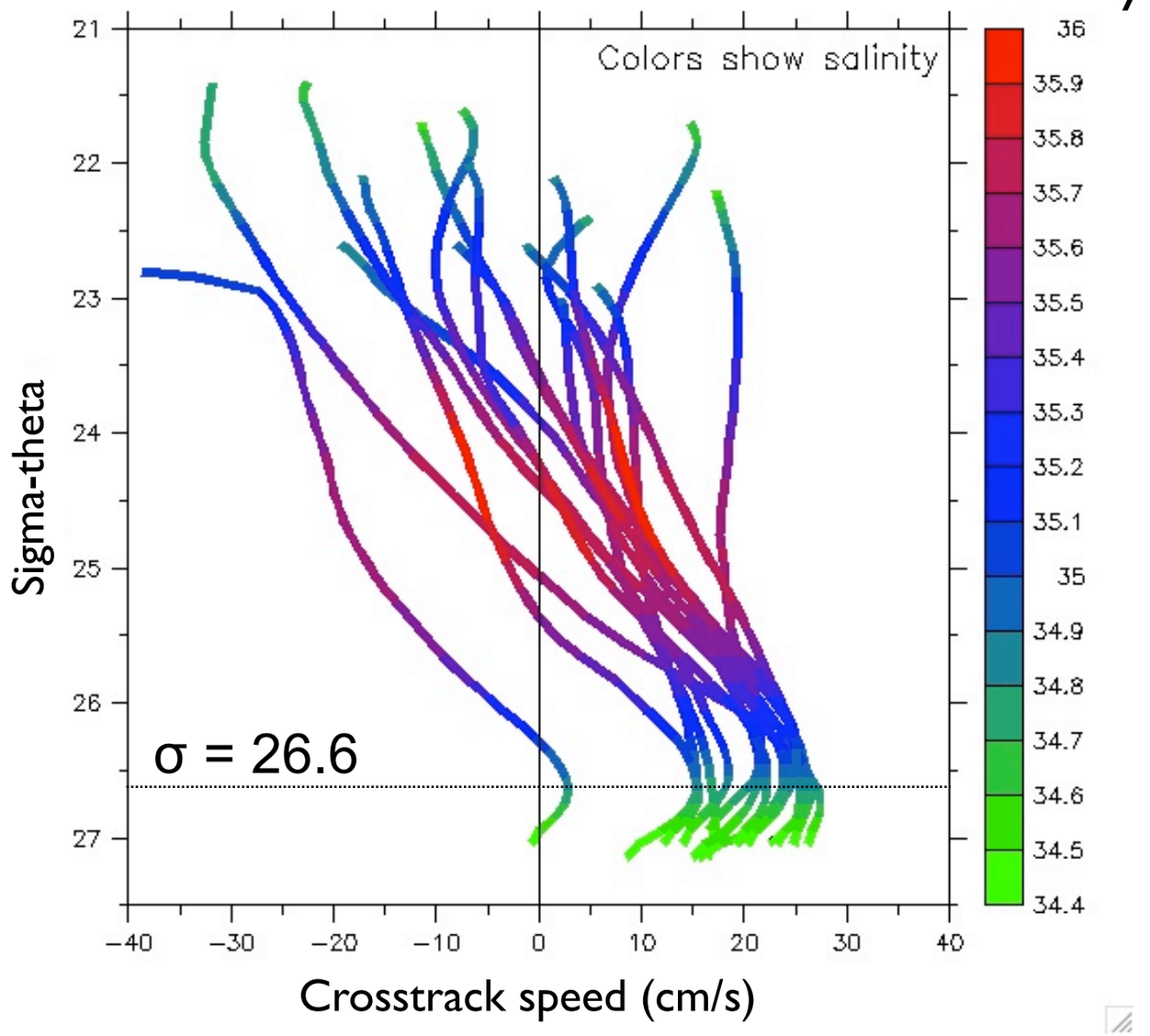
Sections are averages within 85km of the coast

Map showing section locations

16 sections during Dec 07-Jan 10

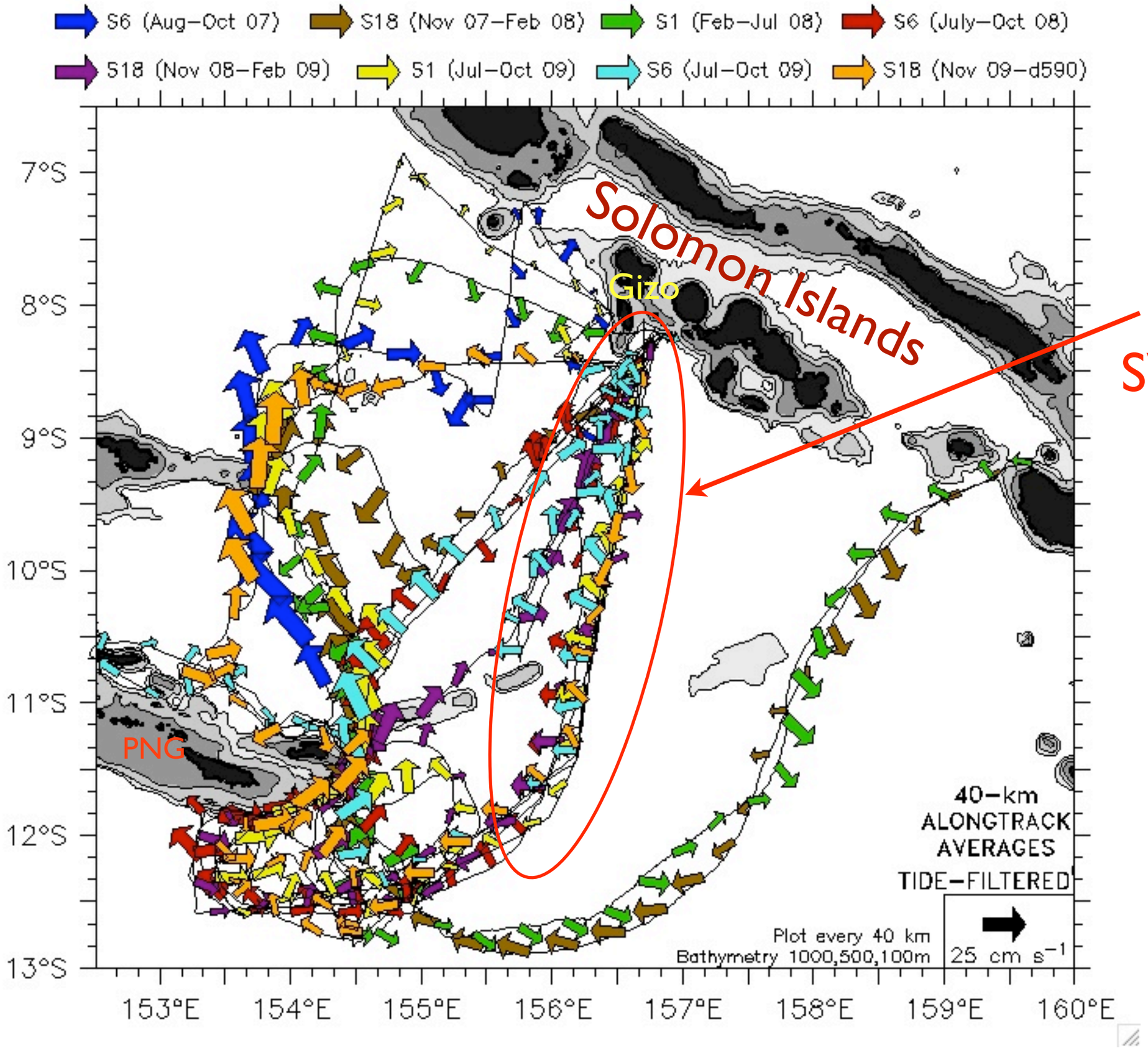




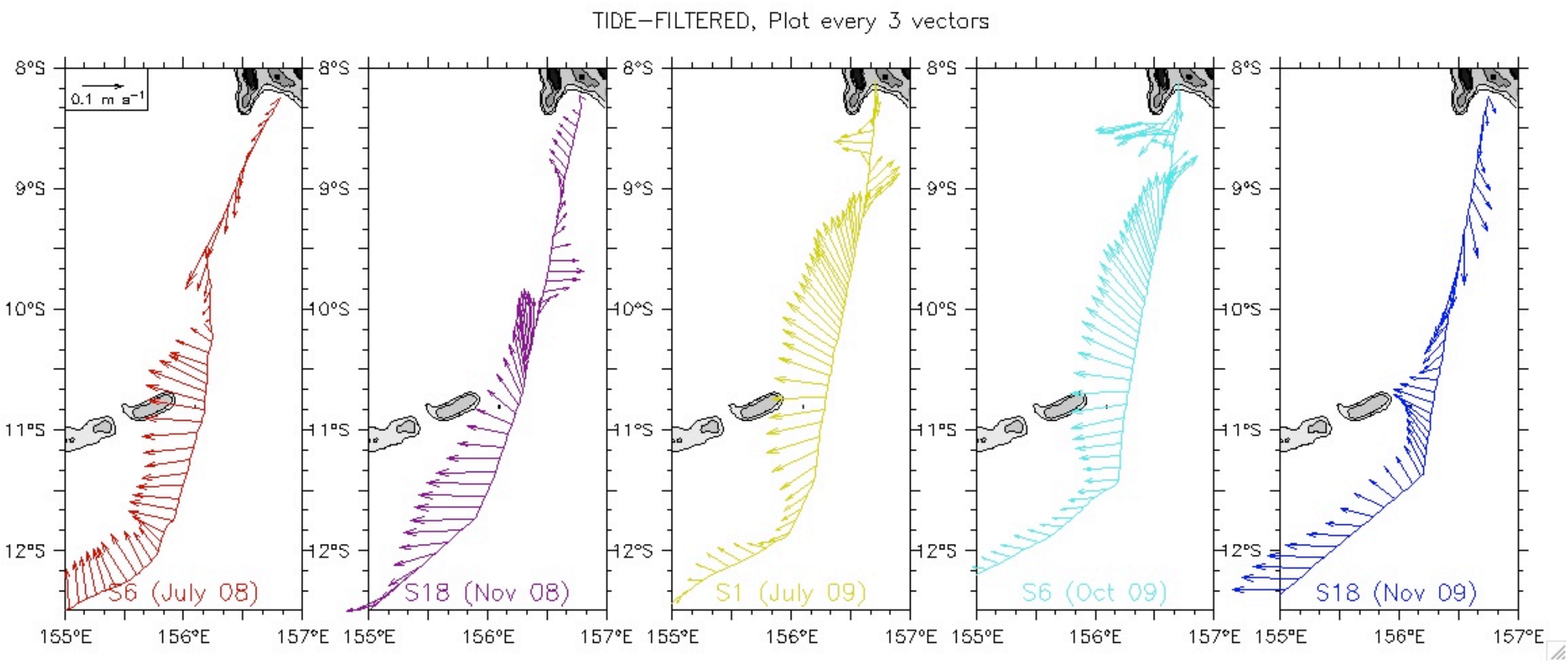


A highly-sheared system

Vertical-average absolute velocity. Jul 2007-Feb 2010



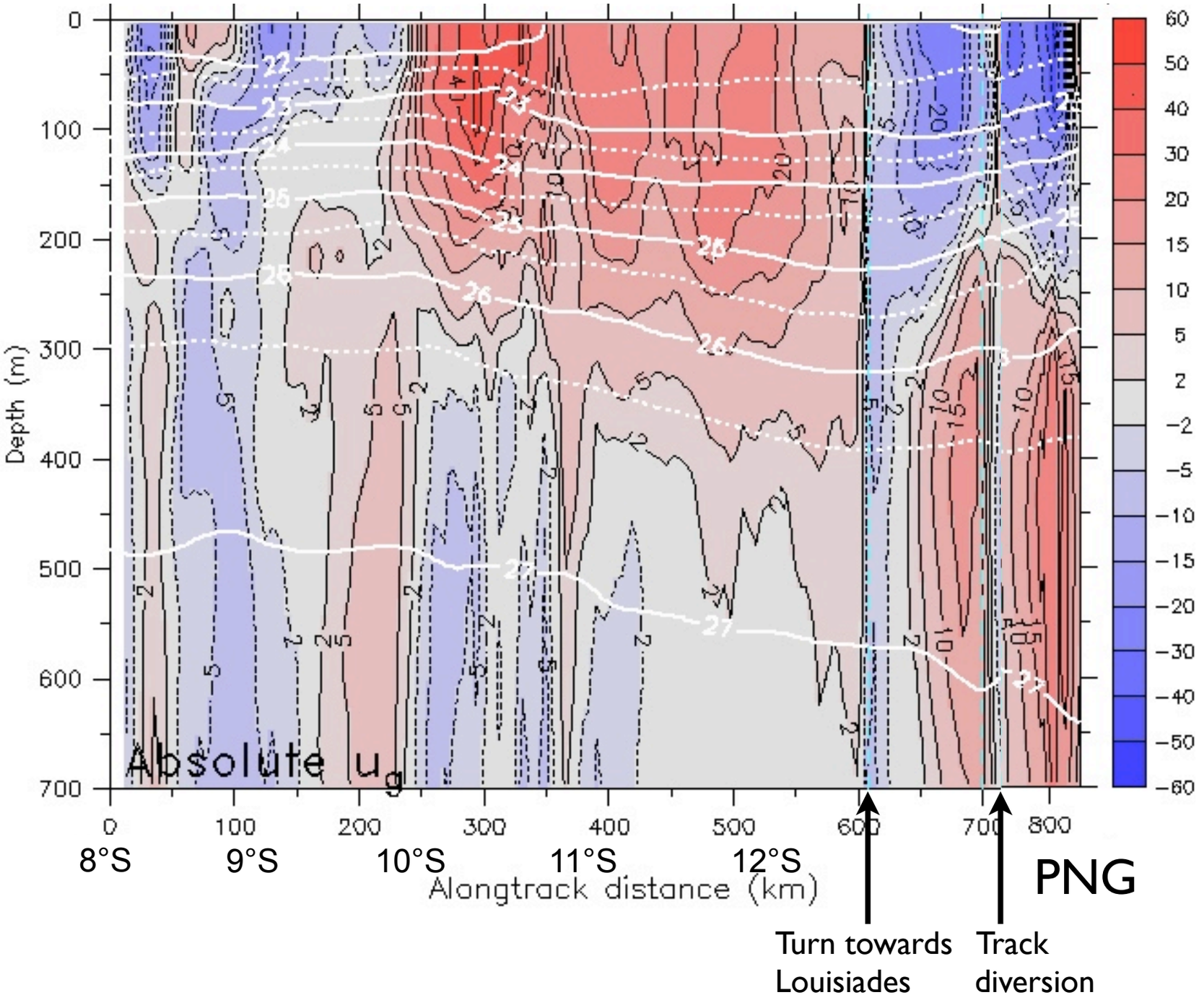
0-700m currents on the repeated track south from Gizo

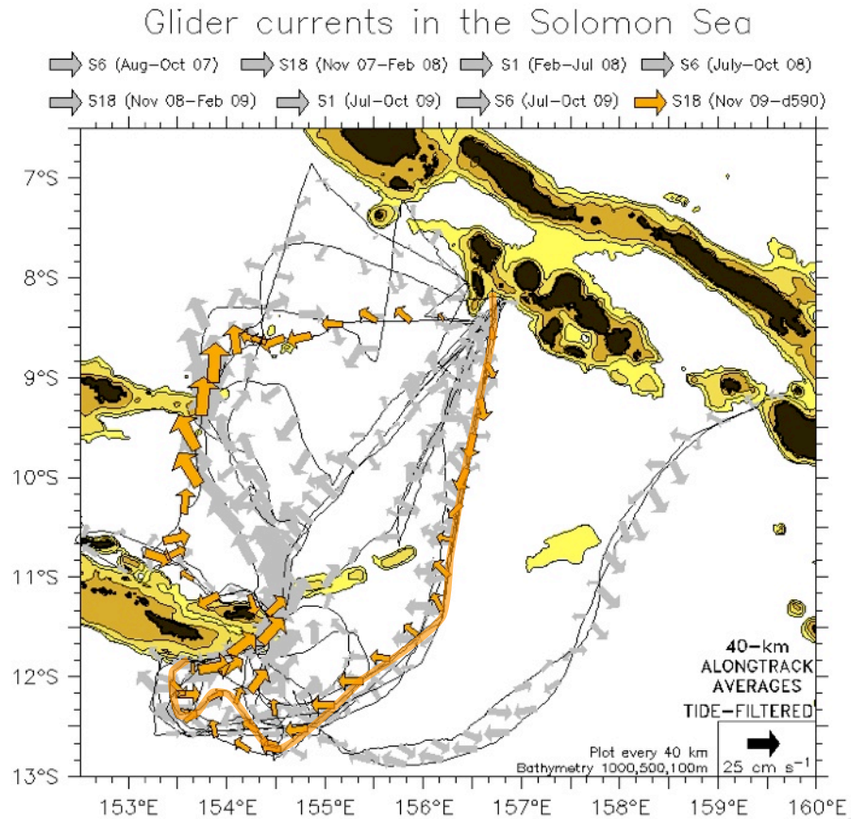


There is always a shallow jet entering the Solomon Sea from the SE.

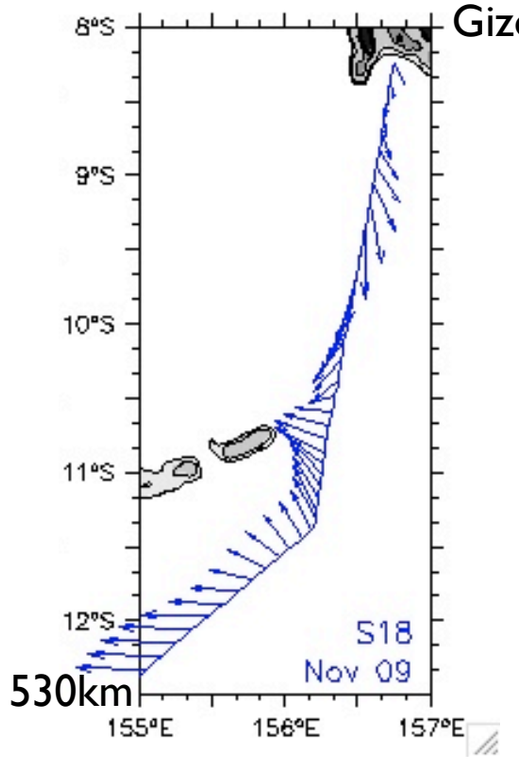
Absolute crosstrack u_g (Present mission)

Gizo …… Interior region ……|←WBC→|



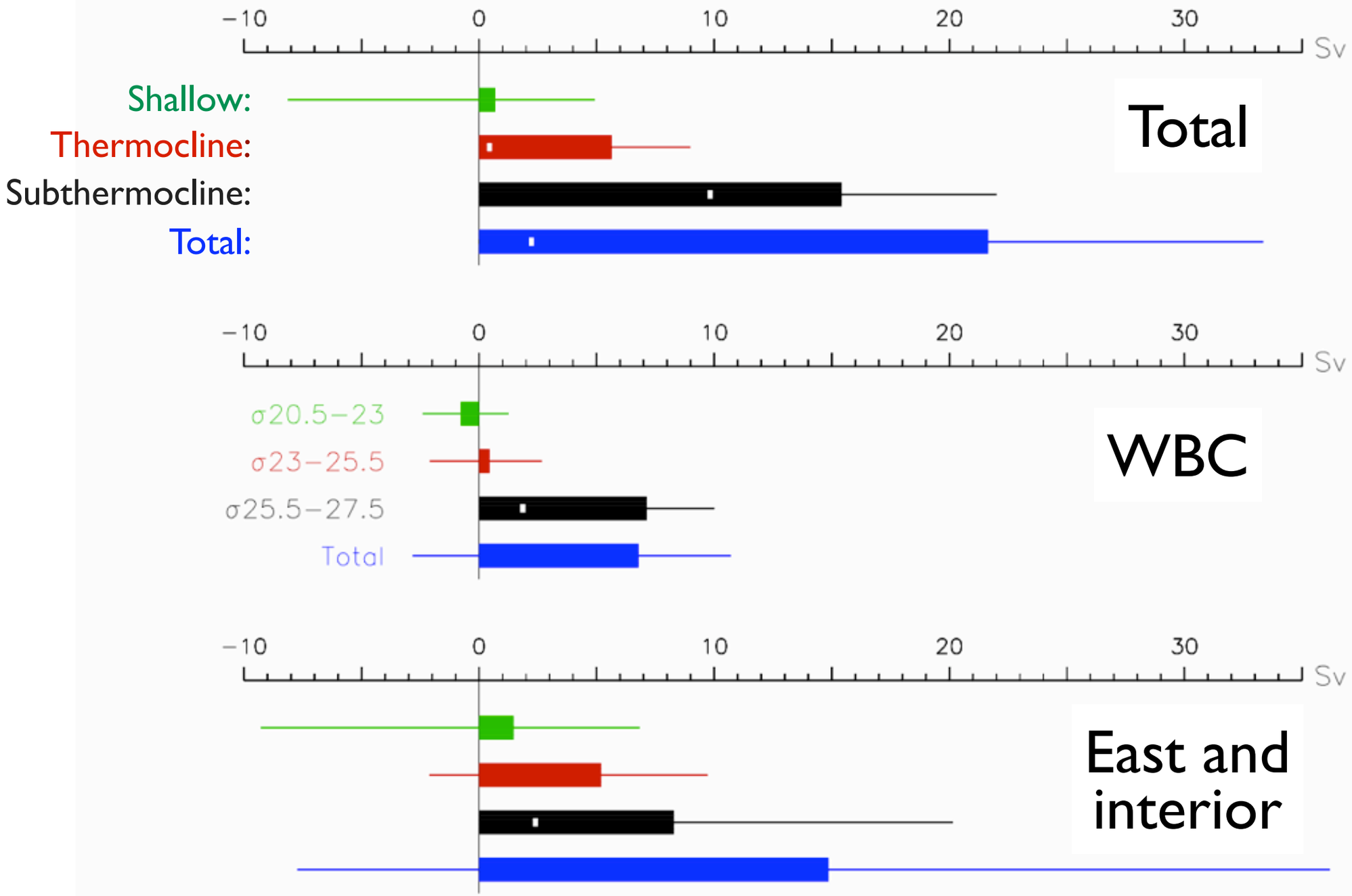


Vertical average



(Positive (red) = equatorward)

Solomon Sea mean transport in density classes: WBC vs Interior

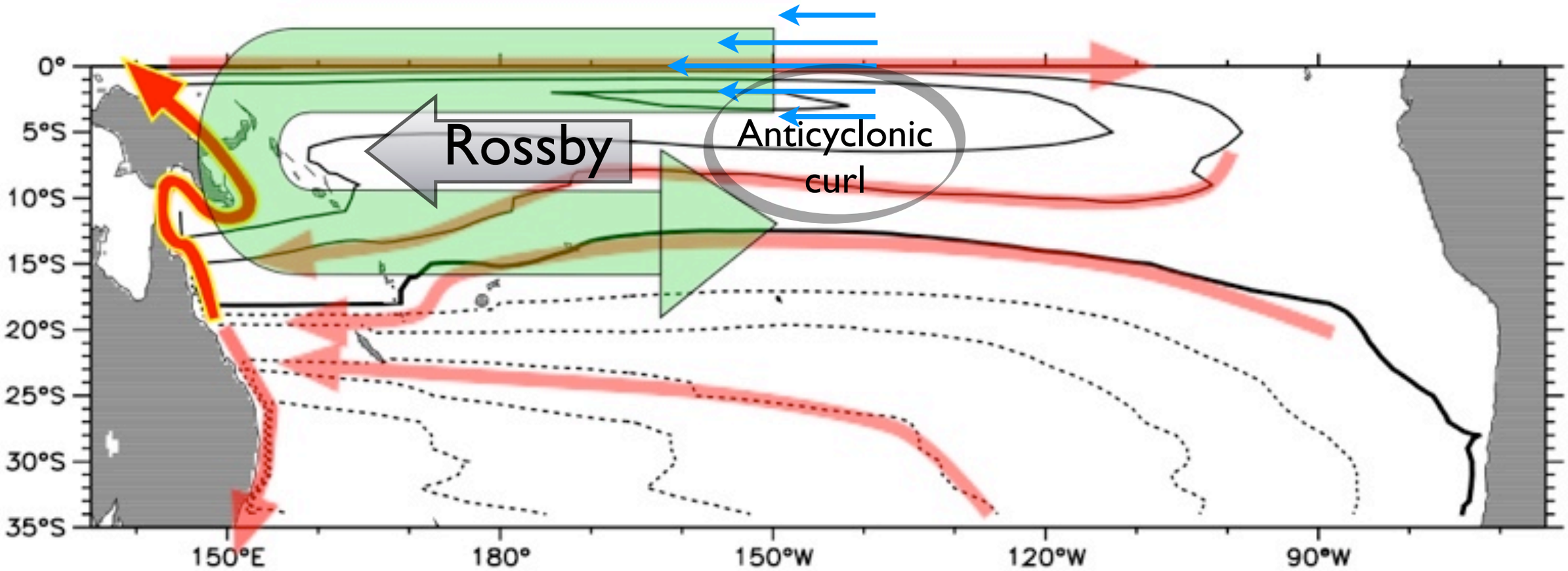


Thin lines/white ticks indicate range of values

La Niña transport anomalies

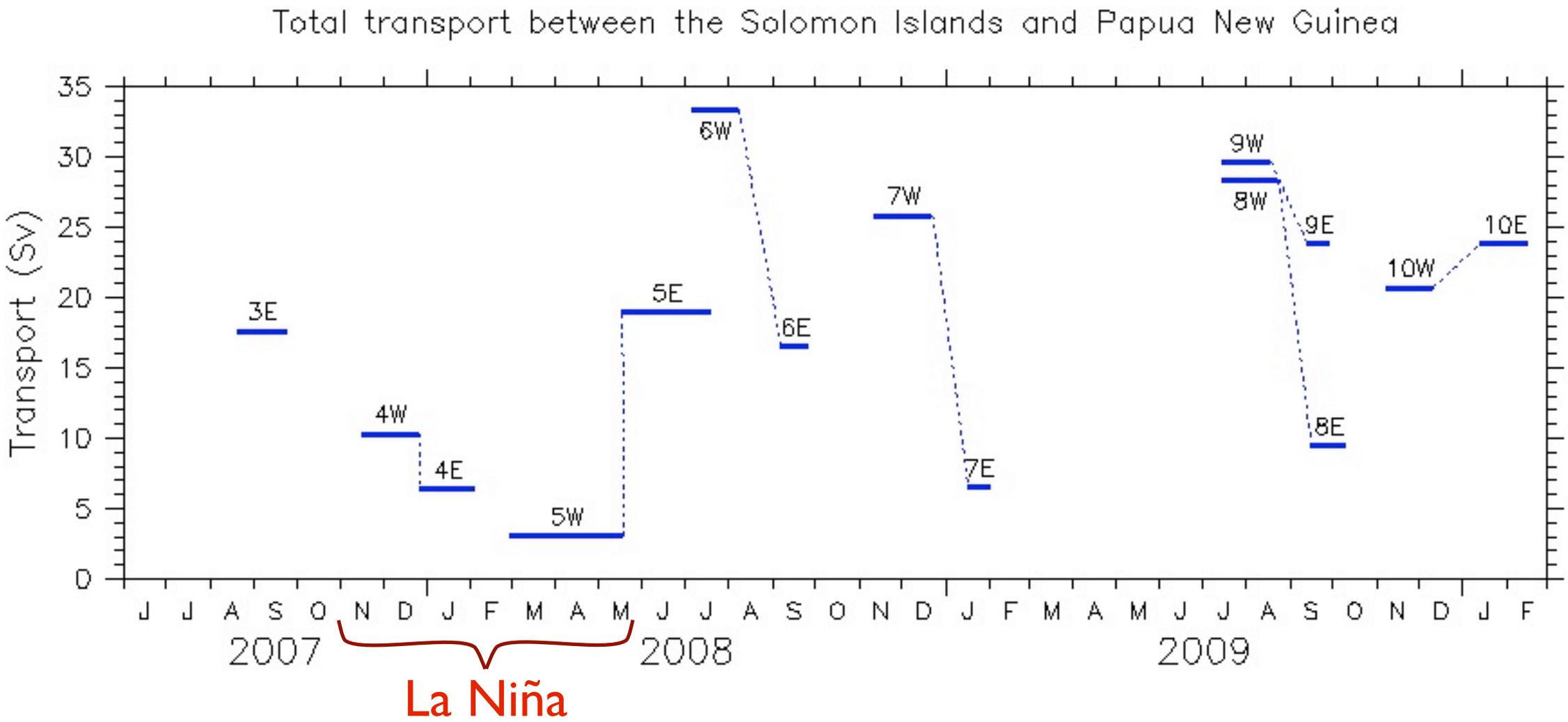
ENSO modifies western boundary transports:

La Niña tends to weaken the WBC in the west



Downwelling curl east of the Solomon Sea during La Niña:
northward interior Sverdrup flow ... Rossby waves ...
→ expect southward WBC anomalies a few months later.

Solomon Sea transport measured by the Spray glider

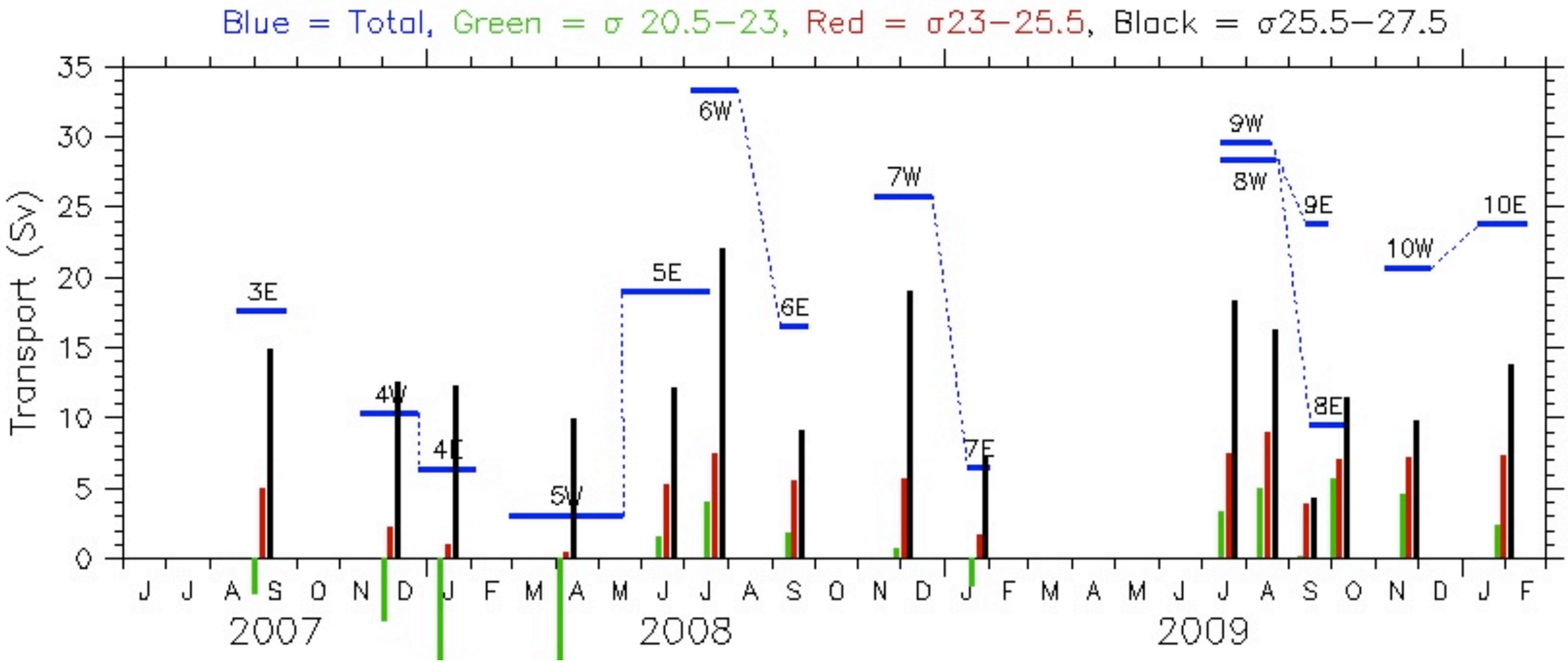


→ Large short-term transport changes show eddy activity.

→ The La Niña of 2007-08 produced
a drastic reduction of equatorward transport.

Solomon Sea transport measured by the Spray glider

Total cross-sea transport: Breakdown by density classes



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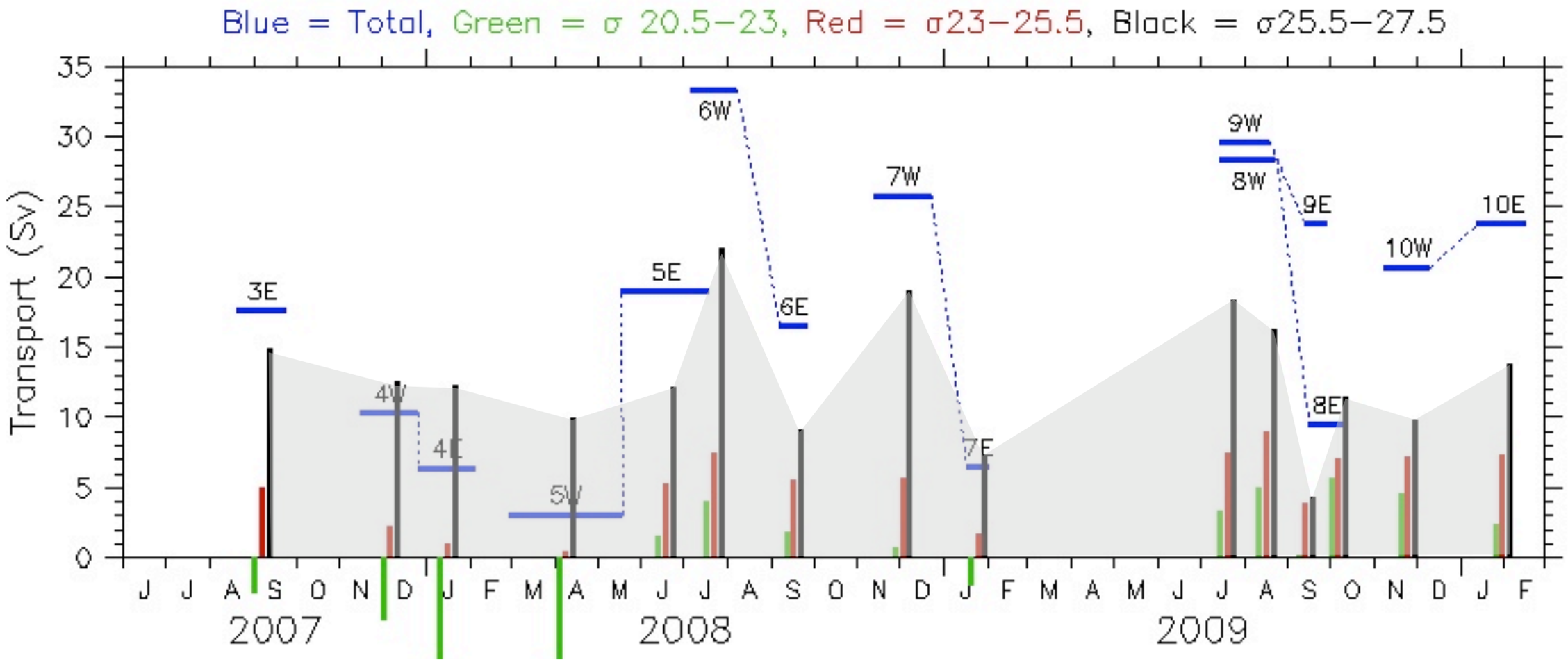
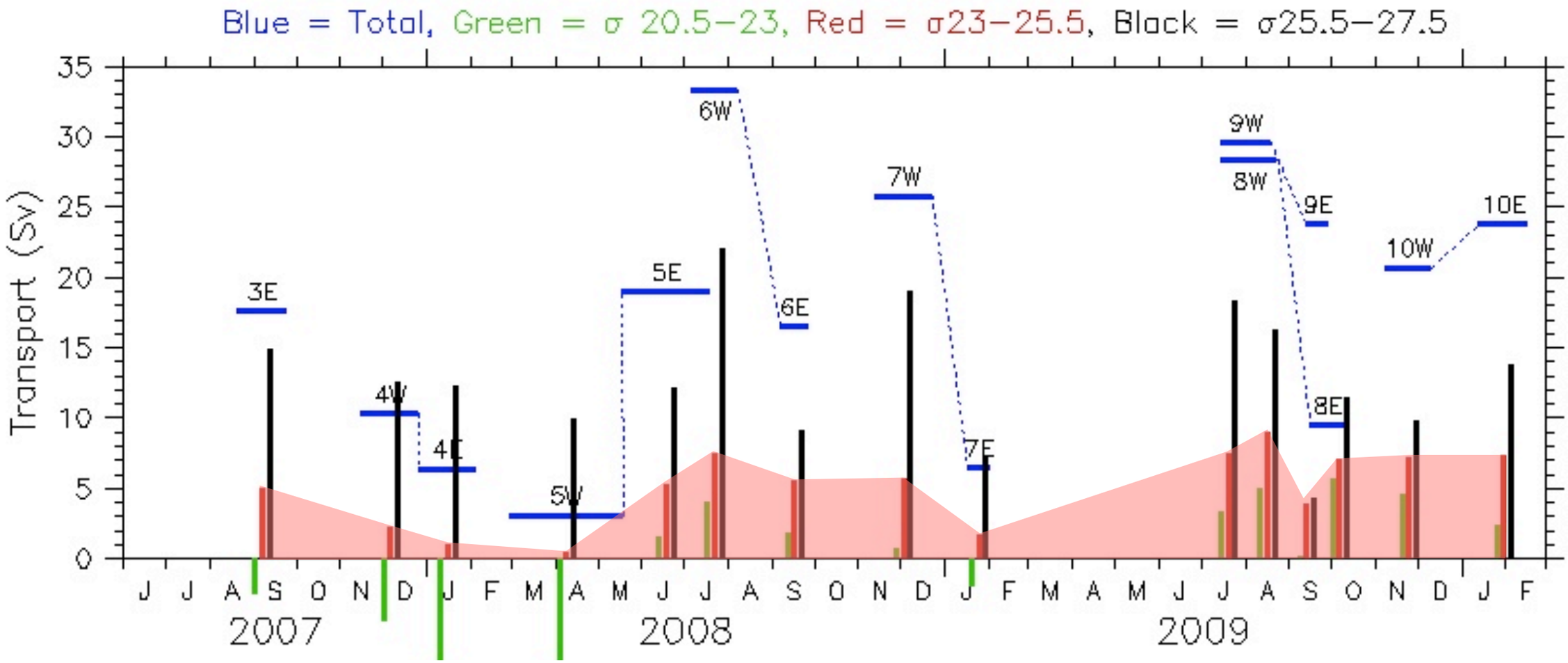


Subthermocline transport

Solomon Sea transport measured by the Spray glider

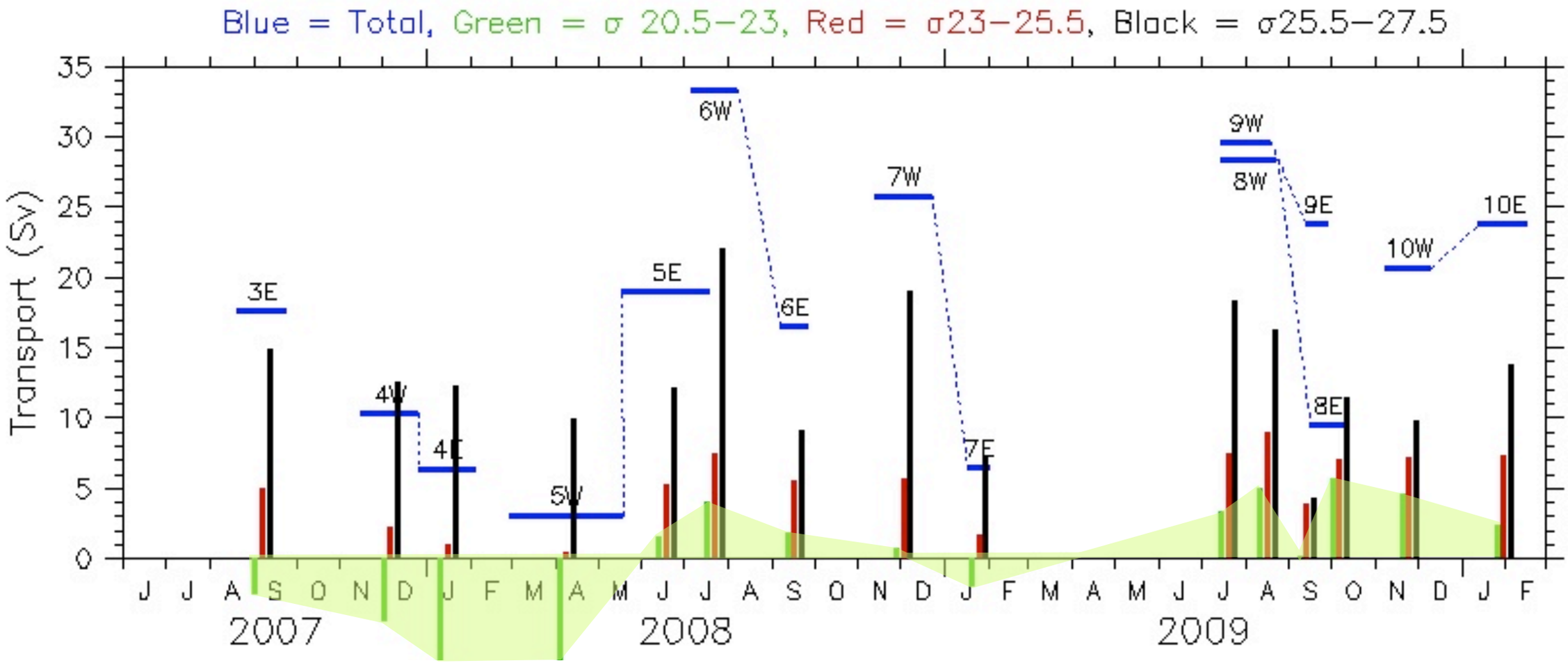
Total cross-sea transport: Breakdown by density classes



Thermocline transport

Solomon Sea transport measured by the Spray glider

Total cross-sea transport: Breakdown by density classes



Shallow transport

Cartoon of the Solomon Sea

Highly schematic circulation:

Upper layer

Subthermocline