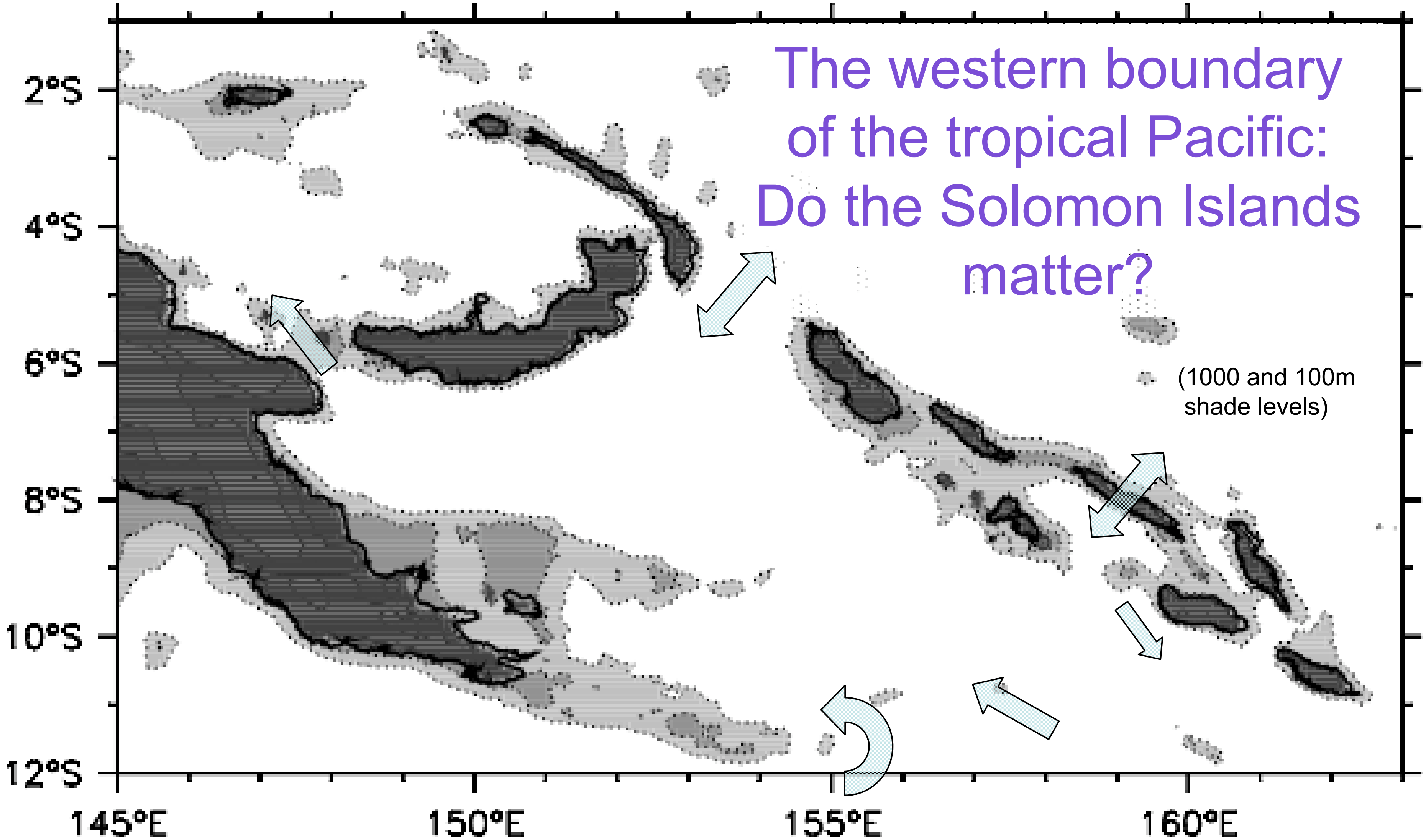
# The western boundary of the tropical Pacific: Do the Solomon Islands matter?




William S. Kessler (NOAA/PMEL) and Lionel Gourdeau (IRD-Nouméa)

# The problem turned out to be both too easy and too hard …

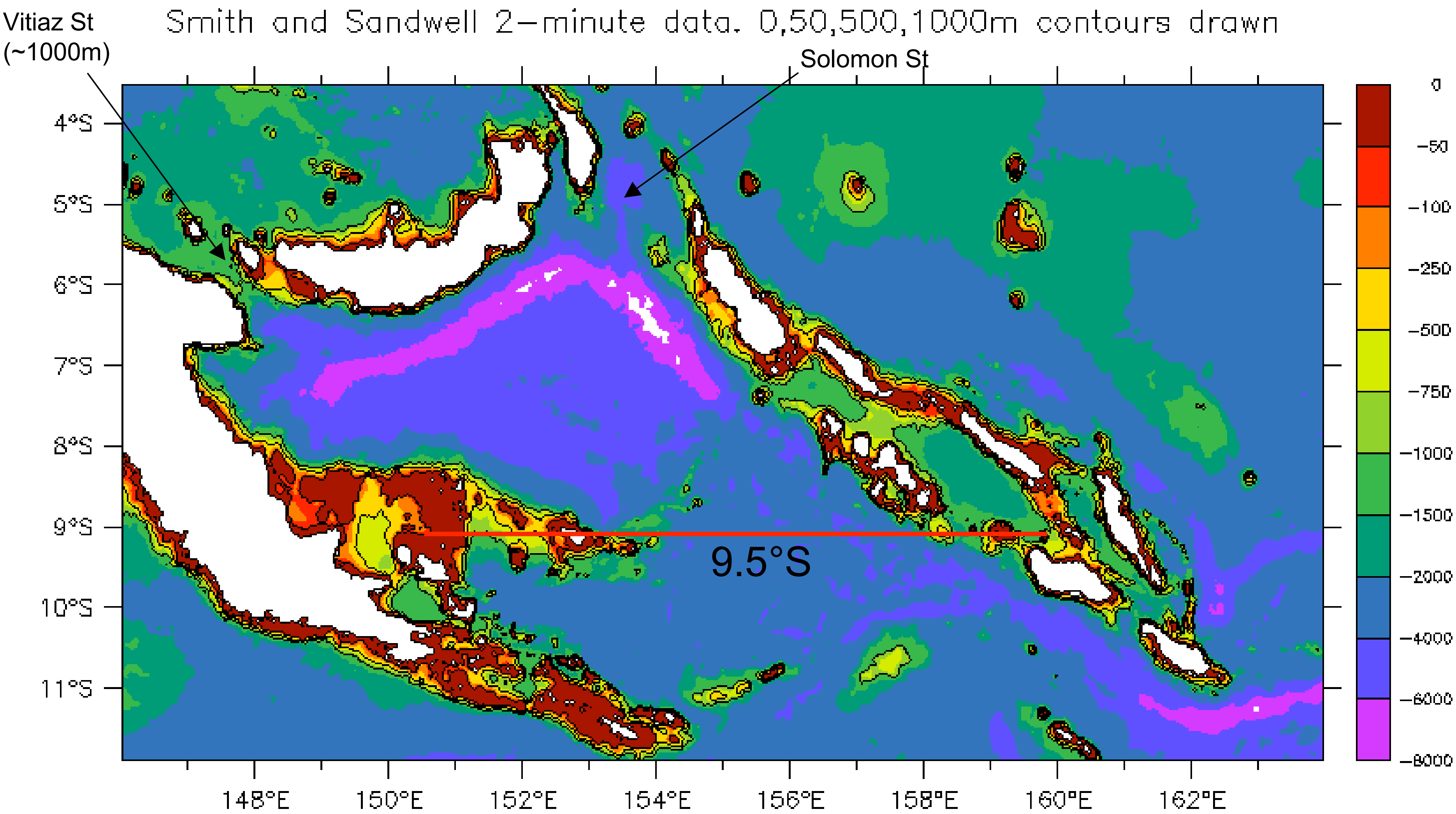
- Too easy, because the meridional scale of the ENSO signal is much larger than the Solomons and easily floods around them.

→ The answer is obvious: The Solomons pose no barrier to ENSO wave propagation.

- Too hard, because diagnosing the balance of transport into the Solomon Sea is not presently possible, either from data or models (need ~1/20° resolution).

→ Choose an "easier" piece of the puzzle ….

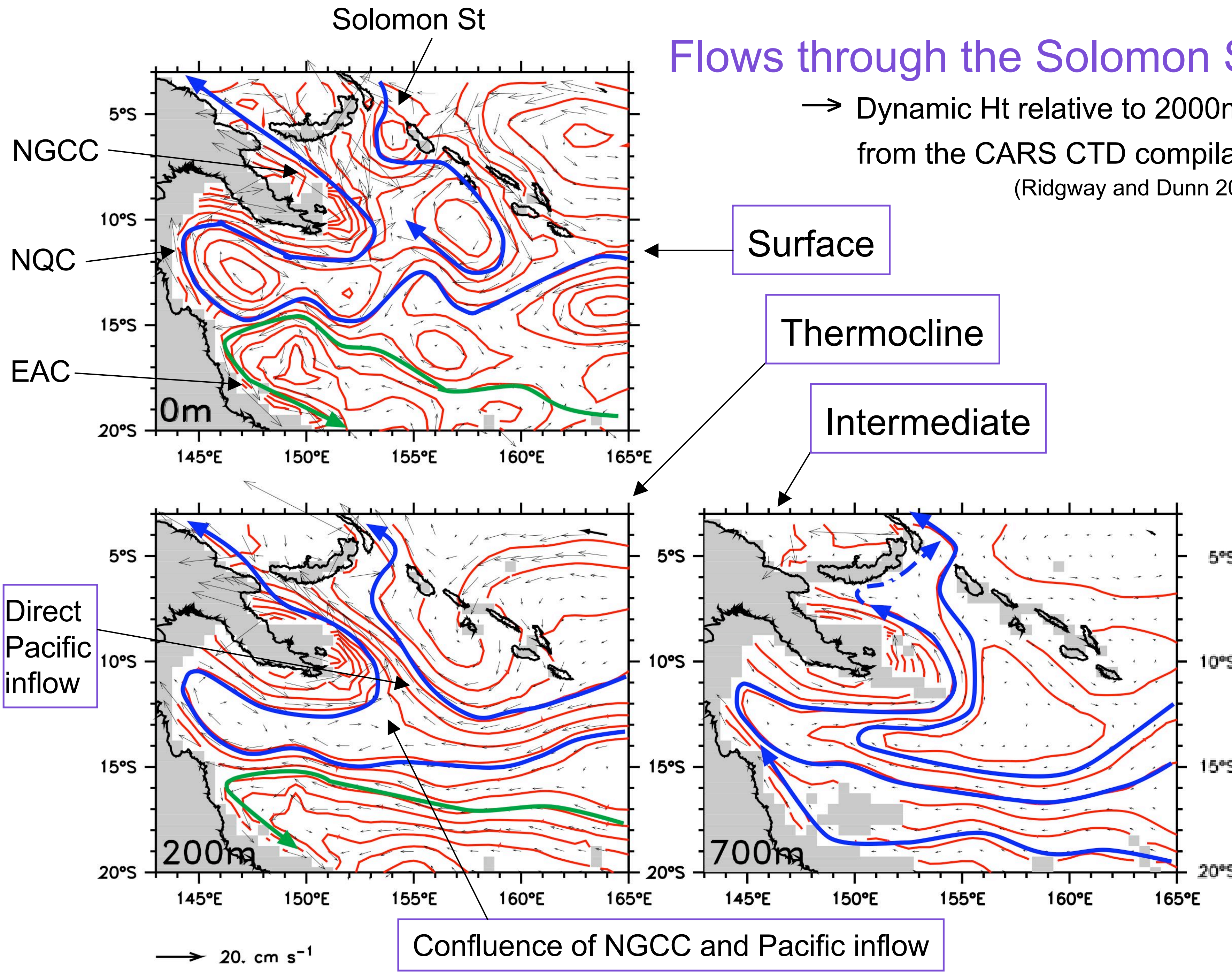
# What is the structure of flow across 9.5°S into the Solomon Sea?



# Flows through the Solomon Sea

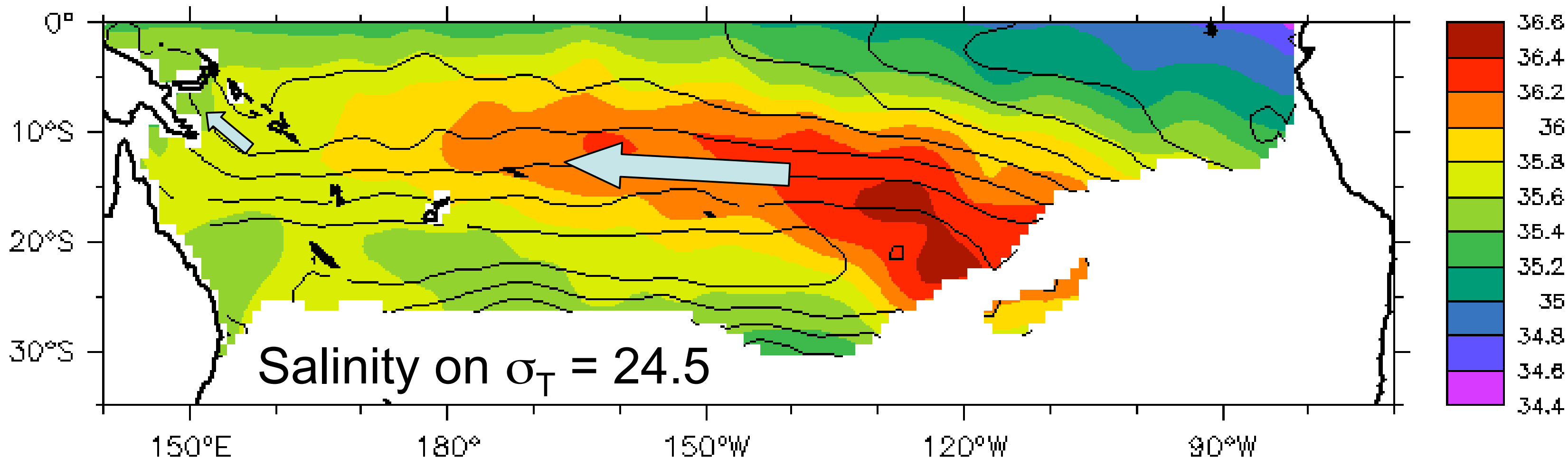
→ Dynamic Ht relative to 2000m from the CARS CTD compilation.

(Ridgway and Dunn 2003)

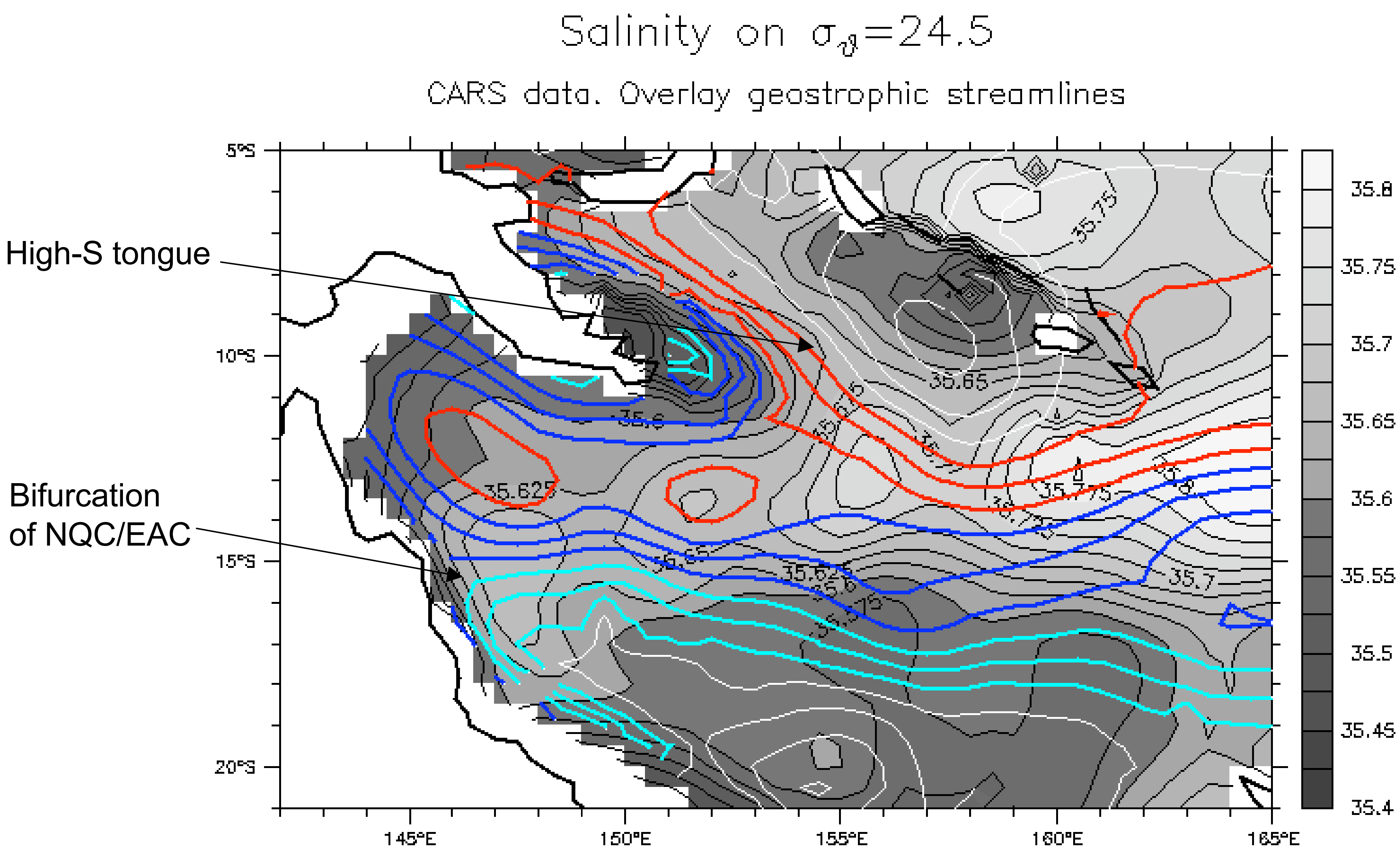


# High salinity traces the thermocline-level flow in the S. Pacific

A tongue subducts in the southeast and flows to the Solomon Sea



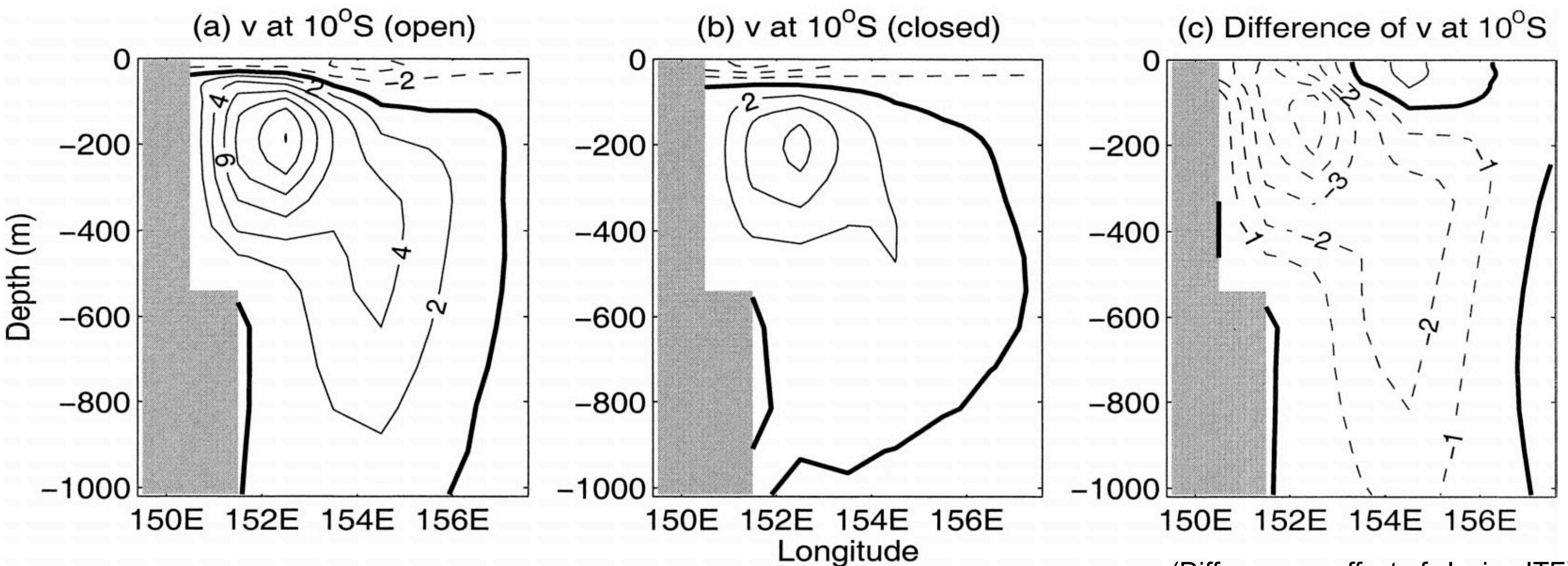
# The high-S tongue enters the Solomon Sea from the open Pacific



# Fewer hints on the intermediate-depth flows …

But this circulation is crucial for understanding the sources of the ITF, in light of the hypothesis that South Pacific intermediate water is transformed into the shallower, warmer outflow of the ITF.

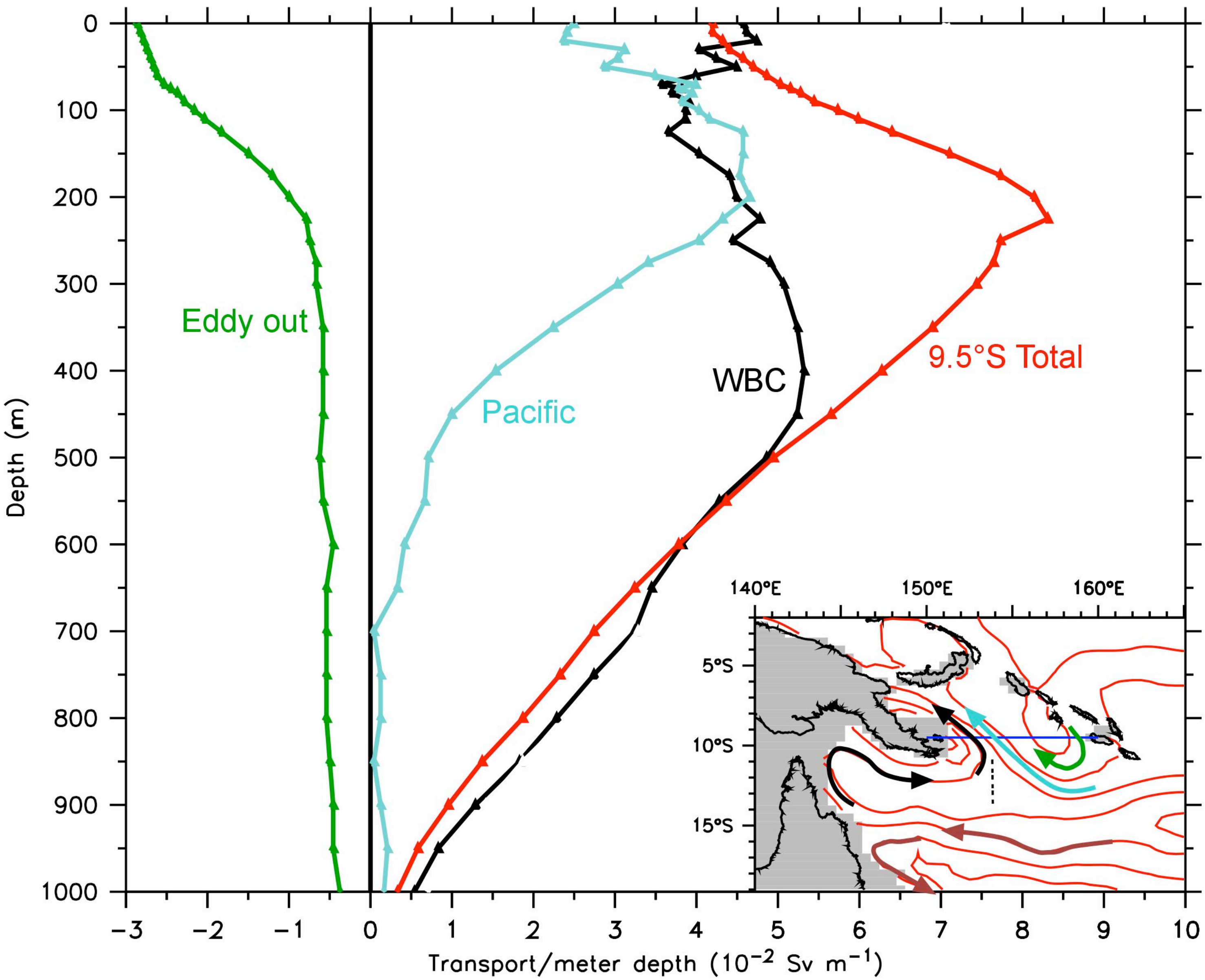
**OGCM meridional current at 10°S with and without an ITF:**




(Difference = effect of closing ITF)

**Lee et al (2002)**
MIT OGCM

# Mean flow across 9.5°S into the Solomon Sea



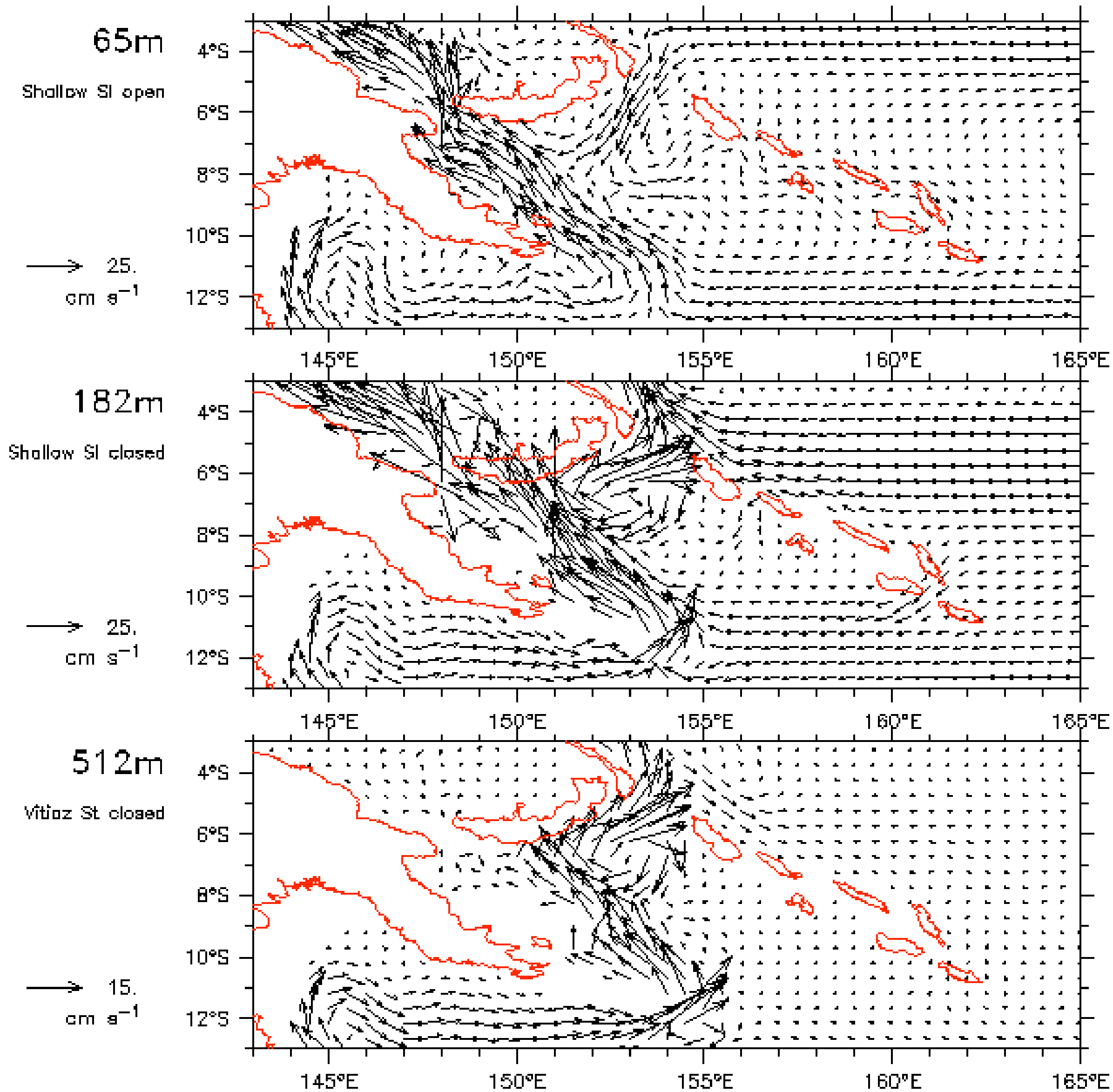

CARS data:

Thermocline flow enters from both the NGCC and the Pacific, but **intermediate water all arrives via the WBC**.

Total transports:

NGCC = 37 Sv
Pacific = 16 Sv
Eddy out = -9 Sv

# ORCA model circulation at surface, thermocline and below



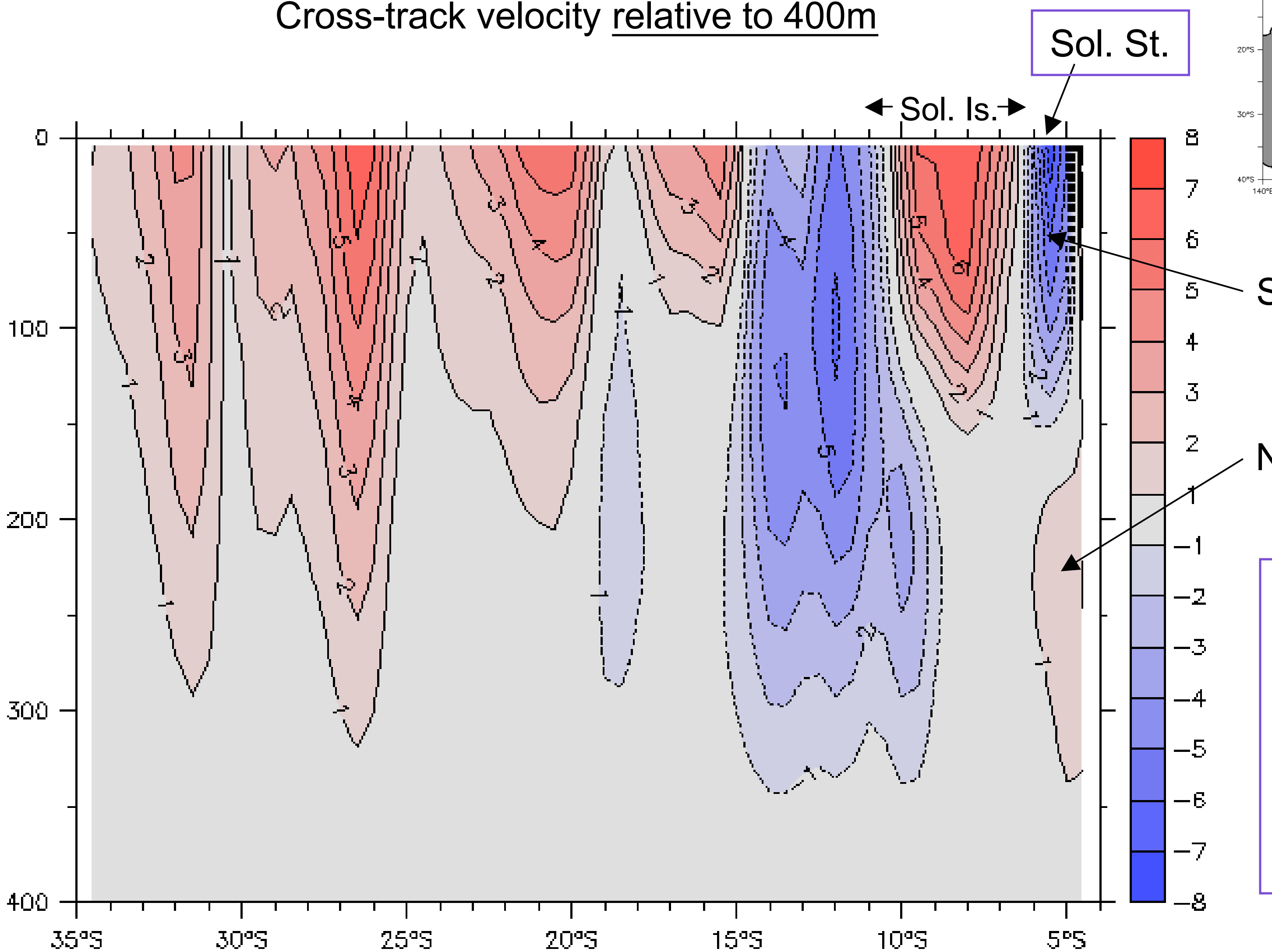

**Above 100m:**
Flow through Sol. St. is *southward*.
(Consistent w/ obs).

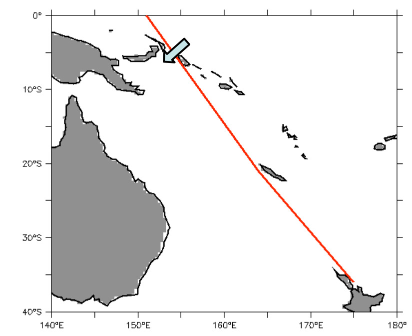
**Thermocline level:**
Sol. St. flow is northward
(Pacific inflow ~1/2 total).

**Below Vitiaz St:**
Entire WBC exits Solomon Sea via Sol. St.
(No Pacific inflow).

# Mean $u_g$ on the Auckland-Solomon St XBT track

Cross-track velocity relative to 400m

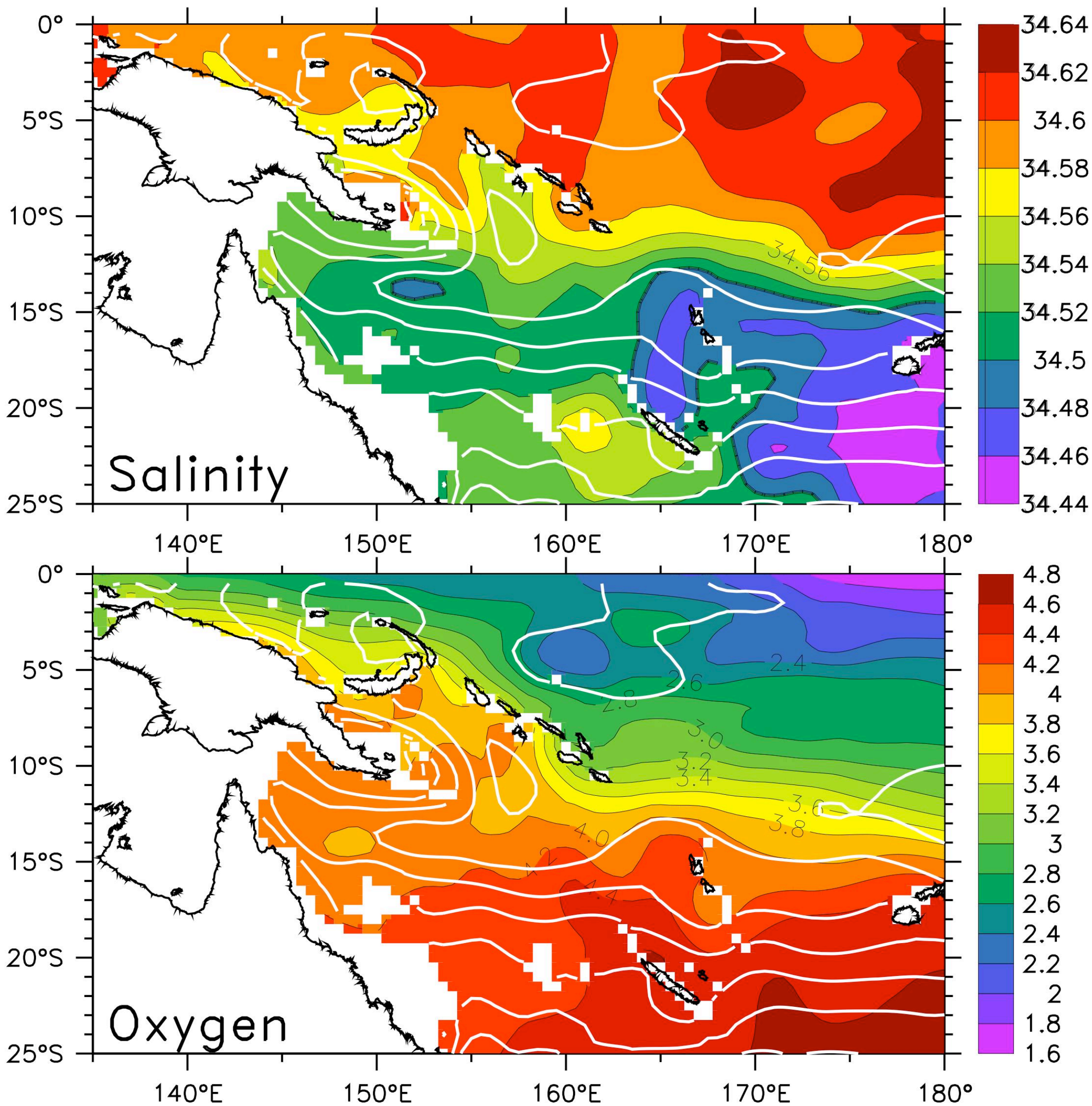


An oblique XBT crossing of the Solomon Strait confirms ORCA model current reversal above the thermocline.

# Salinity and Oxygen on Sigma-theta = 27

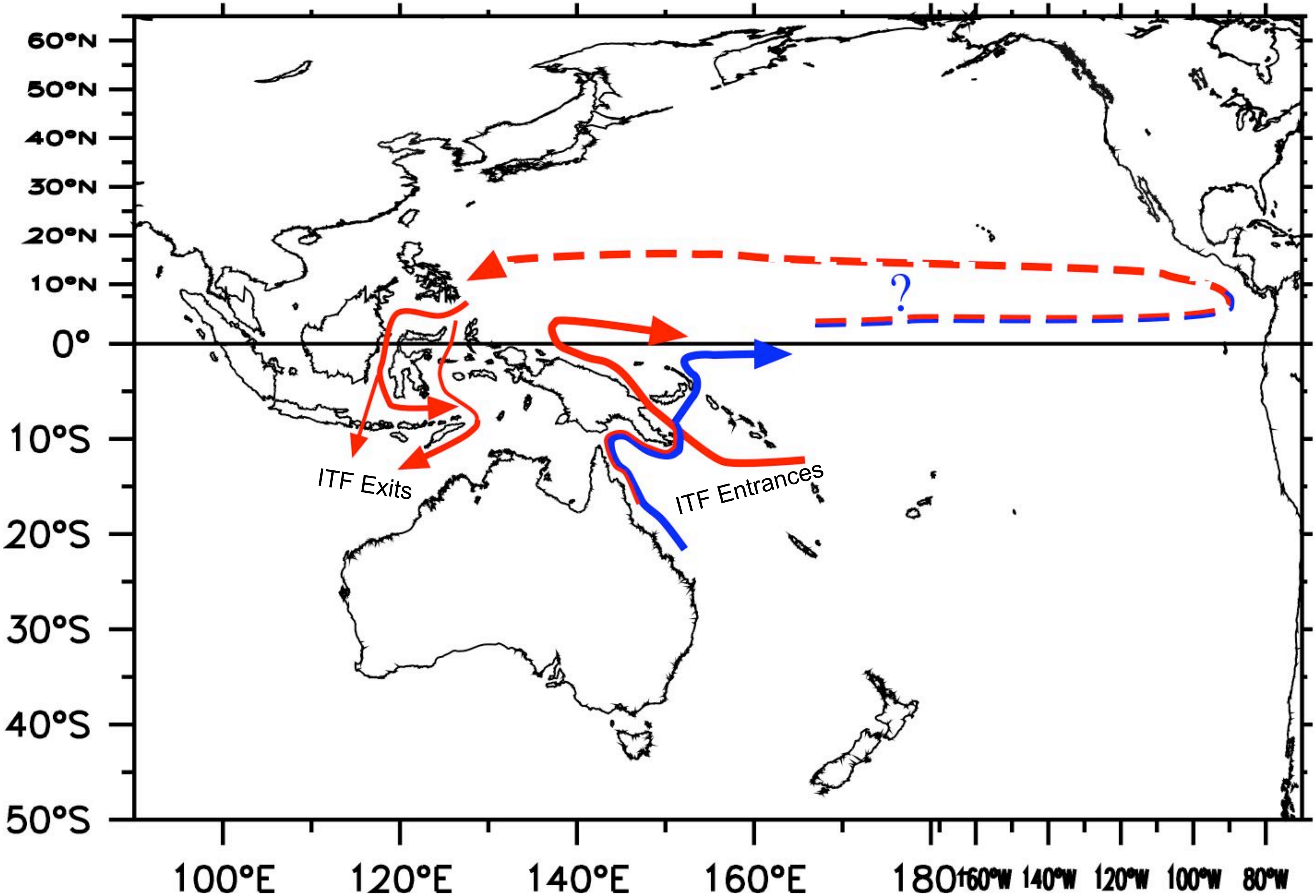
CARS data. Overlay streamlines on isopycnal




At sigma 27 (~6-800m), the sparse available data suggests that a low-S, high-$O_2$ tongue penetrates out of the Solomon Sea into the equatorial Pacific via the Australian WBCs.

The ITF consists of a series of mixing basins starting with the Solomon Sea,

that transform SW Pacific intermediate water to the shallower, warmer water that exits into the Indian Ocean.



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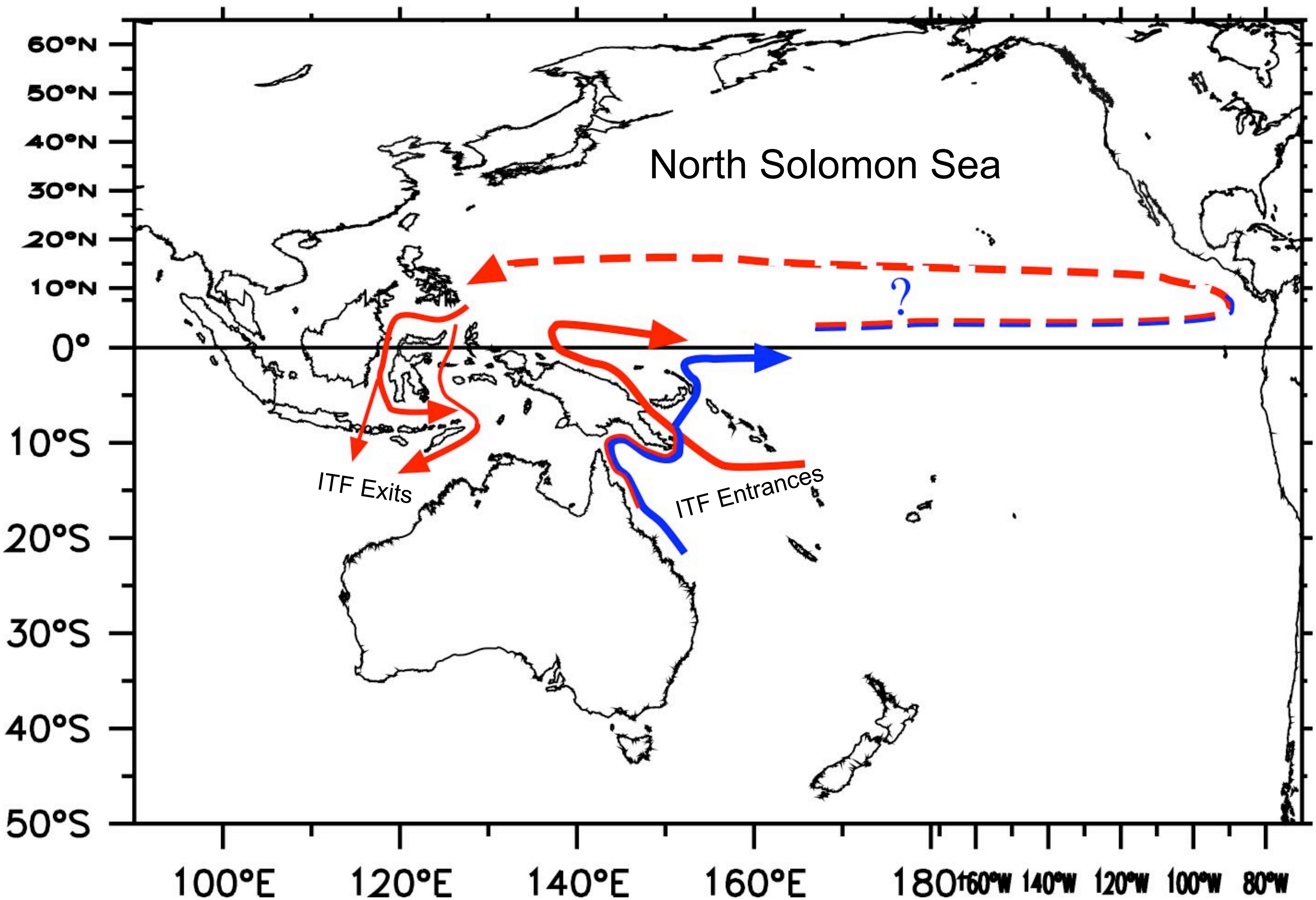
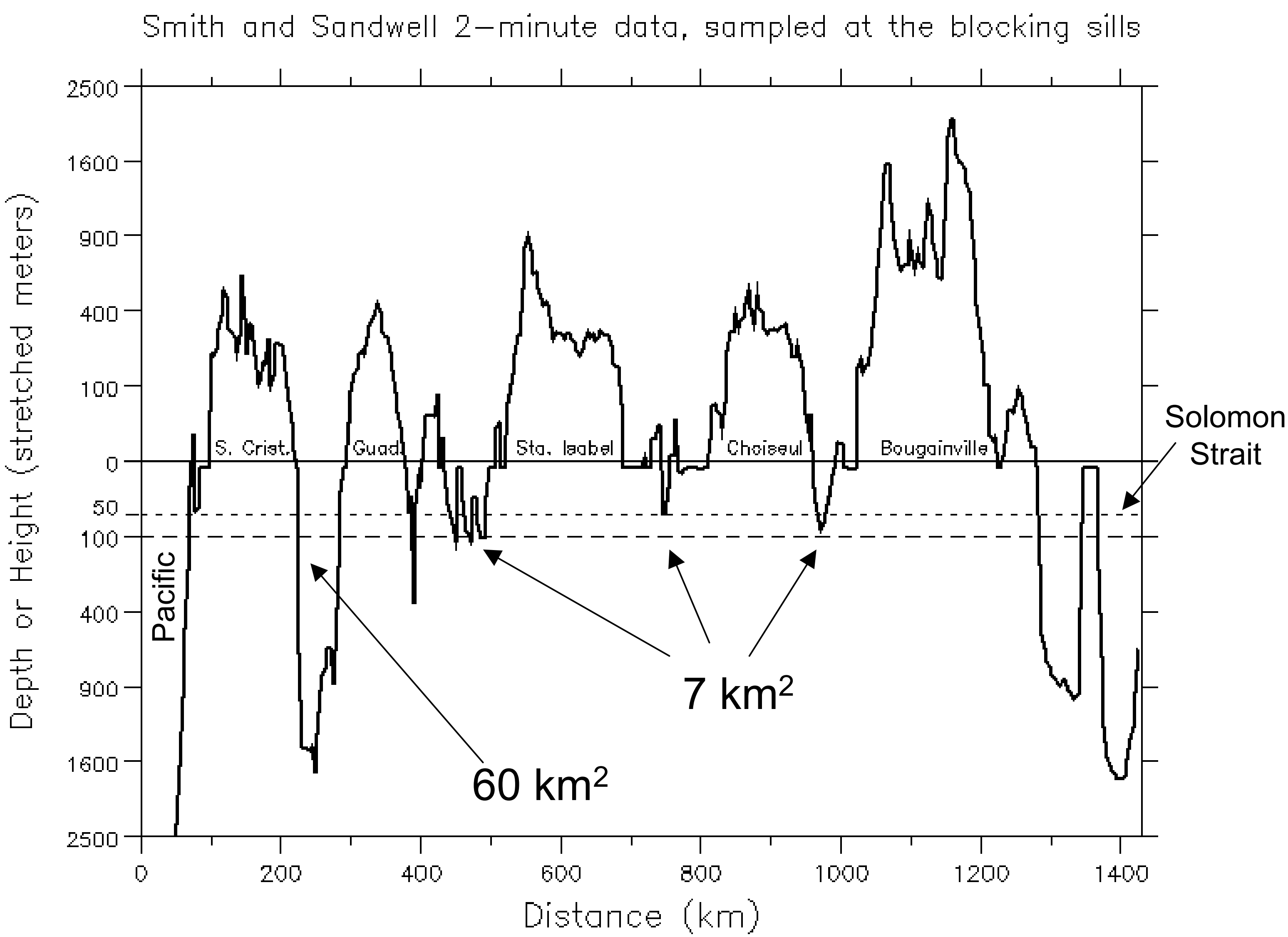


Extra

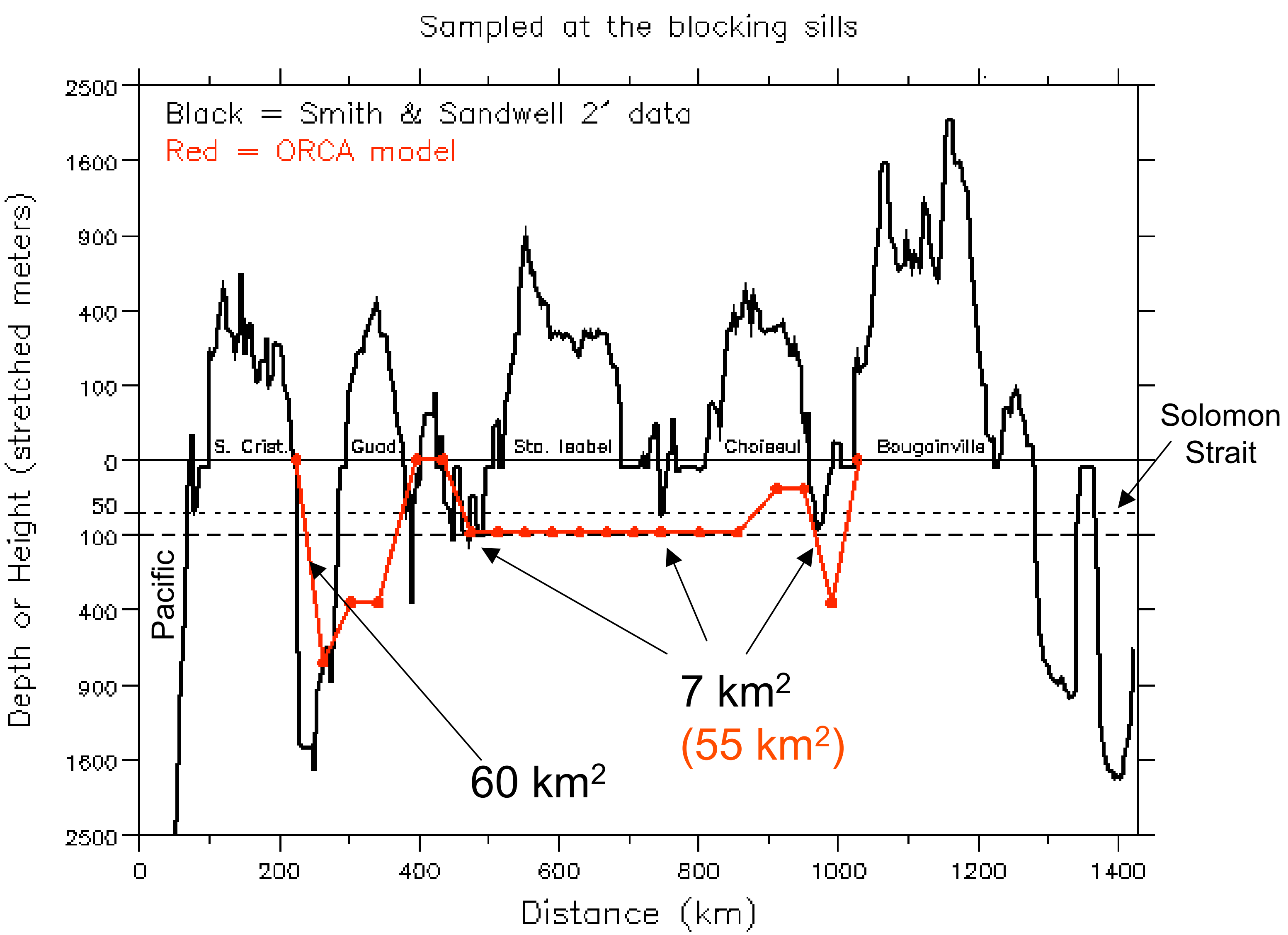
Figures

Follow

# Solomon Island sills



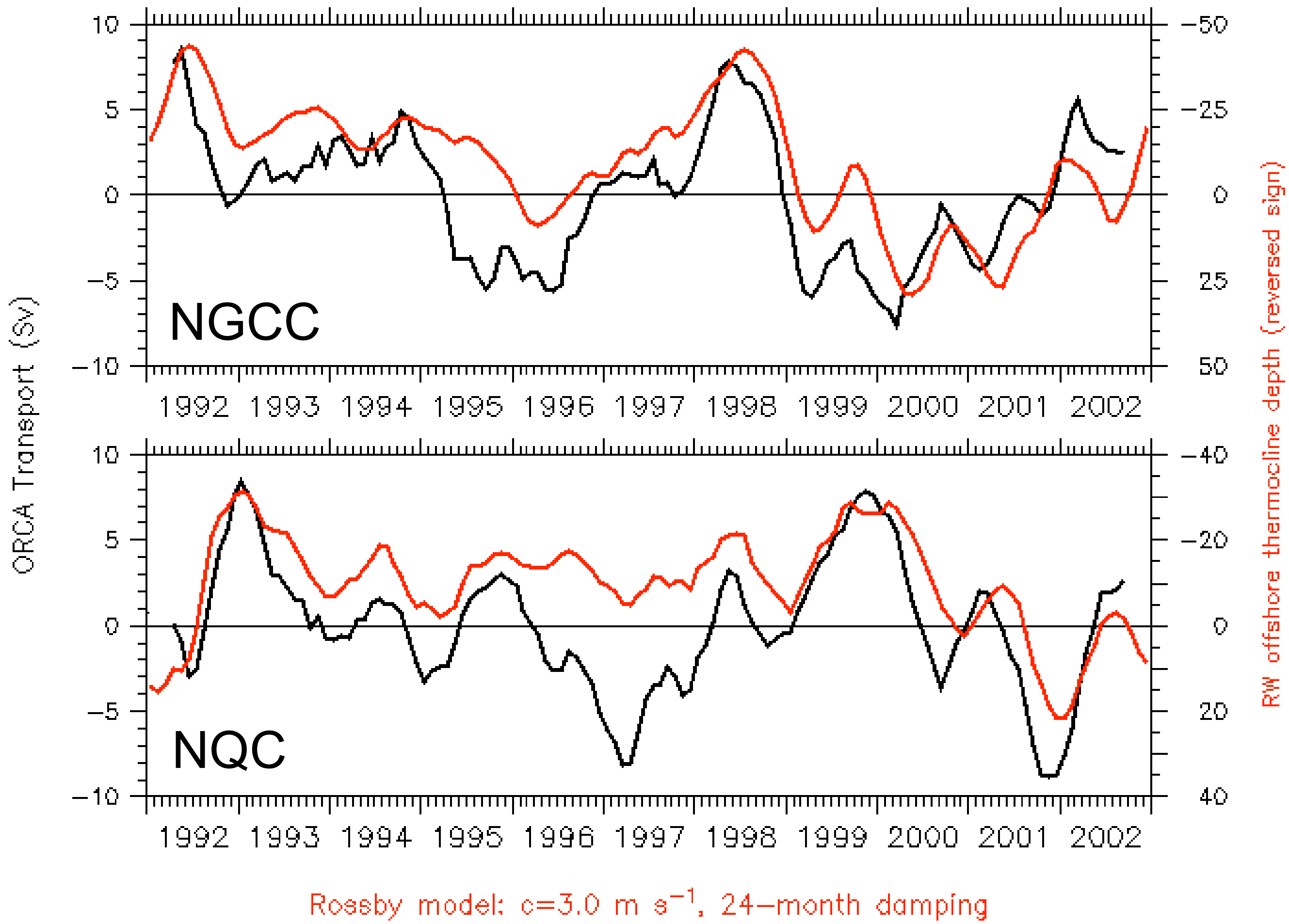
# Overlay ORCA sills



## In an OGCM, the NQC and NGCC are uncorrelated at interannual timescales, due to the lagged arrival of ENSO Rossby waves.

NGCC and NQC transport variability

ORCA OGCM (black) and linear Rossby model (red)




Variability of both is well accounted-for by the arrival of linear Rossby waves (mostly due to central Pacific ENSO curl).

There is a factor of more than 2 between the Rossby speed at the NQC (13°S) vs. NGCC (8°S).
➔ ~1-2 year lag

This mostly reflects the n=1 variability.