On the **Brazil Current thickening** in **Santos Basin (23-28°S)**

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Abstract

Top-bottom direct velocity measurements in the Brazil Current (BC) System are rare and its three-dimensional velocity structure is poorly understood within Santos Basin (23-28°S). We present a description of quasi-synoptic transects of Lowered Acoustic Doppler Current Profiler measurements. These transects are located at different latitudes covering the whole extension of the Santos Basin. The data set allowed us to carry out an unprecedented analysis of the BC thickening related to the Santos Bifurcation (∼26°S) that occurs at intermediate depths. To the north of 26°S the data show the BC flowing southwestward in the upper 500 m, with maximum velocities ∼0.5 m s^{-1} and transport of 5-7 Sv. Underneath the BC the Intermediate Western Boundary Current (IWBC) flows northeastward with vertical extent ∼1000 m, maximum velocities ∼0.2 m s^{-1} and transports 2-5 Sv. To the south of the Santos Bifurcation (∼28°S) the current system switches from mainly baroclinic (70-80%, at 24°S) to a system with a comparable barotropic component (∼50%). In this region the BC extends down to 1200 m with maximum velocities about 0.7 m s^{-1} and transports exceeding 9 Sv.

Introduction

The Brazil Current (BC) is the western boundary current of the South Atlantic Subtropical Gyre. As it flows south/southwestward the BC experiences important downstream changes in its thickness due to the South Equatorial Current bifurcation at intermediate depths (600-1800 m) [*e.g., Rocha et al.*, 2014]. The so-called Santos Bifurcation occurs Between 25°S and 27°S [*Böebel et al.*, 1999; *Legeais et al.*, 2013] and its three-dimensional velocity structure is yet poorly understood (Figure 1).
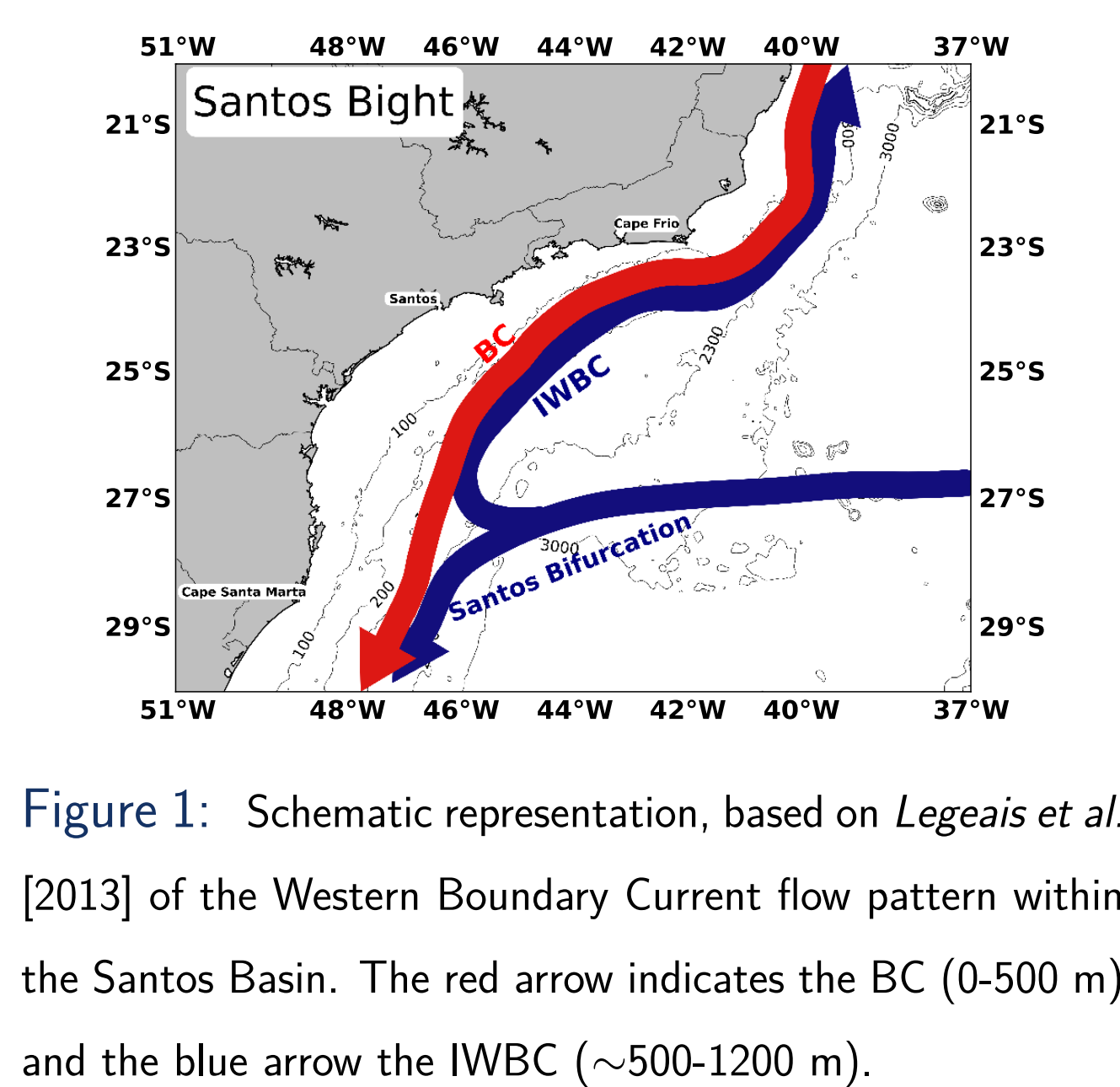
Figure 1: Schematic representation, based on *Legeais et al.* [2013] of the Western Boundary Current flow pattern within the Santos Basin. The red arrow indicates the BC (0-500 m) and the blue arrow the IWBC (∼500-1200 m).

Goal

Describe the BC three-dimensional velocity structure to the north and to the south of the Santos Bifurcation in terms of vertical extent, water mass composition, vertical shear and volume transport.
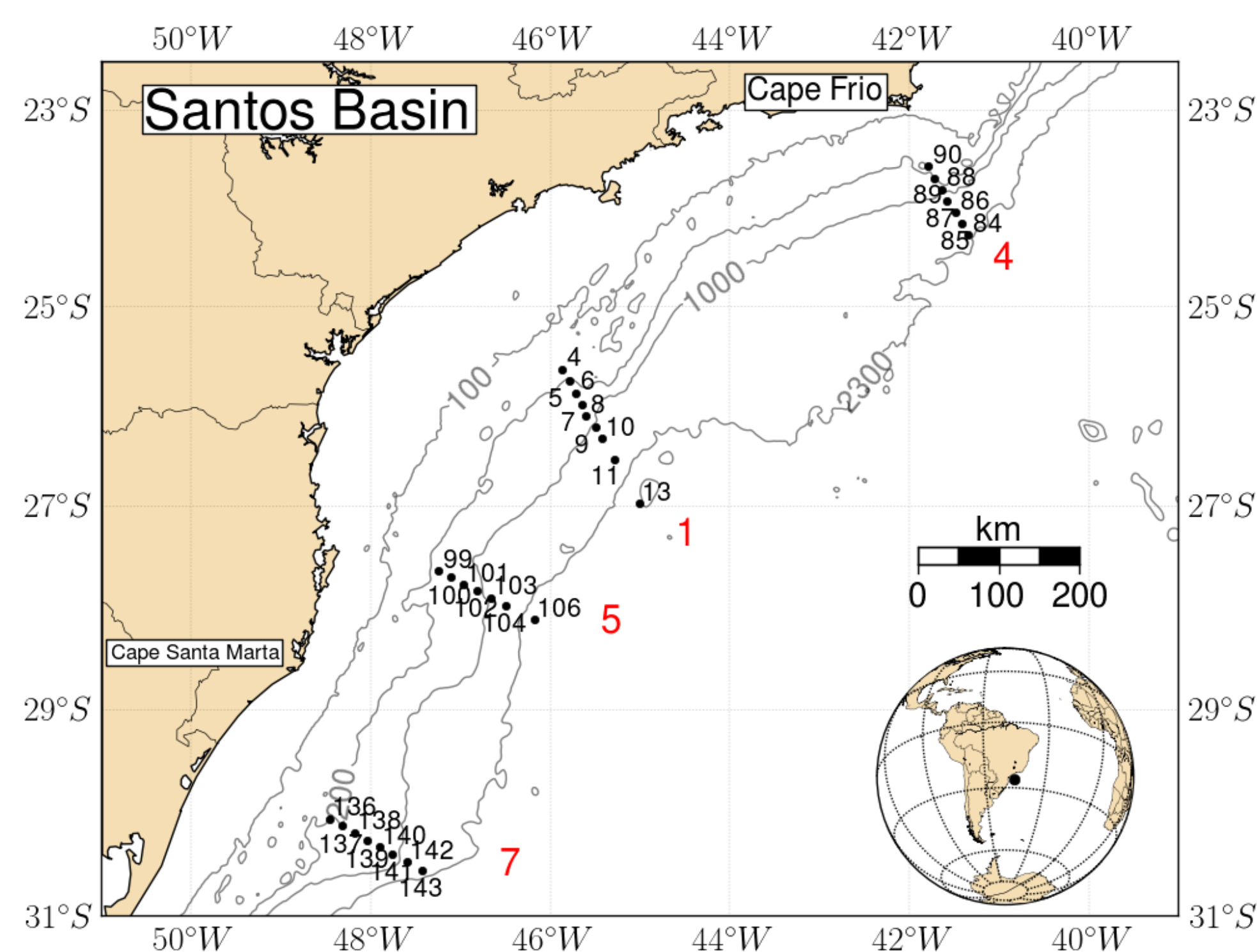
The Data Set

Figure 2: The set of Lowered Acoustic Doppler Current Profiler (LADCP) transects analyzed in this work. Transects 1 and 4 are part of the CERES experiment and were carried out in June 2010. Transects 5 and 7 were conducted during the INCT-CARBOM experiment in November 2013.

Methodology

❶ LADCP data precessing: methodology as described by *Visbeck* [2002];
❷ Vessel Mounted ADCP data processing: usage of the CODAS package;
❸ Section interpolation method following *Schott et al.* [2005];
❹ Transport calculation using the ±3 cm s^{-1} isotachs as current limits [*Silveira et al.*, 2004].
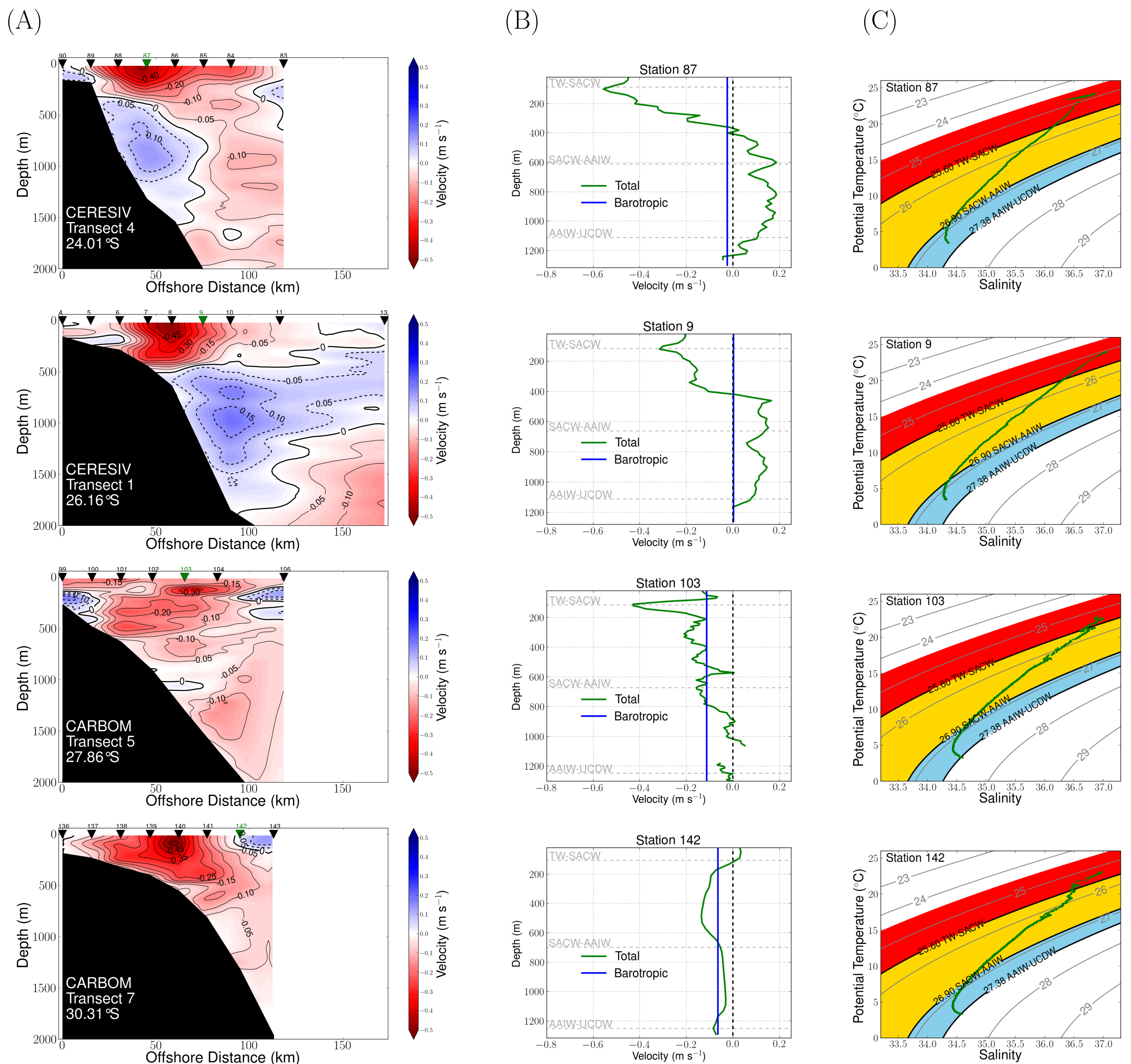
Main Results

(A) (B) (C)

Figure 3: The BC System velocity structure: (A) Cross-section velocity field; (B) Cross-section velocity profiles over the ∼1300 m isobath, the gray lines indicate the water masses interfaces; (C) TS profile over the ∼1300 m isobath, the contours are potential density lines in σ_0 kg m^{-3}. The green triangle on each velocity section (A) represents the velocity/temperature/salinity profiles presented in (B) and (C) panels. The water masses interfaces, as defined by *Mémery et al.* [2000], are: Tropical Water-South Atlantic Central Water (TW-SACW), SACW-Antarctic Intermediate Water (SACW-AAIW) and AAIW-Upper Circumpolar Deep Water (AAIW-UCDW).

Table 1: BC and IWBC volume transports, maximum velocities and vertical extension observed at each transect.

	24.01°S	26.16°S	28.86°S	30.31°S
BC transport (Sv)/maximum velocity (m s^{-1})	-5.51/-0.56	-5.71/-0.59	-7.52/-0.43	-9.53/-0.67
IWBC transport (Sv)/maximum velocity (m s^{-1})	1.81/0.25	4.88/0.22	-	-
BC thickness (m)	400	500	800	>1000

Final remarks

- The BC thickens as it flows poleward with a mean thickening ratio of ∼0.93 m km^{-1}. Between transects 1 and 5 the ratio is ∼2.78 m km^{-1}. The latter higher value is associated with the location of the axis of the Santos Bifurcation (Figure 1);
- The (B) panels of Figure 3 clearly shows the growth of the barotropic component of the velocity poleward;
- For the first time we were able to analyze the Santos Bifurcation by a three-dimensional perspective from velocity vertical profiling;
- These results are preliminary. The next step is broaden the investigation of the dynamic consequences related to the Santos Bifurcation.

References

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