INTRODUCTION

The Benguela Current (BENGC), which forms the eastern limb of the subtropical gyre in the South Atlantic, transports a blend of Atlantic (cool and fresh) and Indian Ocean water (warm and salty) northward. Therefore, it plays an important role in the local foodweb and heat budget and the overall meridional heat and freshwater transports in the South Atlantic. Historically, the BENGC region is relatively data sparse, especially with respect to temporal observations. A new three-dimensional data set, called Argo & SSHA (Sv), of the horizontal velocity in the upper 1000 m that covers the years 2003 to 2015 is used to examine the variability of the BENGC. This data set was derived using observations from Argo floats (300′, satellite altimetry) and winds (15′). The features of the horizontal circulation in this data set are in good agreement with those from earlier observations based on more limited data sets. Therefore, it can be used for an extended study of the flow pattern as well as the variability of the circulation in this region.

It is found that the mean meridional transport in the upper 800 m between 35°S and 28°S reveals phases with large energy densities at periods of 3 to 8 years, which can be attributed to the occurrence of Agulhas rings in this region. Because 35°S is closer to Agulhas retrogression than 39°S and more likely to be influenced by the Agulhas rings, divergence density associated with moonwise variability at this latitude is larger than 35°S. The prevalence of three rings is also behind the fact that the energy density is low at the annual period, especially at 35°S.

With respect to the flow, the significant correlations between the Sverdrup balance derived from the wind stress and the observed transports at 31°S to 28°S, the correlations at 35°S and 30°S are insignificant.

MEAN FLOW FIELD

VERTICAL STRUCTURE

LATITUDE DEPENDENCE OF BENGC

TEMPORAL VARIABILITY

AGULHAS RINGS IN SSHA

CONCLUSIONS

REFERENCES AND ACKNOWLEDGMENTS

It is found that the mean meridional transport in the upper 800 m between 35°S and 28°S is used to analyze the variability of the BENGC. This data set was derived using observations from Argo floats (300′, satellite altimetry) and winds (15′). The features of the horizontal circulation in this data set are in good agreement with those from earlier observations based on more limited data sets. Therefore, it can be used for an extended study of the flow pattern as well as the variability of the circulation in this region. It is found that the mean meridional transport in the upper 800 m between the continental shelf of Africa and 31°S, decreases from 23.5 Sv at 31°S to 13.5 Sv at 26°S. In terms of variability, the Benguela long timescale at 35°S and 20°S reveals phases with large energy densities at periods of 3 to 8 years, which can be attributed to the occurrence of Agulhas rings in this region. Because 35°S is closer to Agulhas retrogression than 39°S and more likely to be influenced by the Agulhas rings, divergence density associated with monthly variability at this latitude is larger than 35°S. The prevalence of three rings is also behind the fact that the energy density is low at the annual period, especially at 35°S.

With respect to the flow, the significant correlations between the Sverdrup balance derived from the wind stress and the observed transports at 31°S to 28°S, the correlations at 35°S and 30°S are insignificant.

Vertical structure reveals that the mean flow in the upper 800 m is weaker than at 35°S. The vertical extent of the BENGC at 35°S is smaller than at 39°S. Compared to the steady regime in the transient regime is mostly smaller and of alternating sign. As 35°S, two distinct regimes can be seen in the steady regime. The main difference is the magnitude of the velocity. Mixing velocities near the coast account for about 25% at 39°S and 35°S, respectively.

Latitudinal structure reveals that the mean flow in the upper 800 m is weaker than at 35°S. The vertical extent of the BENGC at 35°S is smaller than at 39°S. Compared to the steady regime in the transient regime is mostly smaller and of alternating sign. As 35°S, two distinct regimes can be seen in the steady regime. The main difference is the magnitude of the velocity. Mixing velocities near the coast account for about 25% at 39°S and 35°S, respectively.

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Eddy kinetic energy is significantly higher in the eastern Cape Basin which is dominated by the retroaction and the effect of newly formed Agulhas rings. Compared to the steady regime the velocity in the transient regime is mostly smaller and of alternating sign. As 35°S, two distinct regimes can be seen in the steady regime. The main difference is the magnitude of the velocity. Mixing velocities near the coast account for about 25% at 39°S and 35°S, respectively.

The transport from the Sverdrup stream function is significantly lower (−3.7 ± 1.2 Sv) than the observed meridional transport in the BENGC. This is in contrast to the observed meridional transport in the BENGC. There is some similarity in the variability of the scaled Sverdrup transport and the Sverdrup transport across 35°S, but the interannual variability is much smaller and of alternating sign.

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