Preliminary results on lateral mixing from the DIMES Experiment

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TH86A - C37

Introduction

The Diapycnal and Isopycnal Mixing Experiment in the Southern Ocean (DIMES) is an ongoing CLIVAR process study designed to study mixing in the Antarctic Circumpolar Current, including tracer release, floats, and measurement of small-scale turbulence. The tracer and floats were released along 105W between the polar front and the Subantarctic front to capture the flow structure west of and through Drake Passage. At present data has been received from 50 floats and those trajectories are processed, analyzed and presented here.

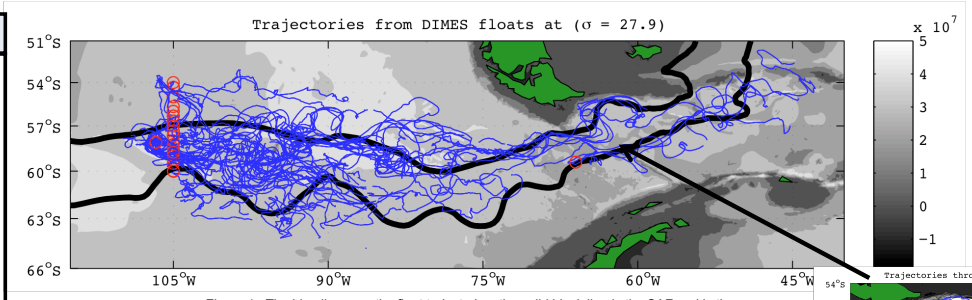


Figure 1 : The blue lines are the float trajectories, the solid black line is the SAF and is the PF. The contours in the background show depth/f (ms). The red circles indicate the launch positions of the floats.

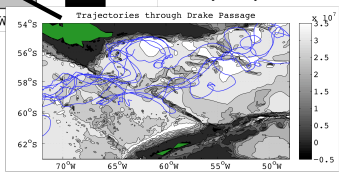


Figure 2 : Floats have a tendency to follow depth/f contours. Some regions show this very clearly.

Results

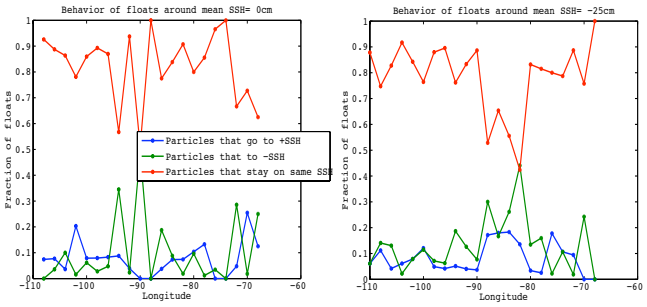


Figure 3 : Fractions of floats that changed their corresponding SSH and in which direction when they were in each longitude bin.

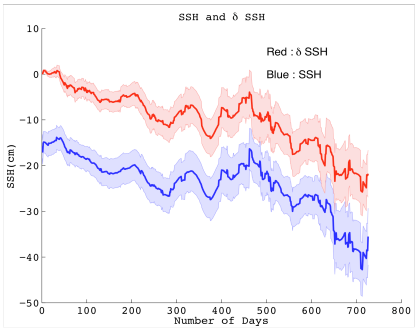


Figure 4 : Ensemble average of SSH and delta SSH of all the floats versus time. Shaped region represents error bars

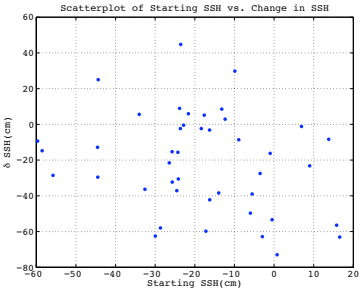
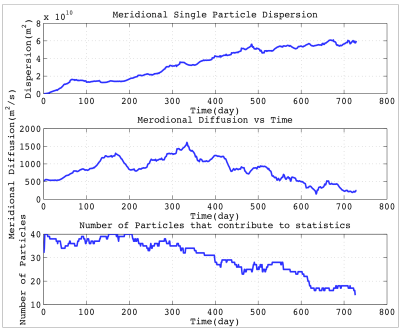


Figure 5: Scatter plot of SSH (starting) vs, change in SSH.

Dispersion Calculations



The meridional diffusivity calculated from the meridional dispersion plot is around 1000m^2/s. [diffusivity = d(dispersion)/dt]

Also from the spread across SSH contours
$K_{diff} = \sigma^2/(2\Delta t)$
$=(30\text{cmof SSH})^2/4\text{yrs}$
$\approx (400\text{km})^2/4\text{yrs}$
$\approx 1200\ m^2/s$

Figure 6 : Meridional statistics

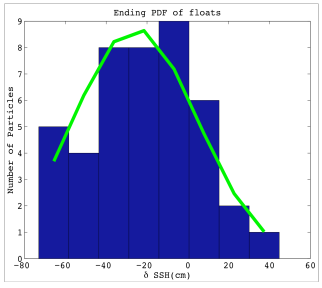


Figure 7 : PDF of floats at the end of 2 years with a Gaussian fitted to it. The Gaussian has σ = 30cm, μ = -25cm.

Summary

- The floats show significant cross SSH transport and have a tendency to drift southward (to more negative SSH) in SSH coordinates. See figure 4.
- The limited number of floats provide diffusivity values which are of the same order as those presented in other studies (Marshall et al. 2005, Poster TH81B-C37)
- The cross-SSH transfer is not uniformly distributed as seen from figure 3 and topography might be a significant contributor.
- Topography has significant control on the trajectory as can be seen in figure 2.

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