VELOCITY AND POTENTIAL VORTICITY STRUCTURE OF A KUROSHIO EXTENSION COLD CORE RING

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1. “What is the history of Ring 04A interactions with the Kuroshio?”

May 2004

Cold core ring 04A formed

 Satellite SSH

4A attached to the Kuroshio Extension (KE)

 Geopotential height \( \phi \) was mapped from round-trip acoustic travel times by an array of Inverted Echo Sounders

04A inflated and intensified during its interaction with the KE.

04A detached from KE

May 2005

Interaction 1

Interaction 2

In mid August 04A was absorbed by the KE for the final time

July 2005

Sept. 2005

4A stalled for nearly 100 days

Geopotential height \( \phi \) was mapped from round-trip acoustic travel times by an array of inverted echo sounders

04A detached from KE

4A detached from KE

2. What is the velocity structure of a Kuroshio Ring?

a.) Mapped July 2005 ADCP survey.

b.) Average section from two radial transects.

3. What can the \( \phi_{200} \) streamfunction tell us about subsurface structure?

An optimal interpolation of ADCP velocities across the ring estimated a streamfunction at 200 m \( \phi_{200} \). The \( \phi_{200} \) field was referenced by CTD geopotentials \( \phi_{200} \text{-CTD} \).

Using this referenced \( \phi_{200} \) as an index for an empirical lookup table from historical CTDs, we constructed the ring transect of temperature and salinity.

The temperature and salinity sections determined the buoyancy frequency N. The ADCP velocities determined the relative vorticity \( \zeta \). Combined, these estimated the Enstrophy Potential Vorticity (PV) field across the ring.

3. Applications/Questions:

1.) What can the ring core PV tell us about the origin of the ring?

2.) What role do rings play in the cross-frontal exchange of heat and salt across the KE front?

3.) What is the PV flux into surrounding waters from Kuroshio Rings? (Qiu et al. 2006)

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How well can this technique estimate \( \zeta \)? Agreement is good below seasonal pycnocline.

Net volume transport 50 Sv between 80 and 670 m depth out to \( r = 160 \) km.

Rotational Rossby number \( = 0.25 \).

Core of the ring is in nearly solid body rotation with a 7-day period from 100 m to 300 m depth out to \( r = 50 \) km.

Subsurface velocity maximum around warm periphery.