The formation of the Tsushima Warm Current in a high resolution ocean circulation model

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Introduction

- **Tsushima Warm Current**
  - Supplies heat and salt to the East/Japan Sea
  - Origin (Nitani, Qiu, Beardsley, Fang, Lie, Isobe, Teague, Ichikawa …)
    - Kuroshio
    - Continuation of the Taiwan Warm Current

![Figure from Isobe, 99, CSR](image)

Beardsley et al., 85
Fang et al., 91
Nitani, 72
Lie and Cho, 94
Lie et al., 98

Figure from Isobe, 99, CSR
Fig. 10. The revised schematic views of the origin of the Tsushima Warm Current in (a) season except the autumn, i.e. January–September and (b) autumn, i.e. October–December.

Teague et al., 03: 1999 Fall

Kim et al., 05: April 1988
Previous Studies

• Complexity of the area
  – Lack of data
  – Short term observation

• Modeling (regional)
  – Fixed open boundary (inflow/outflow: Tshusiham and Taiwan Warm Currents, Kuroshio) conditions
    • Can we investigate the origin properly?
High resolution modeling results

• http://www2.es.jamstec.go.jp/ofes/eng/index.html
• Model: Ogcm For Earth Simulator (MOM3-based optimized code for ES)
• Domain: 75S-75N, 0.1 horizontal resolution, 54 vertical levels
• Surface bc:
  – Momentum, heat and salt flux: NCEP/NACR reanalysis data set, SSS restoring to WOA98
• IC: WOA98
• Mean of the last 5 years from 50 years long simulation
Purpose

• From the high resolution model results
  – The origin of the Tsushima Warm Current
  – East China Sea Circulation
Validation
Model (surface, annual mean)  
Levitus (surface, annual mean)
Mean annual surface velocity and temperature
Model results

Surface flow from drifters
(Lie et al., 98)
West of Kyushu
Flow & Temperature at 45m
Mass Budget

DJF

+ : from Kuroshio
- : toward Kuroshio
North of Taiwan
Mass Budget
Summary & Conclusion

• Taiwan-Tsushima Current system exists through a year
  – Stronger at the subsurface level
  – Topographic steering
• KBCWK: stronger during the colder half
  a part of Taiwan-Tsushima Current system?
• KBCNT: stronger during the 2nd half
  a part of the Taiwan current system?
• Tsushima Current is weaker than the observation
  Lack of the Kuroshio Frontal wave (Isobe and Beardsley 06)?
Thank you