Cross-Kuroshio Surface Transport as seen by Surface Drifters and Altimeters

Kaoru Ichikawa¹,², K. Kato³ and D. Ambe⁴

Data and Methods

Approaching speeds of a drifter & the Kuroshio axis
For each drifter, calculate the daily distance to the Kuroshio axis temporally interpolated (from the 7-day interval axis data)
Determine velocity component toward the axis (V_b)
Also determine the approaching speed of the axis toward the drifter (V_k)
from the temporal change of the distance and V_b
Average V_b and V_k for all drifters within a 1-degree grid

Surface geostrophic velocity field
Anomaly
Merged Altimetry product
provided by Ssalto/Duacs, AVISO (Delayed updated mode)
Mean
estimated from drifter and altimetry data based on Uchida and Imawaki (2003)

Results

~40% of WOCE drifters have experienced crossing the Kuroshio
although this number would depend on deployment
55 drifters out of 149
23 from Offshore to Coast (2-7 days)
32 from Coast to Offshore (2-5 days)
NB: duplicated counted

Adveective Crossing
Processes entering/leaving the Kuroshio
All drifters (including no crossing) that enter/leave the Kuroshio found all over the Kuroshio
V_b is significant w.r.t. V_k, especially along the shelf edge

Direct crossing
Axis movement (V_k) is dominant
limited in areas with larger Kuroshio meanders

Summary
The cross-Kuroshio transport is studied using surface drifter data and altimetry data
Movement of the Kuroshio axis (V_k) plays important role for the crossing of the Kuroshio large movement near the Tokara Strait and northeast of Taiwan may cause direct crossing between the Offshore and Coastal areas
The velocity component normal to the Kuroshio (V_b) is important when drifters enter/leave the Kuroshio
which may be associated with small-scale frontal eddies or Ekman drifts
Such boundary processes are often observed even when the Kuroshio axis is stable, although drifters may not cross the Kuroshio

Reference
Ambe, Ichikawa, Uchida and Ichikawa, JO 69(2), 2004