Satellite Tracked Drifter Studies in the Eastern Aleutian Passes

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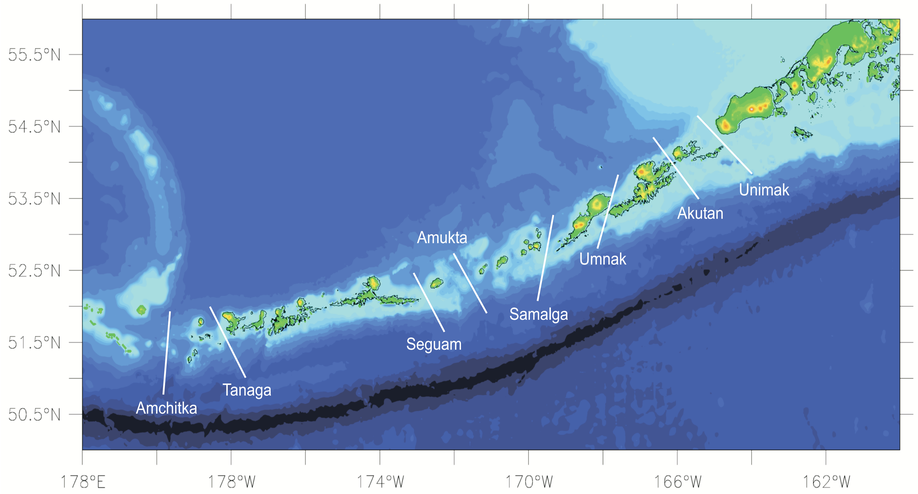
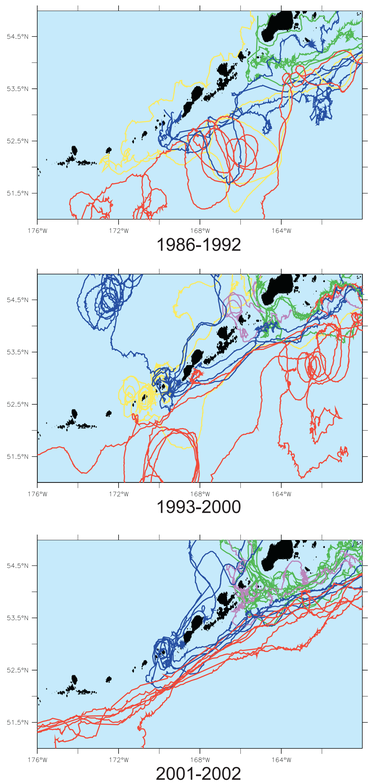


Map of the eastern Aleutian Islands and passes.

ABSTRACT

Satellite tracked drifters provide important information about the flow patterns in and around the Aleutian Passes. The spatial patterns illustrated by drifter trajectories provide a strong complement to more traditional current meter measurements. Current meters provide time series information at a point or series of points in space. Because the deployment locations have to be selected *a priori* by the investigator, current meter measurements can result in an understanding of the flow field that is biased by preconceptions. Drifters, on the other hand, go where the current takes them often resulting in surprising new information.

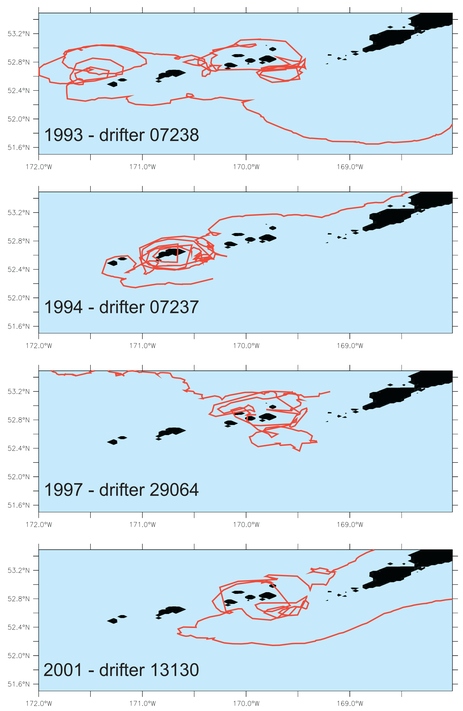
Examination of drifter trajectories for all drifters that transited the region of the eastern Aleutian Passes since 1986 has lead to some surprising new information. *A priori* assumptions about the importance of Amukta Pass have resulted in numerous current meter deployments there over the years. However, very few drifters have gone through Amukta Pass on their way from the North Pacific to the Bering Sea. Drifter trajectories suggest that the most important connections between the two basins are Unimak and Samalga Passes.



Drifter Trajectories during 3 different time periods. Drifter trajectories illustrate the tendency for Gulf of Alaska water to flow into the Bering Sea through either Unimak Pass (green) or Samalga Pass (red) but rarely through any of the other eastern passes. Over 17 years, of 53 drifter deployments in this region, almost 60% went through either Unimak or Samalga Pass with another 26% bypassing the passes altogether.

Pass	Number of drifters	Percentage
Unimak	16	30%
Tanaga	3	6%
Samalga	15	28%
Amukta	5	9%
None	14	26%
Total	53	

The upstream location (on- or off-shelf) influences which pass the drifter is most likely to go through. The on-shelf drifters tend to go through Unimak Pass. Drifters nearer the shelf-break tend to go through Samalga Pass. And drifters at the shelf-break or further off-shore tend to stay in the North Pacific, eventually turning south (usually near ~180º).



Over the years of drifter observations in the region, 4 drifter trajectories provide interesting examples of clockwise circulation around some of the Islands of Four Mountains.

In 1993, drifter 07238 entered the Bering Sea through Amukta Pass. It was then carried eastward by the Aleutian North Slope Current and turned south through Samalga Pass. It made one circuit around the islands in ~4.5 days.

In 1994, drifter 07237 entered the Bering Sea through Amukta Pass. It made 4.5 circuits around Yunaska Island over 5 days before being carried northeast by the Aleutian North Slope Current.

In 1997, drifter 29064 approached the Island of Four Mountains from the Bering Sea. It made 2 circuits around the islands. The first circuit took 10 days as the drifter became trapped in an eddy. The 2nd circuit took 4 days.

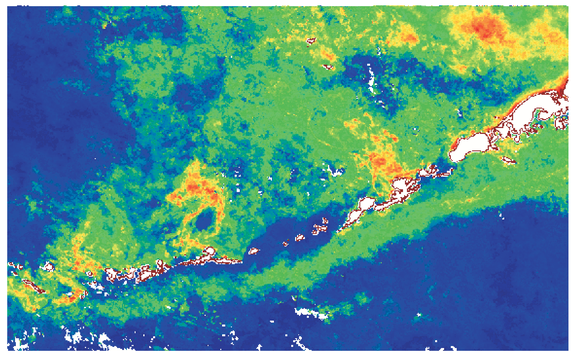
In 2001, drifter 13130 made one circuit around the islands in 6 days. Four days were spent in an eddy to the southeast of the islands.

Conclusions & Implications:

These drifter trajectories illustrate that some amount of the flow through these passes is recirculated and can't be considered inter-basin transfer. Thus the net transport through the passes is likely greater than the net transport of North Pacific water to the Bering Sea.

The drifters also show that flow is generally northward on the eastern side of the passes and southward on the western side.

These 4 drifters are the only ones to show closed clockwise circulation around islands. This suggests that the circulation around the Islands of Four Mountains is unique and may have unique implications for the ecosystem. A closed circulation surrounding this group of islands suggests that the Islands of Four Mountains marine ecosystem may be somewhat isolated from the surrounding archipelago.



Average August – September chlorophyll (mg/m^3) from the SeaWiFS satellite. Low chlorophyll is exhibited in most of the eastern Aleutian passes relative to the passes further west and the regions north and south of the passes. As illustrated by drifter trajectories (and current meters; see Stabeno et al. poster), the current speed through these passes is substantial and heavily influence by tides. The associated mixing within the passes is strong enough to light-limit phytoplankton.

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