Cross-shelf exchange in the Gulf of Alaska

Carol Ladd, Phyllis Stabeno, Nicholas Bond, Al Hermann,

Nancy Kachel, Calvin Mordy

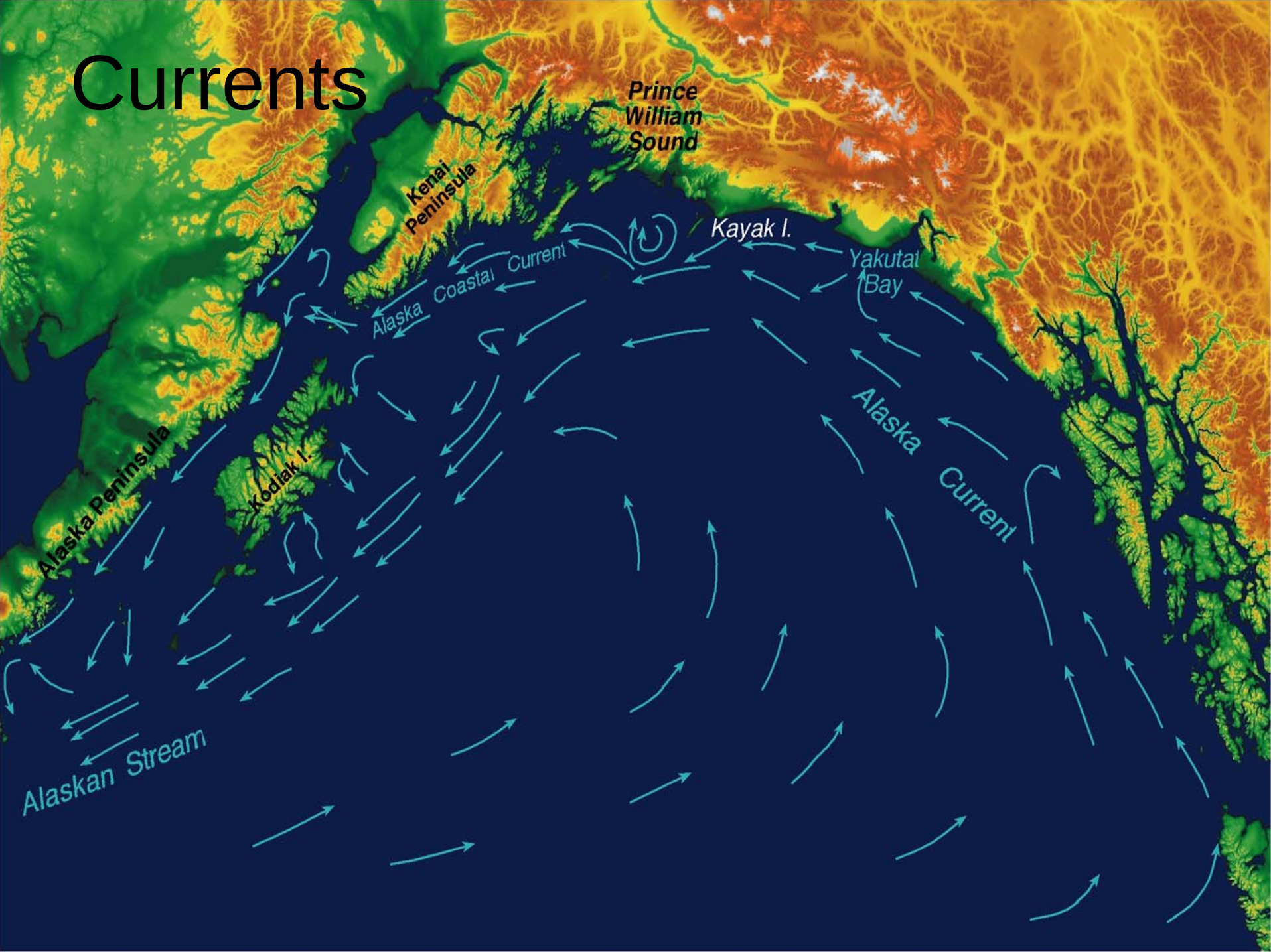
Overview of Gulf of Alaska

Cross-shelf exchange mechanisms

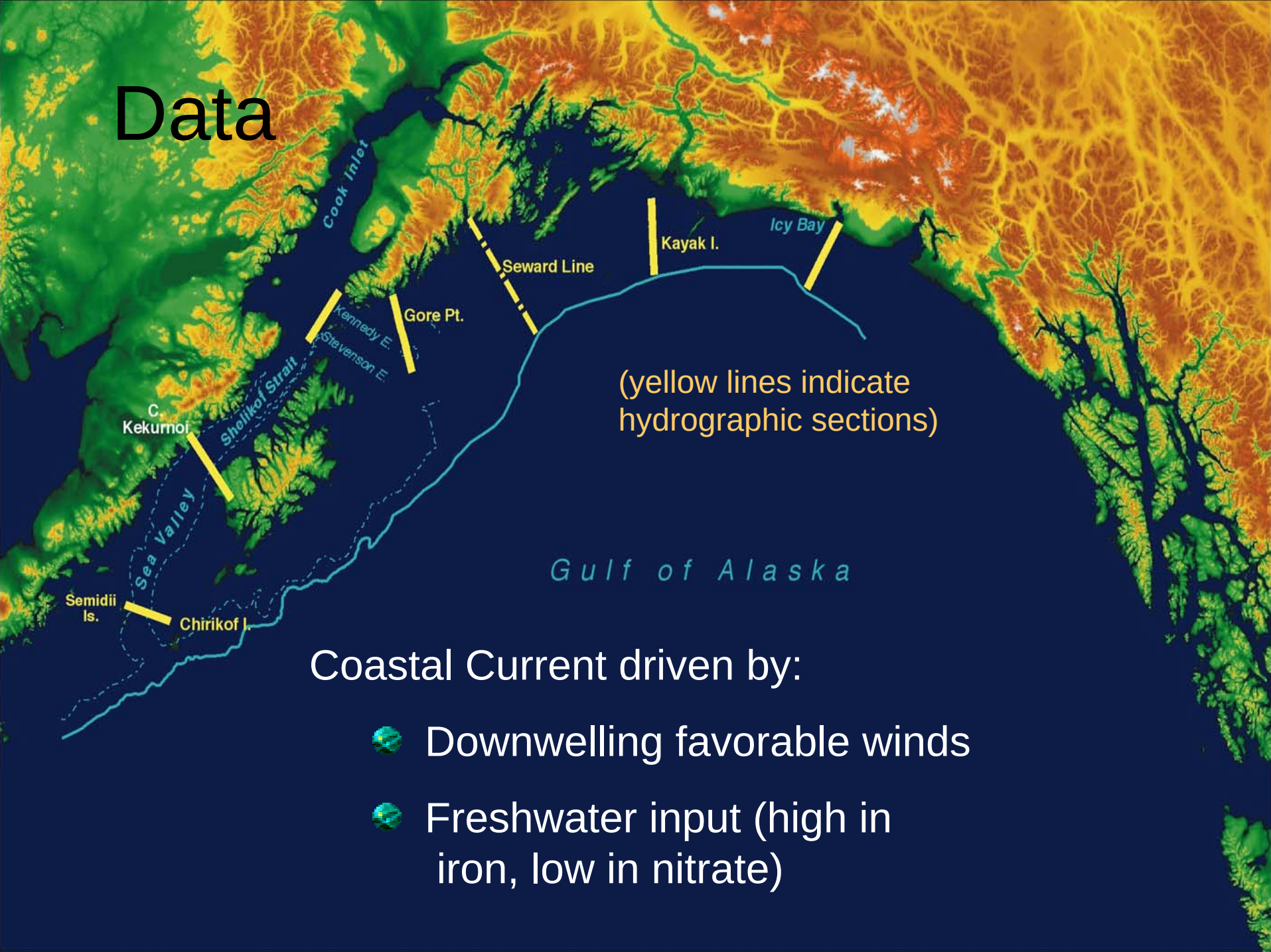
- **Downwelling/Upwelling**
- **Eddies**
- **Coastal wind stress curl**
- **Bathymetric steering**

Summary

Currents

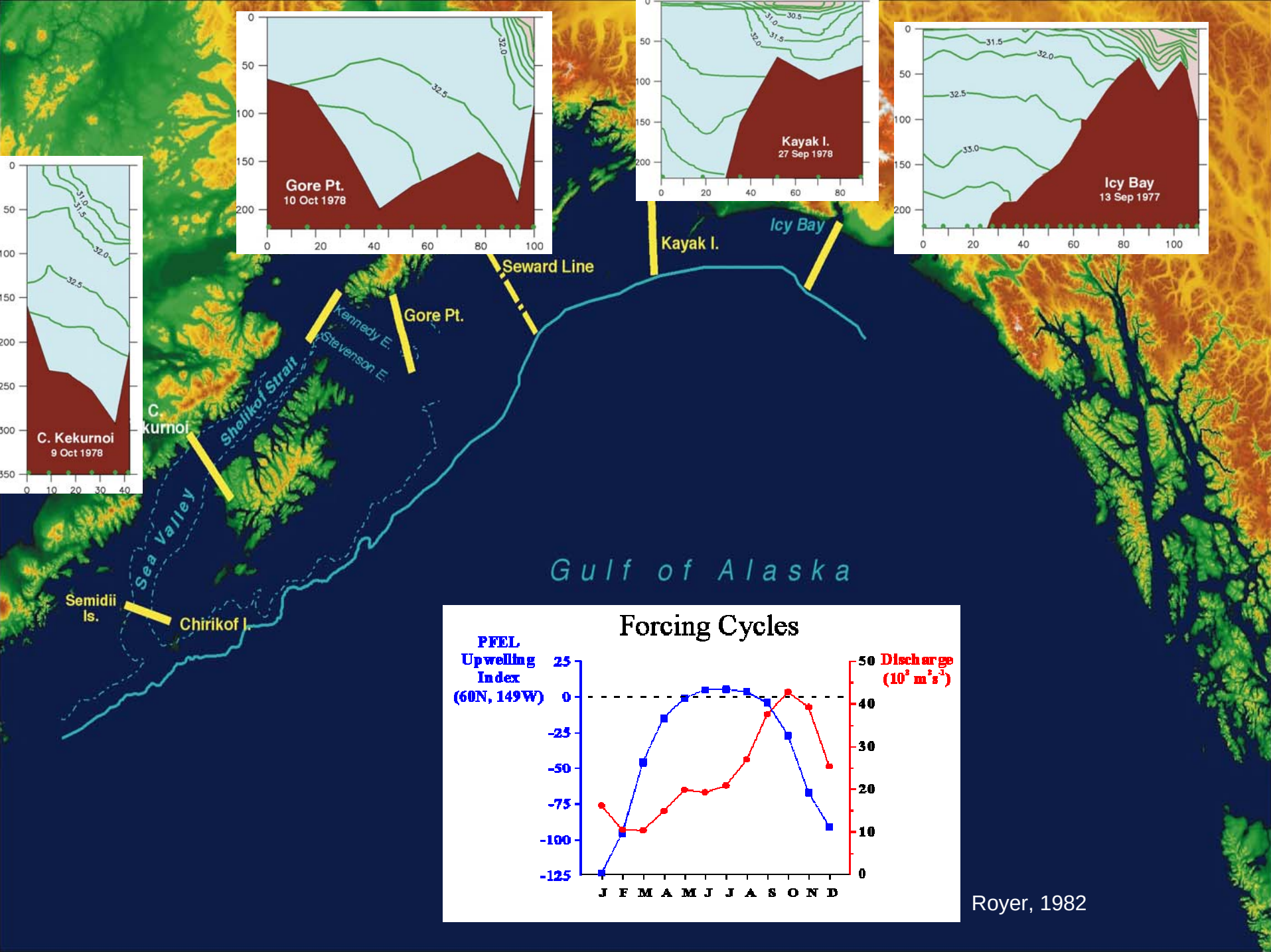

Prince William Sound
Kenai Peninsula
Kayak I.
Yakutat Bay
Alaska Coastal Current
Alaska Current
Alaska Peninsula
Kodiak I.
Alaskan Stream

Data



Coastal Current driven by:

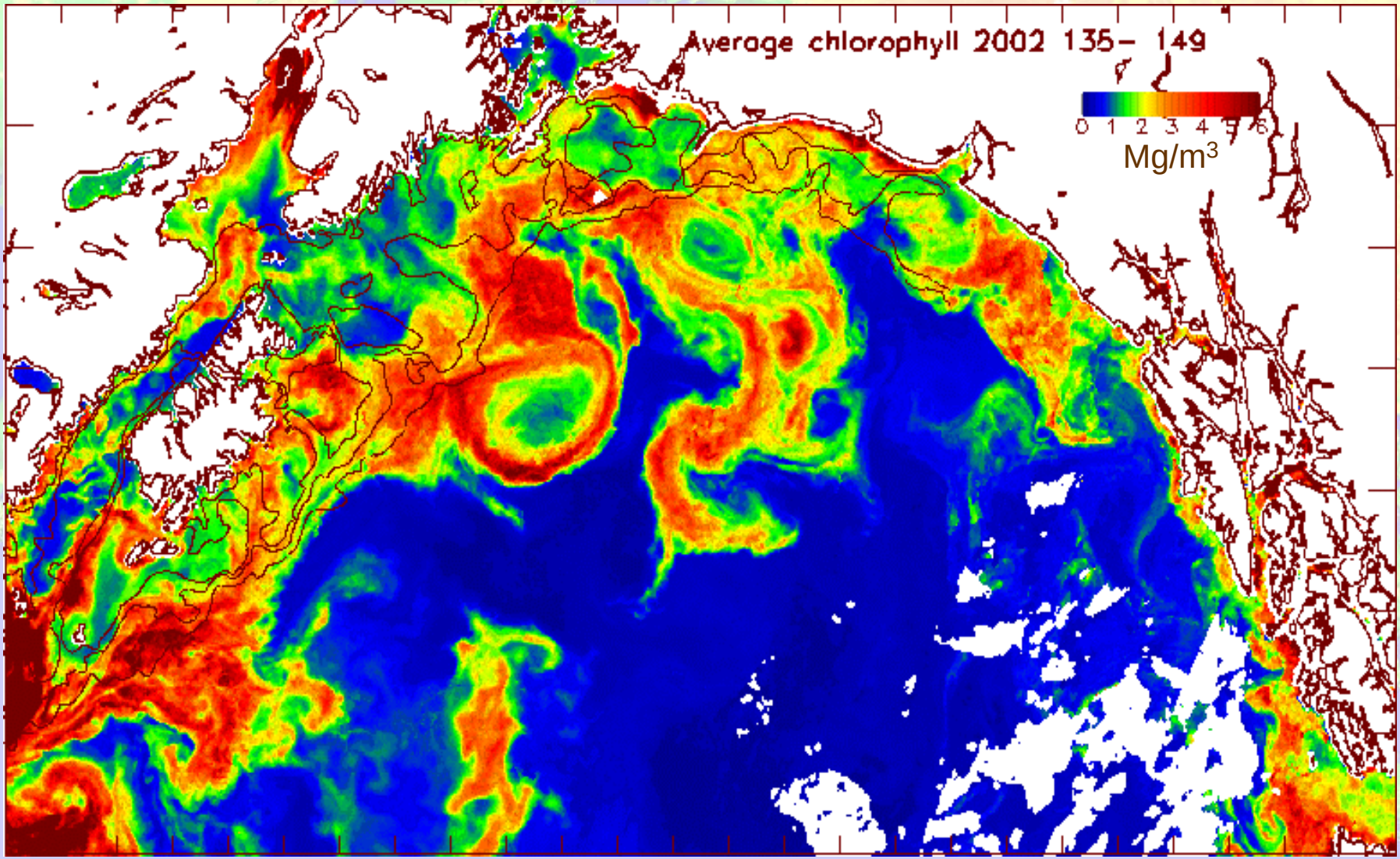
- Downwelling favorable winds
- Freshwater input (high in iron, low in nitrate)


Gore Pt.
10 Oct 1978
Kayak I.
27 Sep 1978
Icy Bay
13 Sep 1977
C. Kekurnoi
9 Oct 1978
Seward Line
Kayak I.
Icy Bay
Gore Pt.
Kennedy E.
Stevenson E.
Sheilikof Strait
C. Kekurnoi
Sea Valley
Semidii Is.
Chirikof I.
Gulf of Alaska
Forcing Cycles
PFEL Upwelling Index (60N, 149W)
Discharge (10^3 $m^3 s^{-1}$)
J F M A M J J A S O N D

Royer, 1982

SeaWiFS chlorophyll

15 May – 29 May 2002

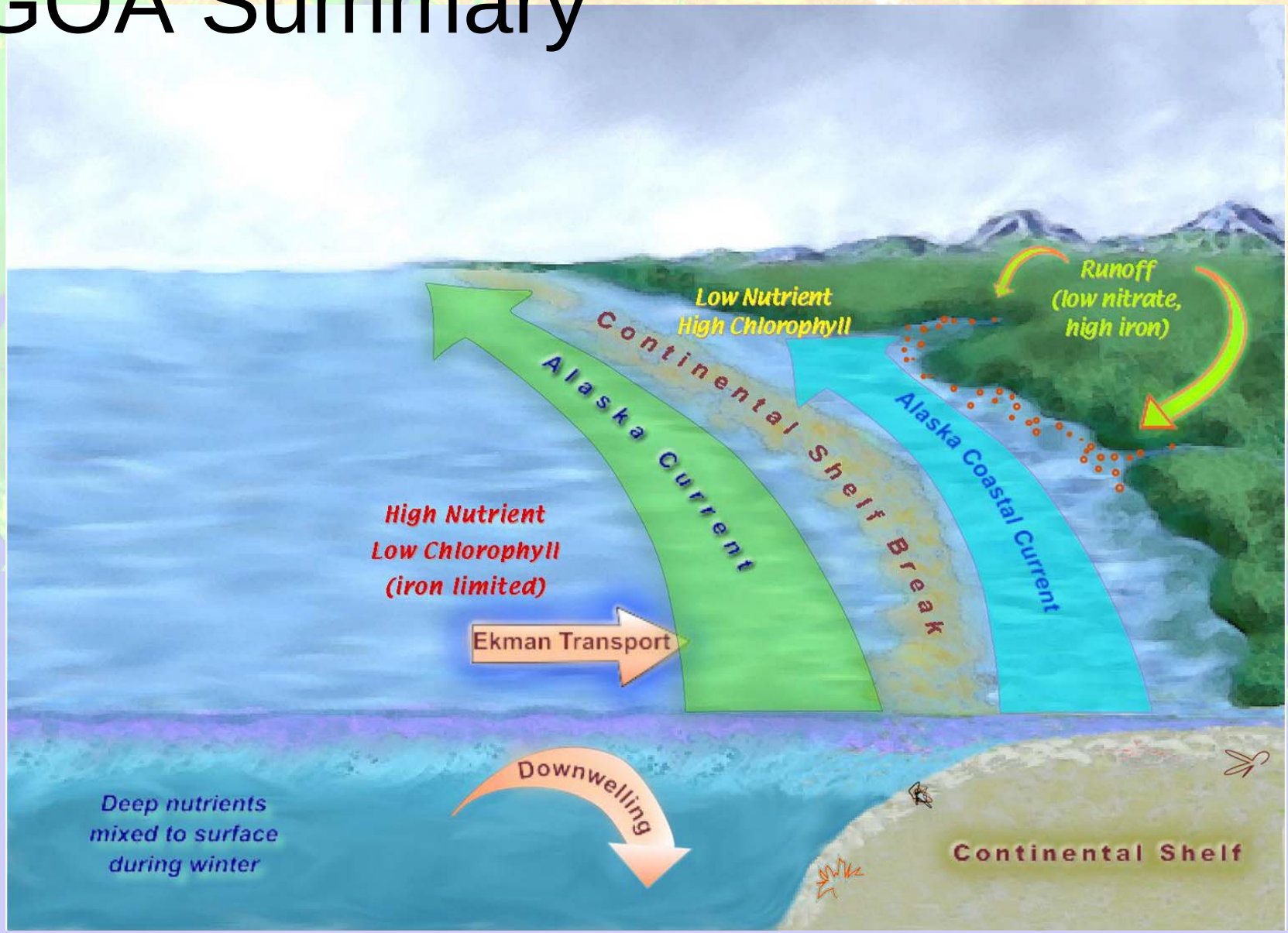


Gulf Of Alaska biology

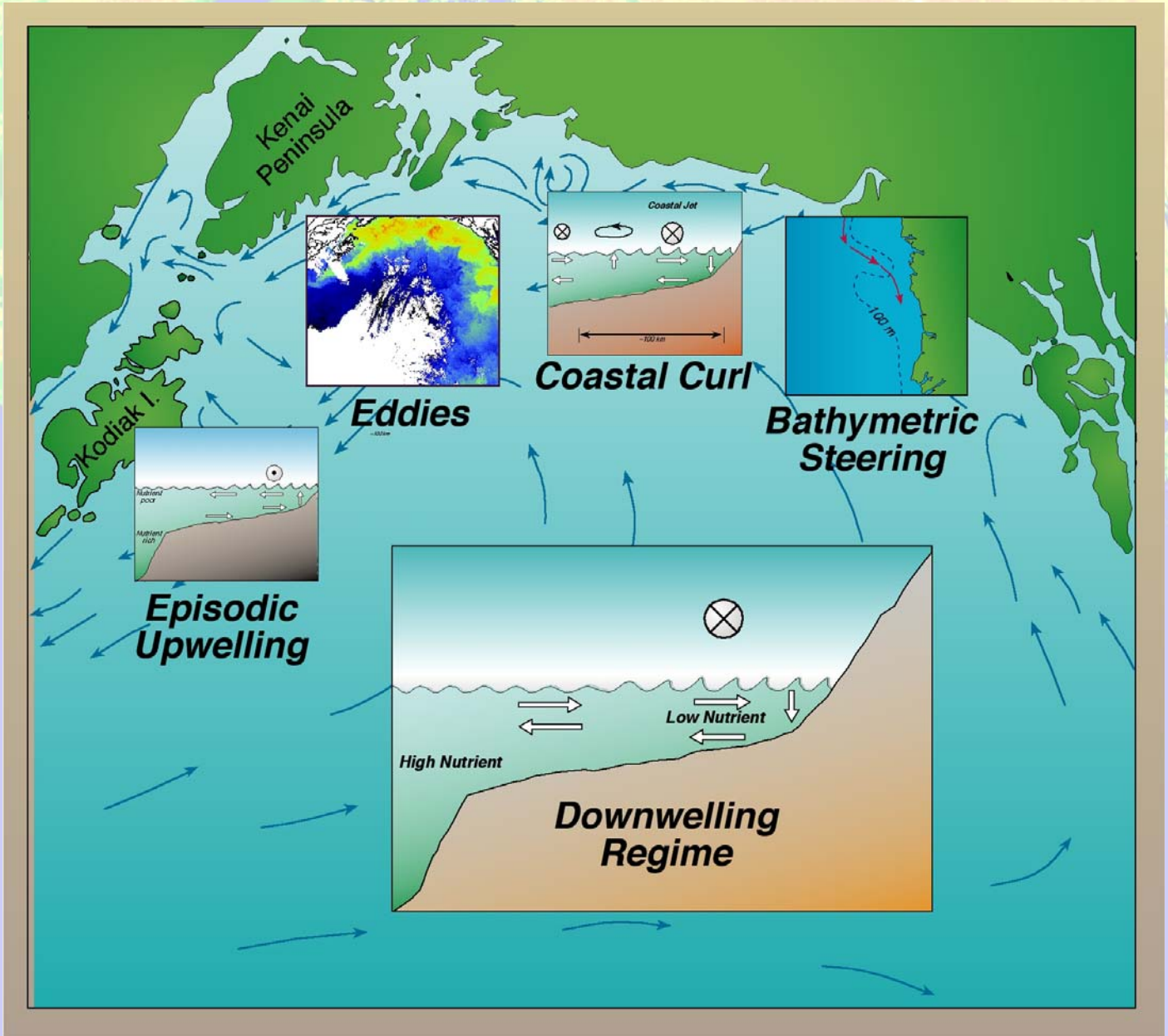
- 25 species of marine mammals
- 26 species of seabirds
- 287 known species of fish

Reference: Gulf of Alaska Ecosystem Monitoring and Research Program

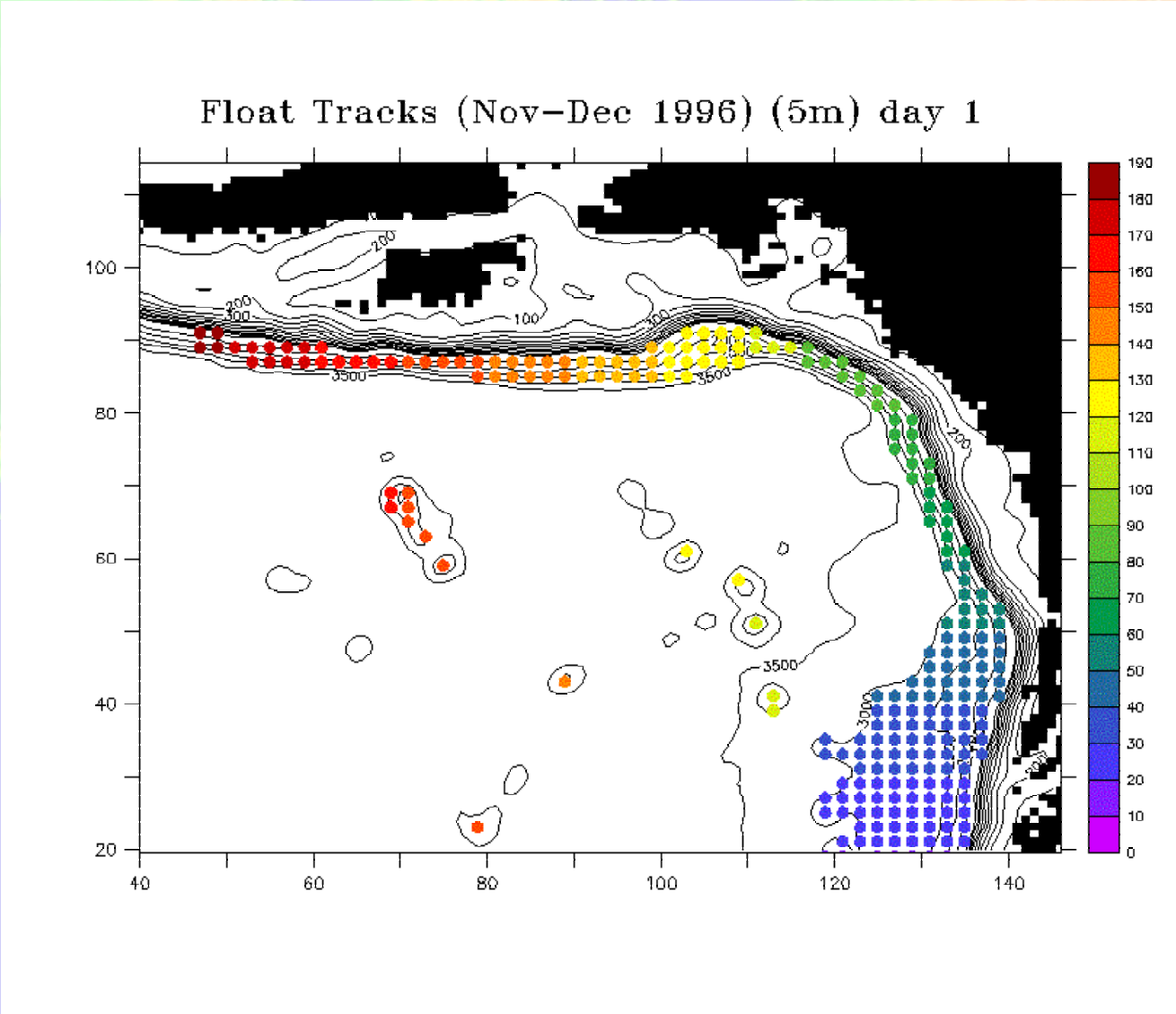
GOA Summary


Runoff
(low nitrate,
high iron)
Low Nutrient
High Chlorophyll
Continental Shelf Break
Alaska Current
Alaska Coastal Current
High Nutrient
Low Chlorophyll
(iron limited)
Ekman Transport
Downwelling
Deep nutrients
mixed to surface
during winter
Continental Shelf

Cross-shelf Transport Mechanisms



Surface Ekman Flux
(downwelling)



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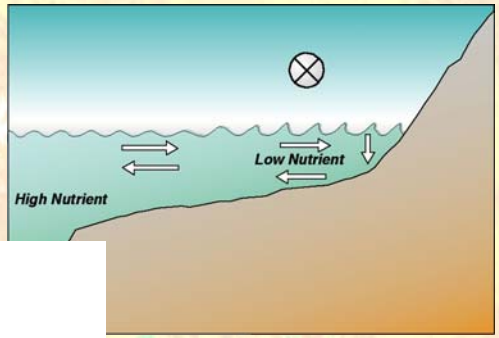
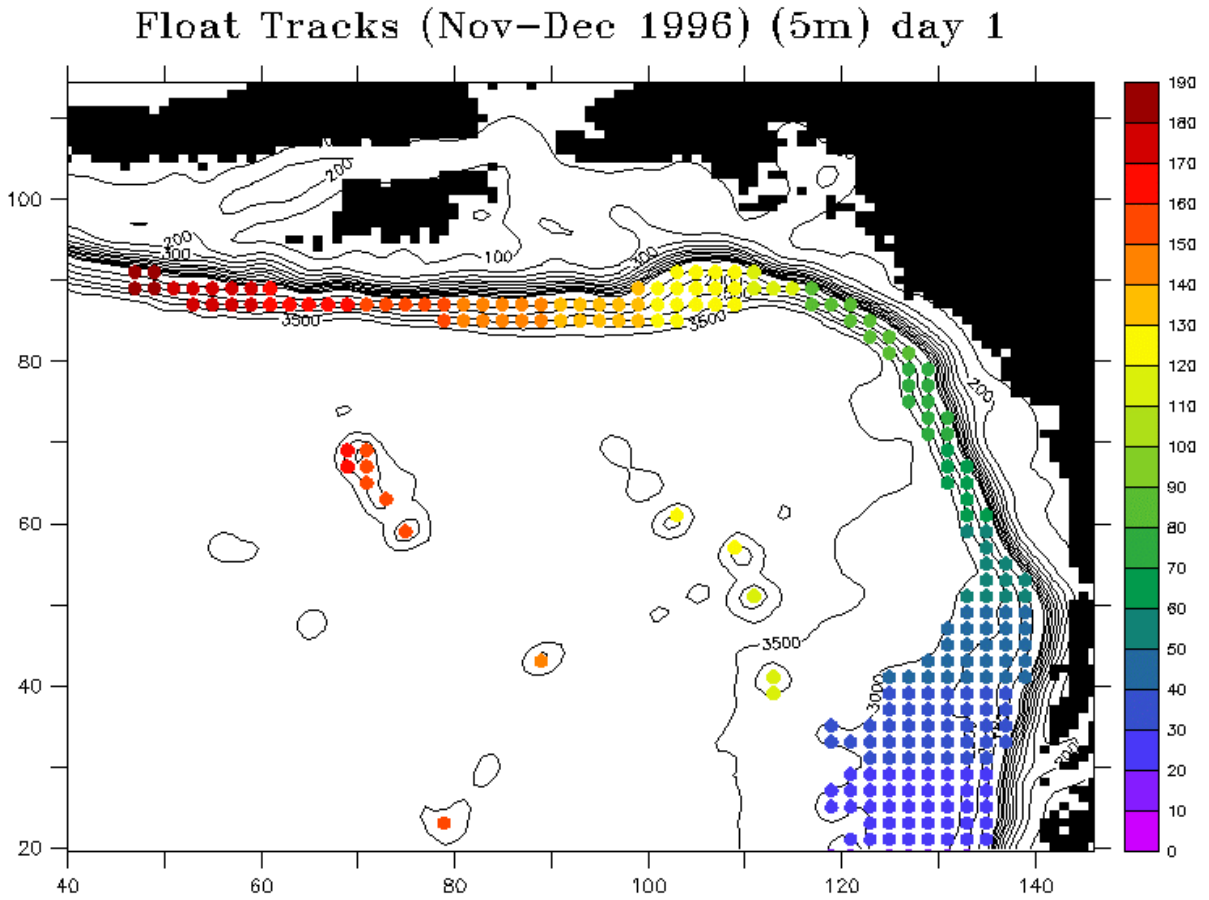
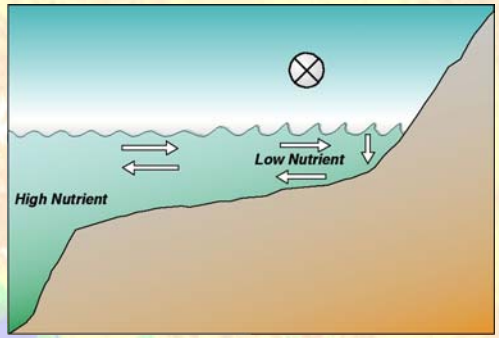
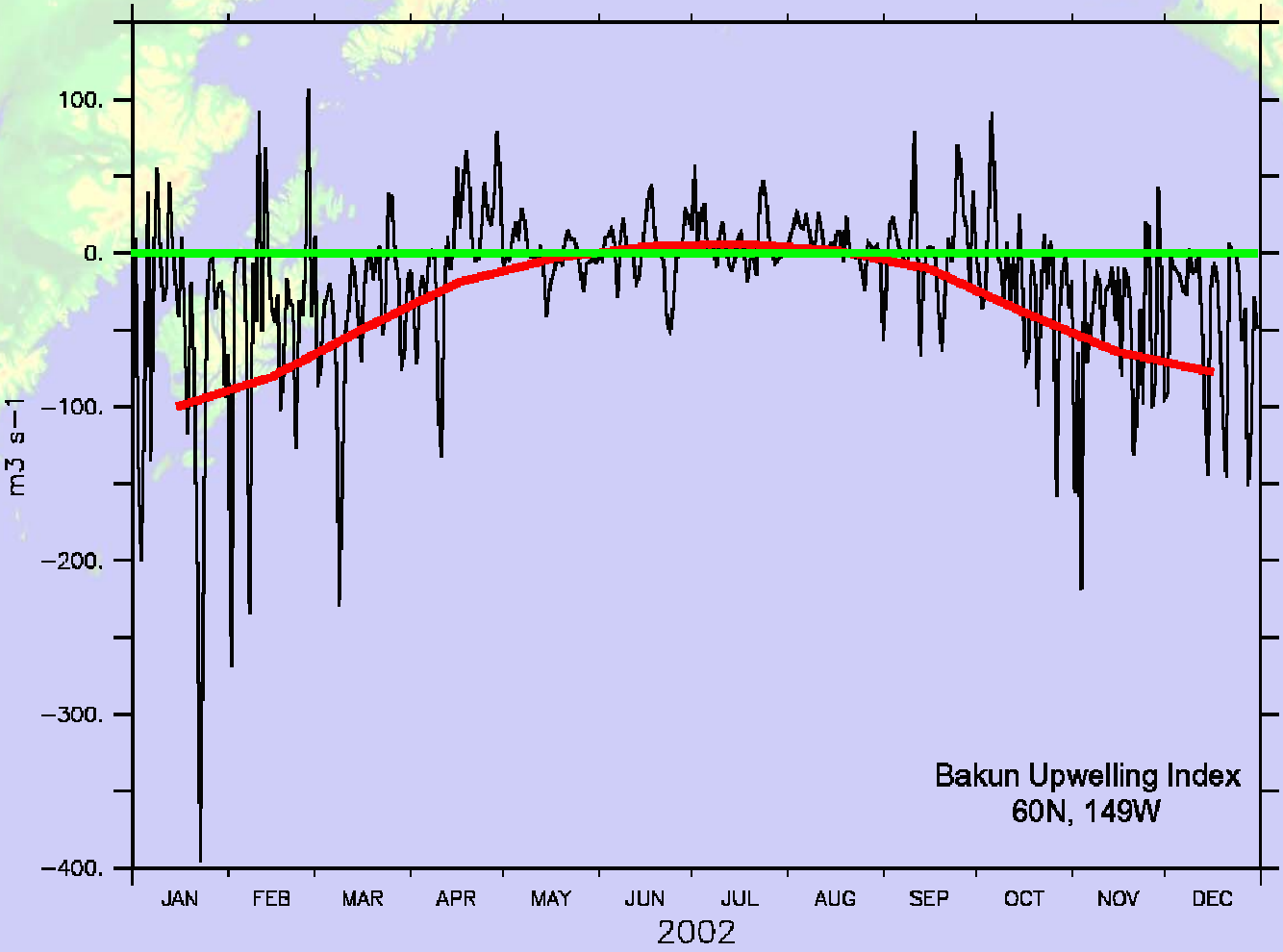




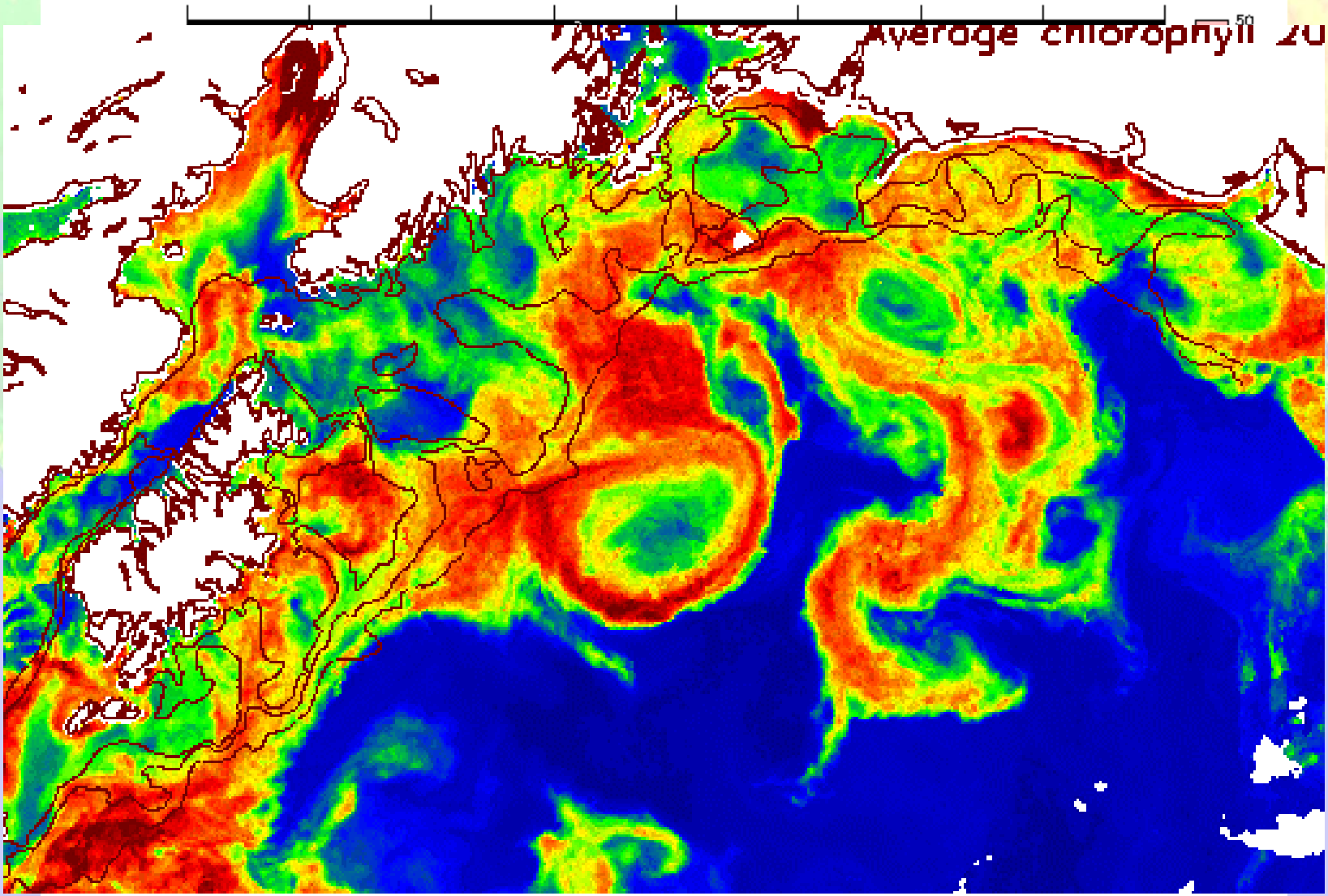
(Hermann et al, 2002)

Episodic Upwelling





Oceanic Eddies



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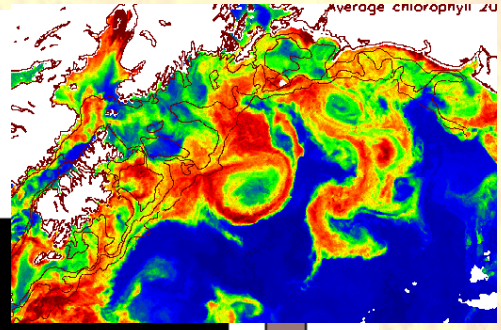
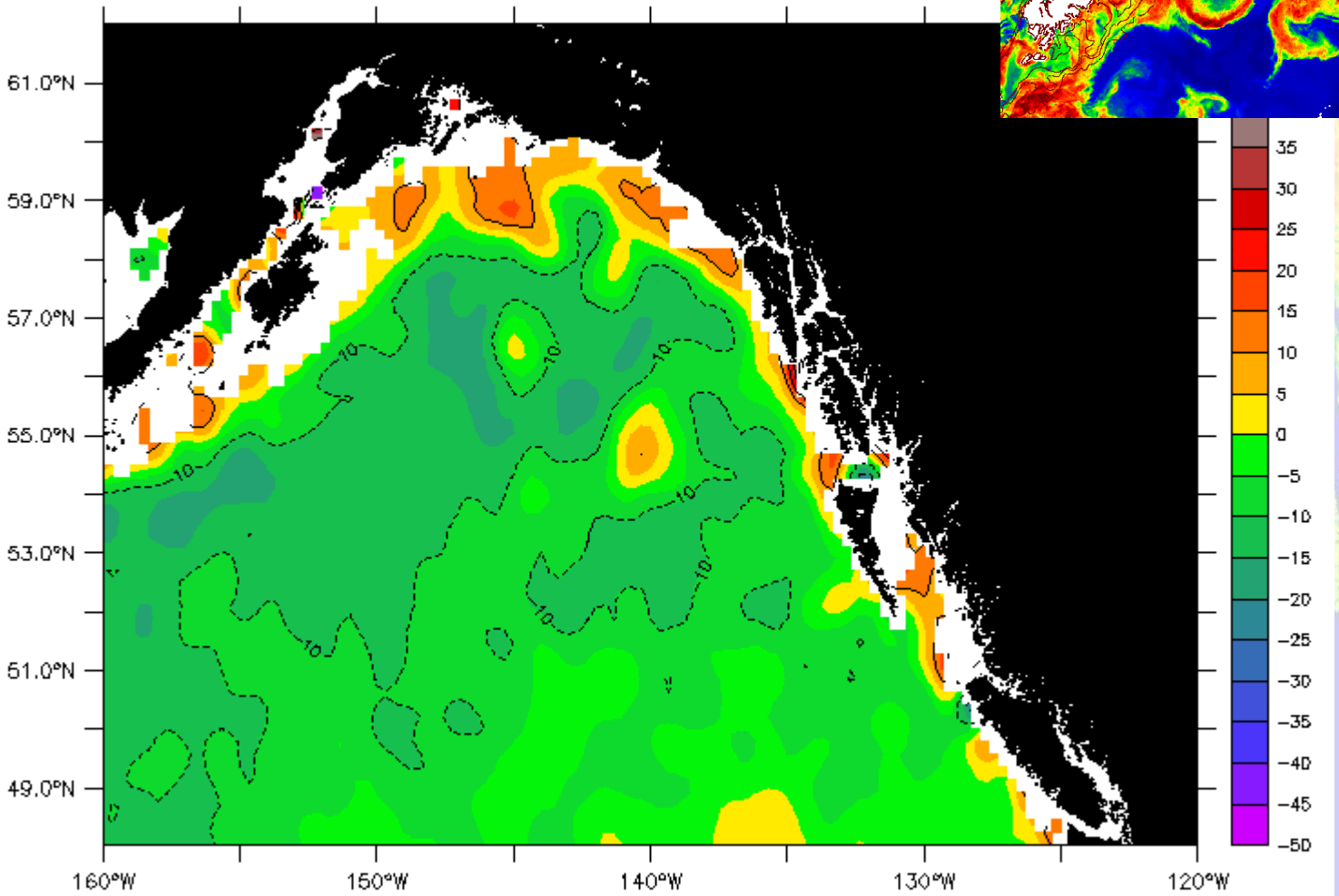
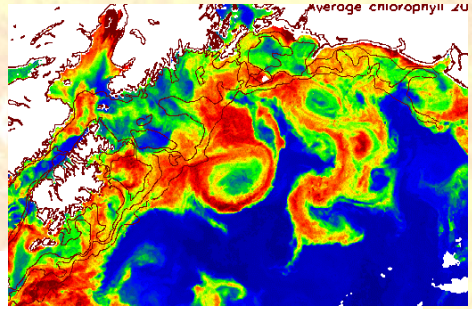
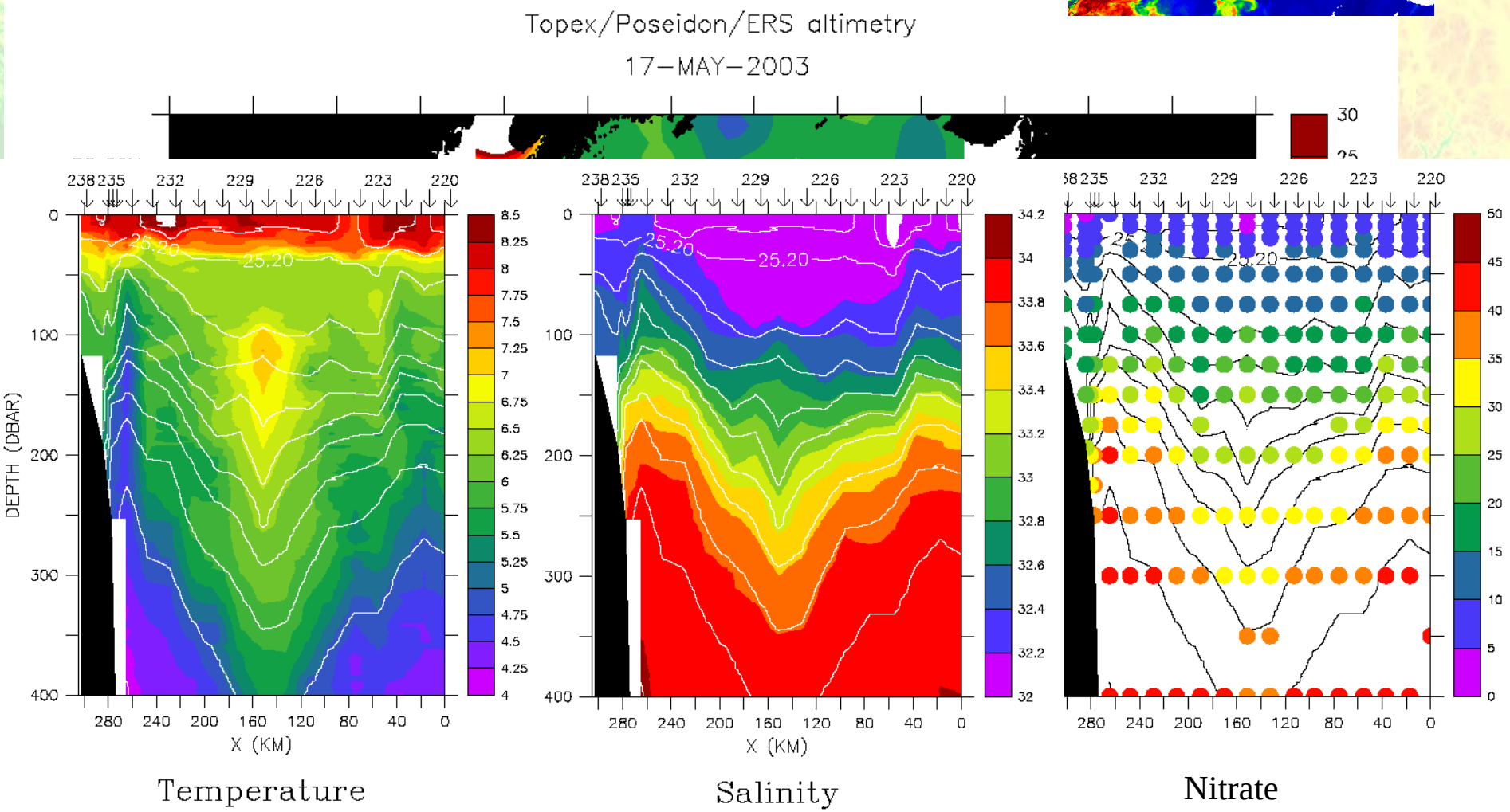


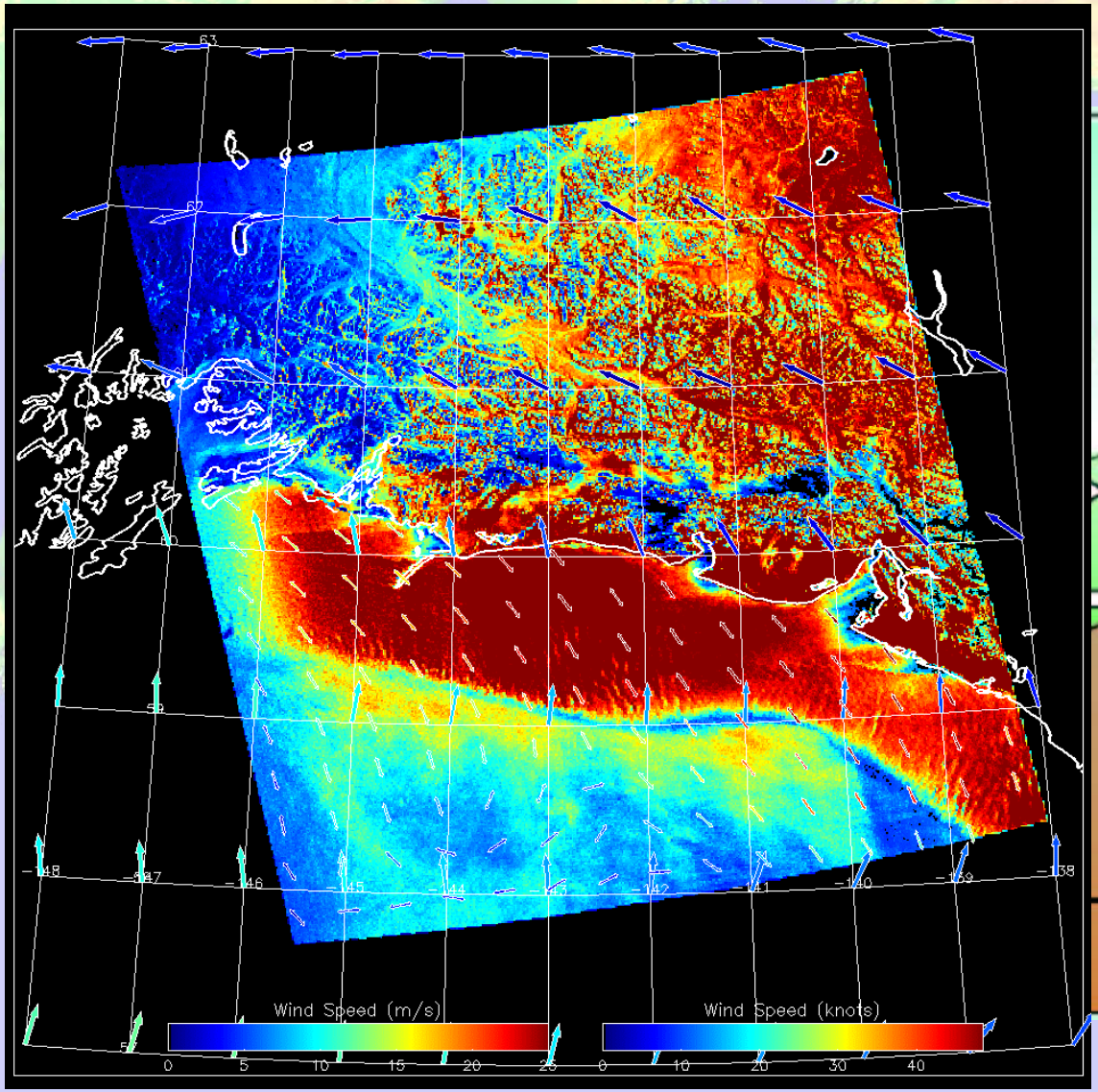


Observations of 2003 Eddy





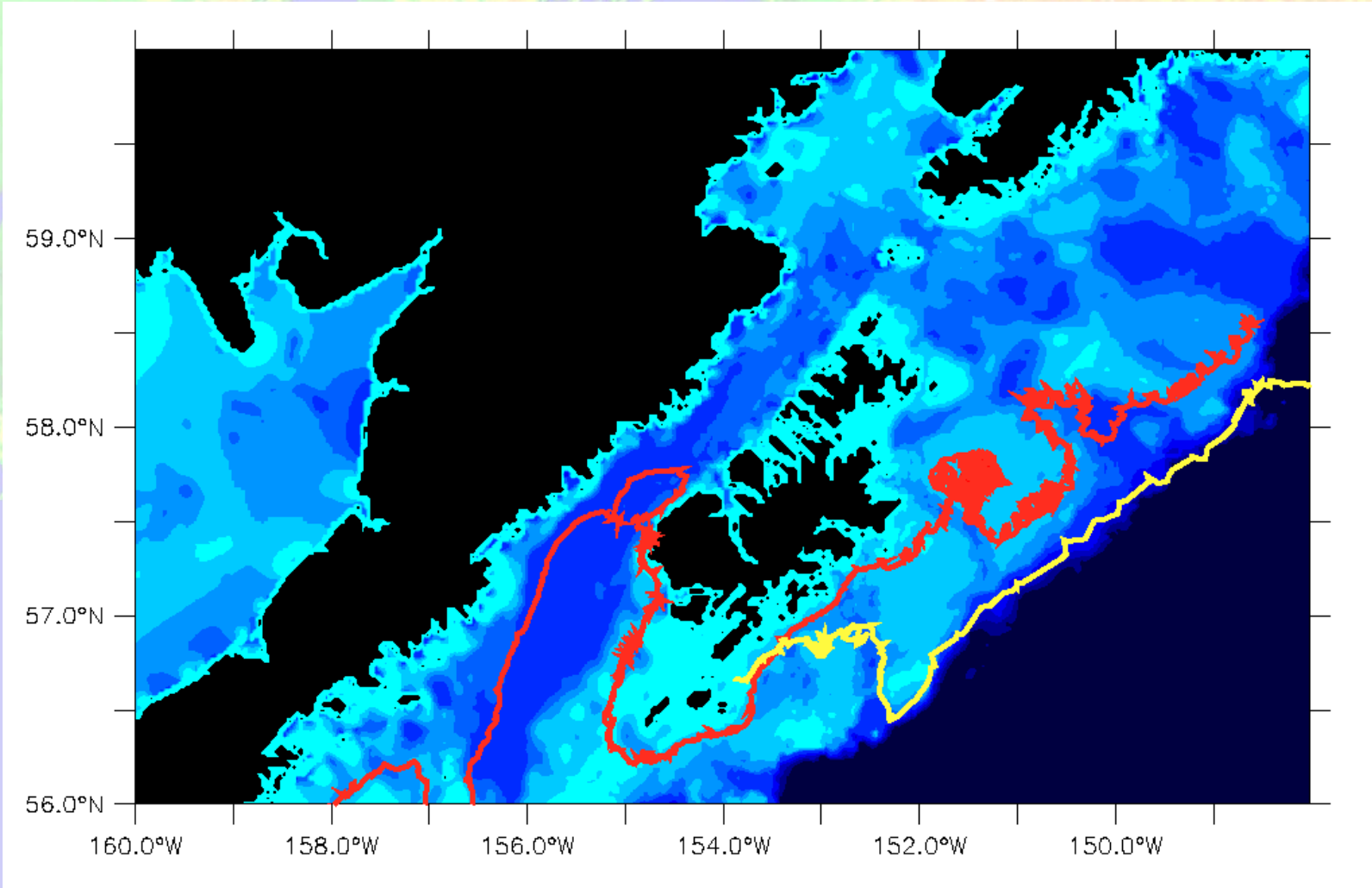
Coastal Windcurl



Synthetic Aperture Radar image

- Conditions favorable to barrier jets occur 1/3 of time during cool season
- avg Ekman pumping velocity of 10 m/day over cool season

Bathymetric Steering



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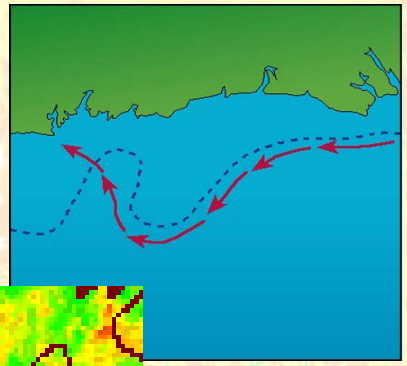
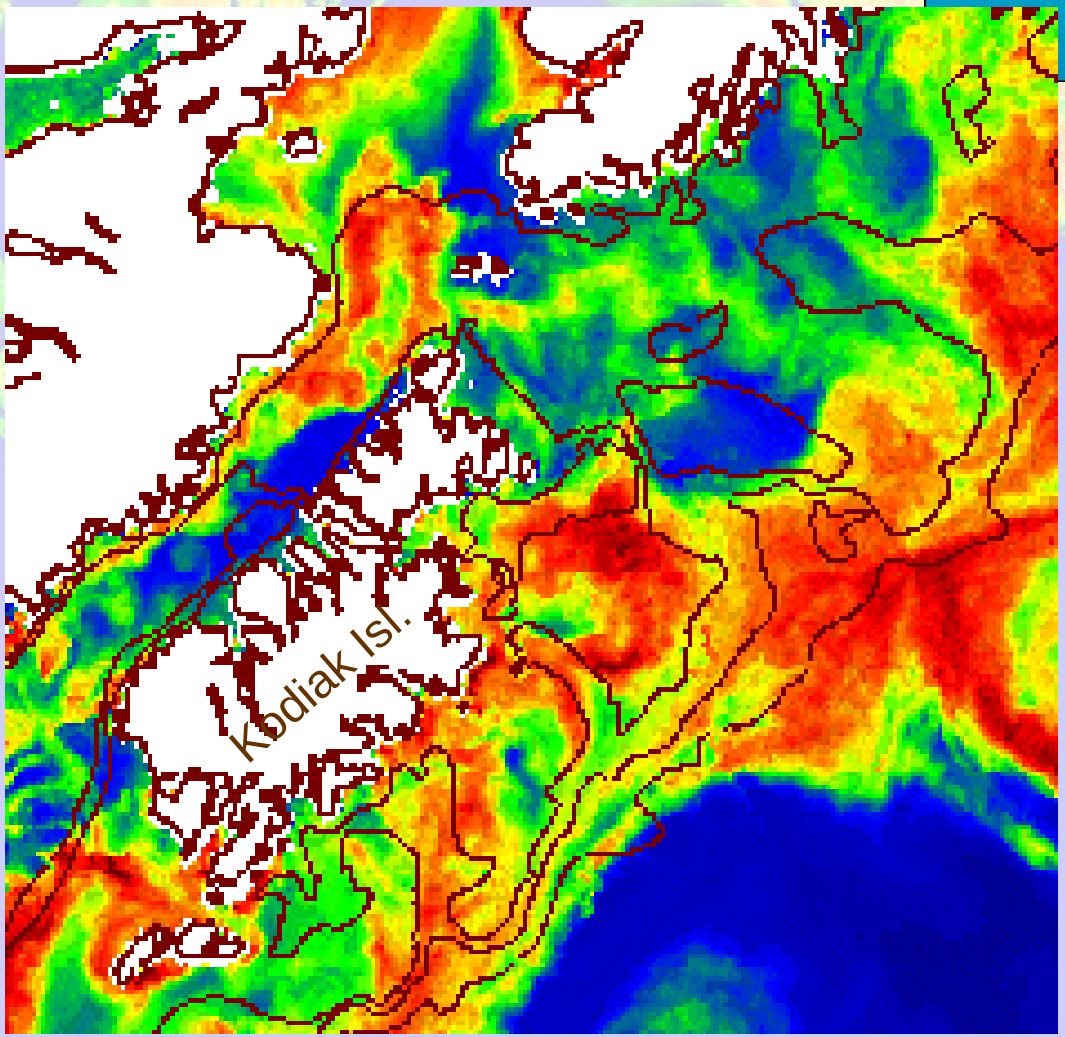
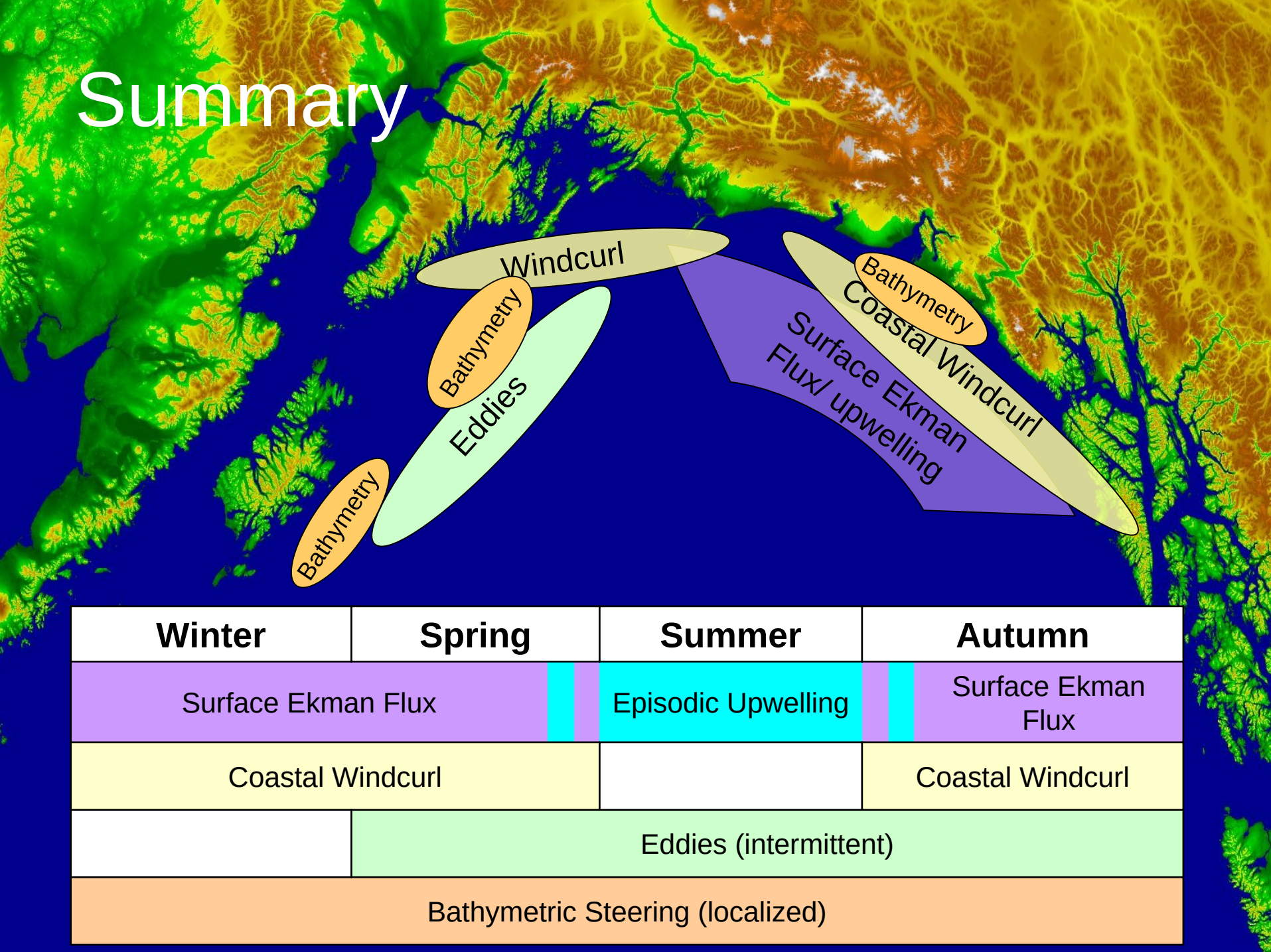




15 May – 29 May 2002

Summary



Winter	Spring	Summer	Autumn
Surface Ekman Flux		Episodic Upwelling	Surface Ekman Flux
Coastal Windcurl			Coastal Windcurl
	Eddies (intermittent)		
Bathymetric Steering (localized)			