

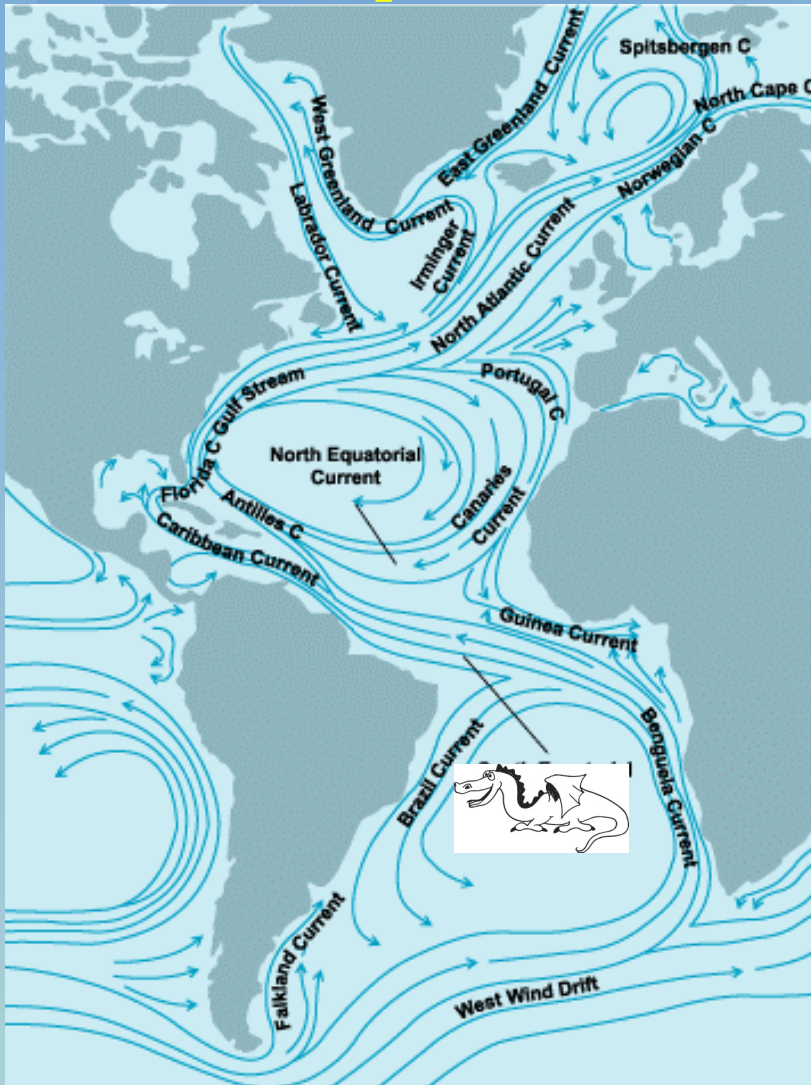
Ocean Surface Currents:

The challenge for the 21st century

Graham Quartly, Adrian Martin,
George Nurser & Paolo
Cipollini



InComplete Knowledge



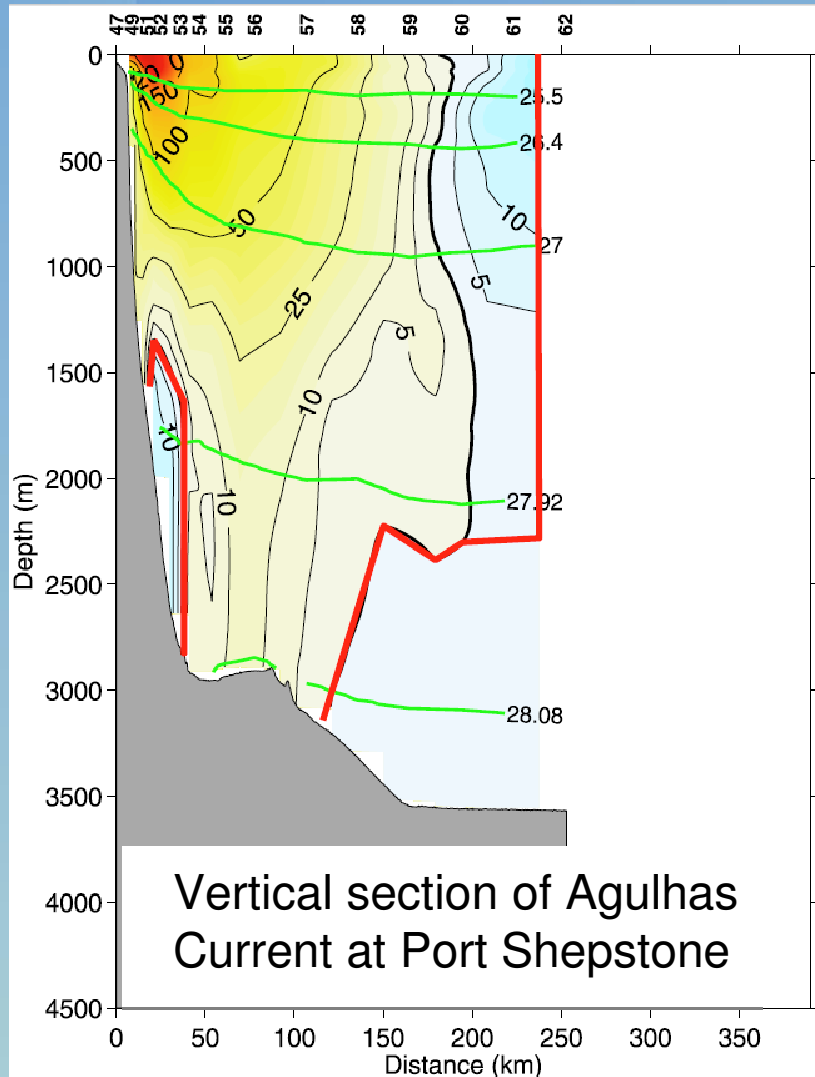
Counter currents
Seasonally-varying currents
Meanders
Eddies
El Niño
River plumes
Tides ...

*Big whirls have little whirls
That feed on their velocity
And little whirls have lesser whirls
And so on to viscosity*

L.F. Richardson



Major Currents - I

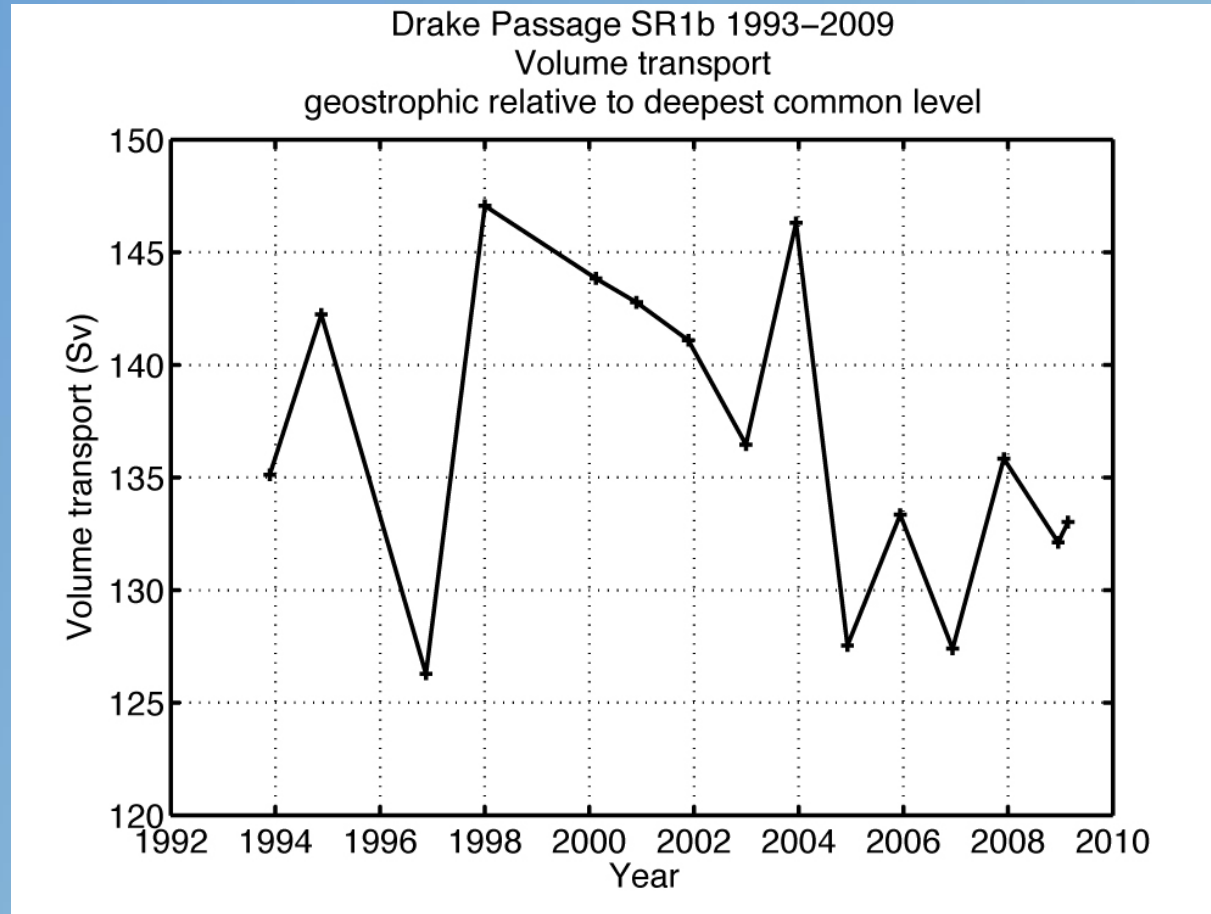


Req: Sample whole current, esp. close to coast

Casal et al. JGR (2009)



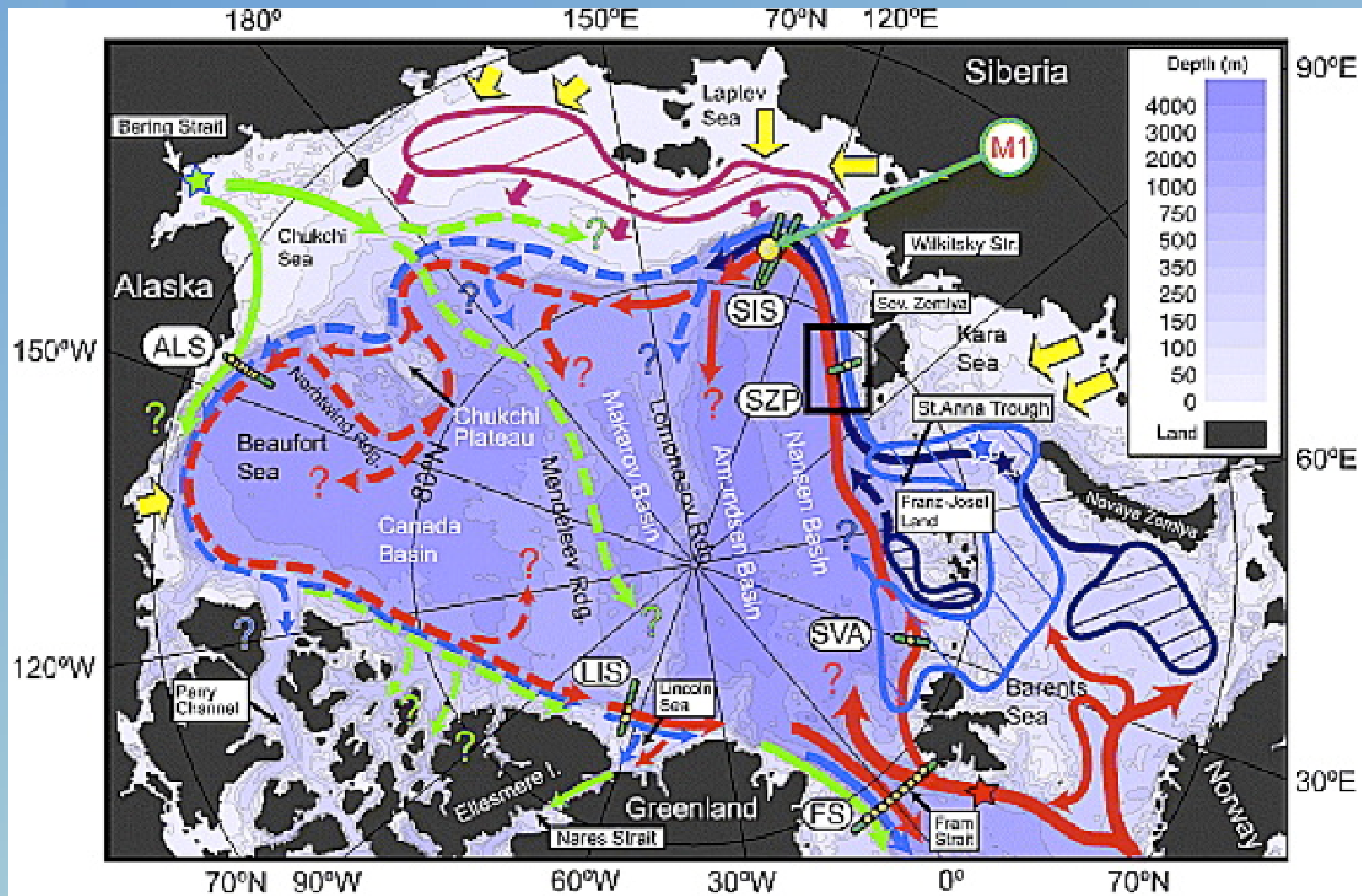
Major Currents - II



King / Hammersley

Req: For climate studies, do not need high-res or high accuracy
Do need long-term consistency



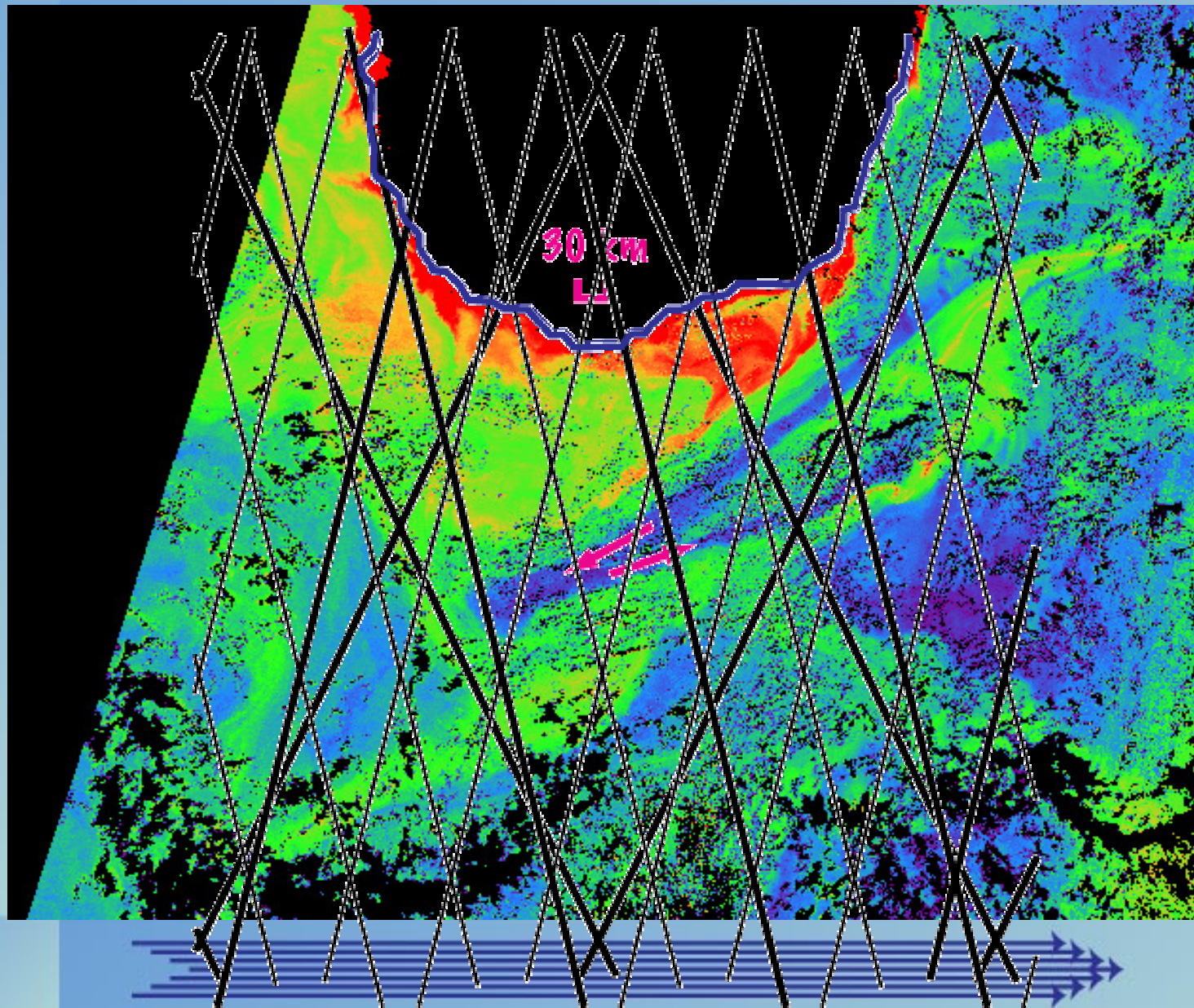


Aksenov et al. JGR (2010)

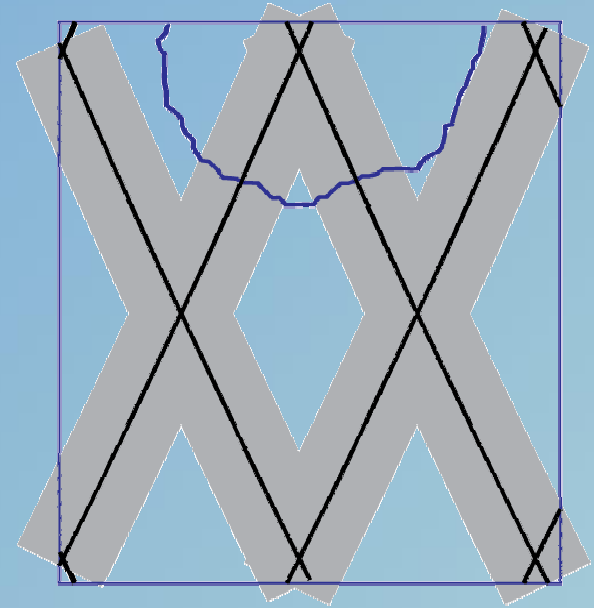
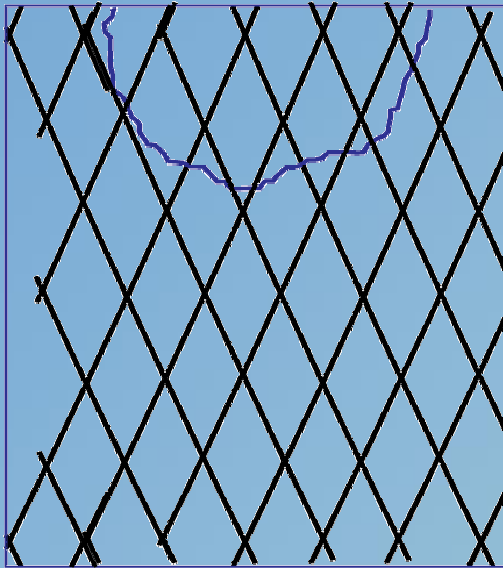
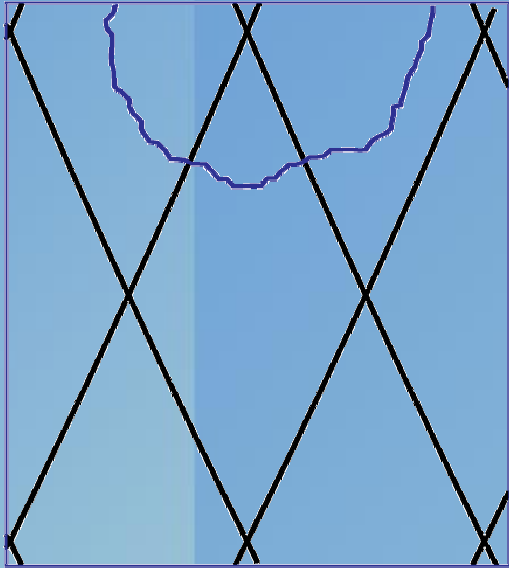
Req: Also work within sea-ice



Sampling of the mesoscale



Eddy statistics

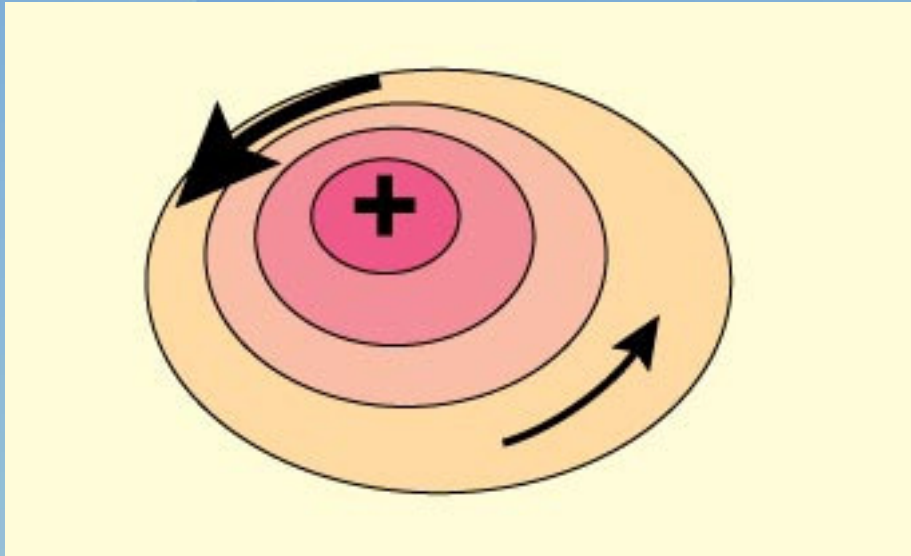


There will be different sampling of eddy field for different periods, no matter whether using along-track or gridded (interpolated) fields.

.Req: Product must include realistic estimates of uncertainties



Sub-mesoscale

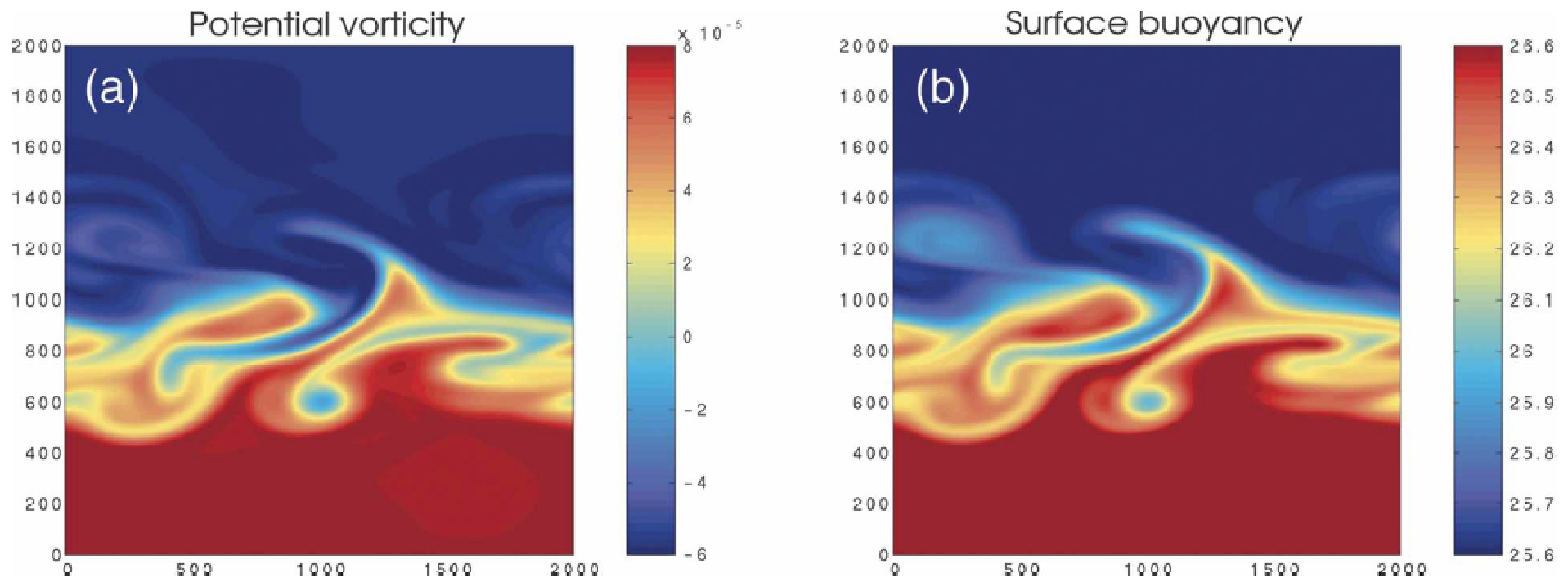


Non-geostrophic flows

Important vertical flows
enhanced mixing
affect mixed layer depth
exert control on nutrient fluxes



Sub-mesoscale



Lapeyre & Klein, JPO (2006)

.Req: To measure vorticity directly, need accuracy in gradients of current — order 5 cm/s for points 2 km apart



Sediment transport

Strong currents along coast may increase erosion of beaches and headlands; transported sediment will be deposited elsewhere, possibly blocking access to ports

.Req: Ideally some knowledge of whether information on surface currents is a skin deep gust on the surface or is a flow several metres deep
Ideally some statistics on peak flows as well as mean



Ecosystem monitoring and Search and Rescue

Many forecast applications:

Oil from Deep Water Horizon

Capsized boats

Wreckage from Air France plane

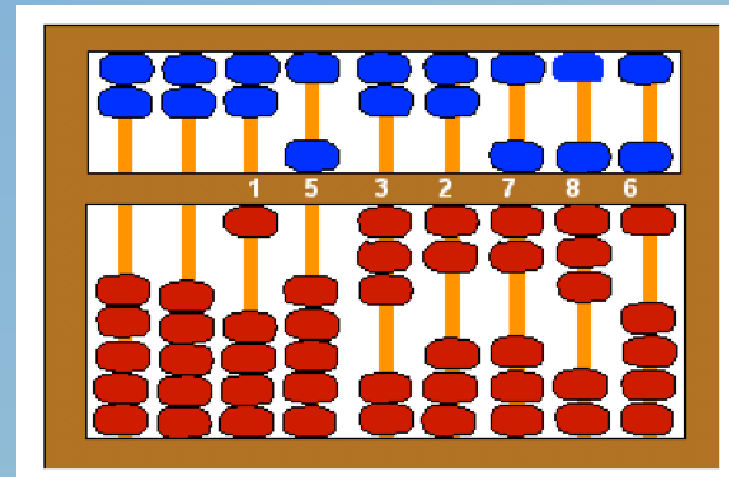
Ship routing (oil tankers to racing
yachts)

.Req: High-resolution product available in near real-time



Operational Current Forecasting

European Centre for Ocean
Current Forecasting
— reanalyses to be available



Summary

Everywhere, including close to coast

Within partially ice-covered regions

Consistent, with information on uncertainty

Resolve sub-mesoscale

Relative accuracy of 5 cm/s over 2 km

Near real-time

Superficial flows and 5m deep flows

Ideal: Less than 1 km resolution, every few hours,
peak and mean flows & into the future !!

