Physical, biological, and geochemical impacts of riverine systems in marine and estuarine environments

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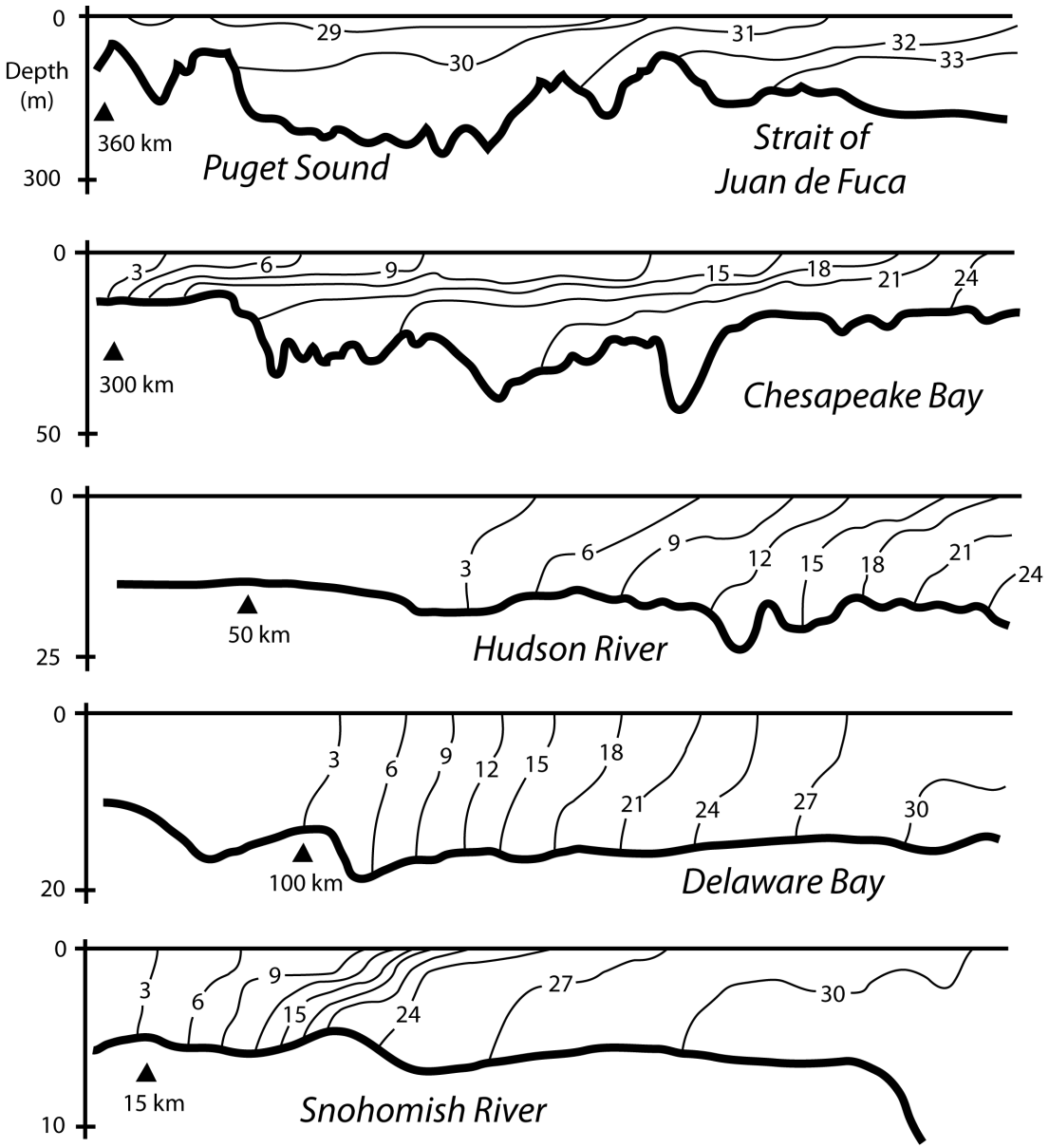
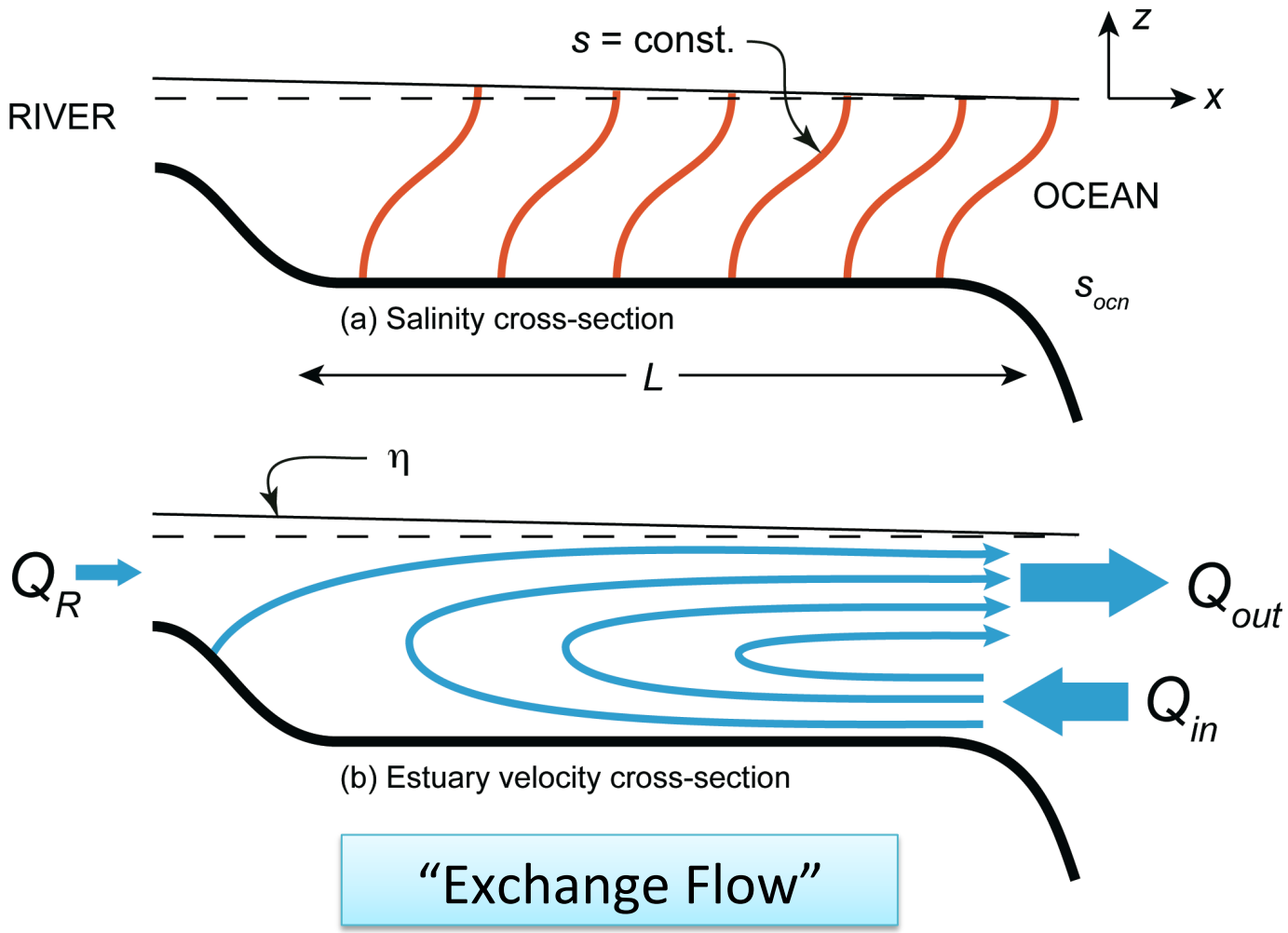
Thanks to: PRISM, COFS, SoO, NSF, NOAA, EPA

Salinity Sections over a wide range of scales



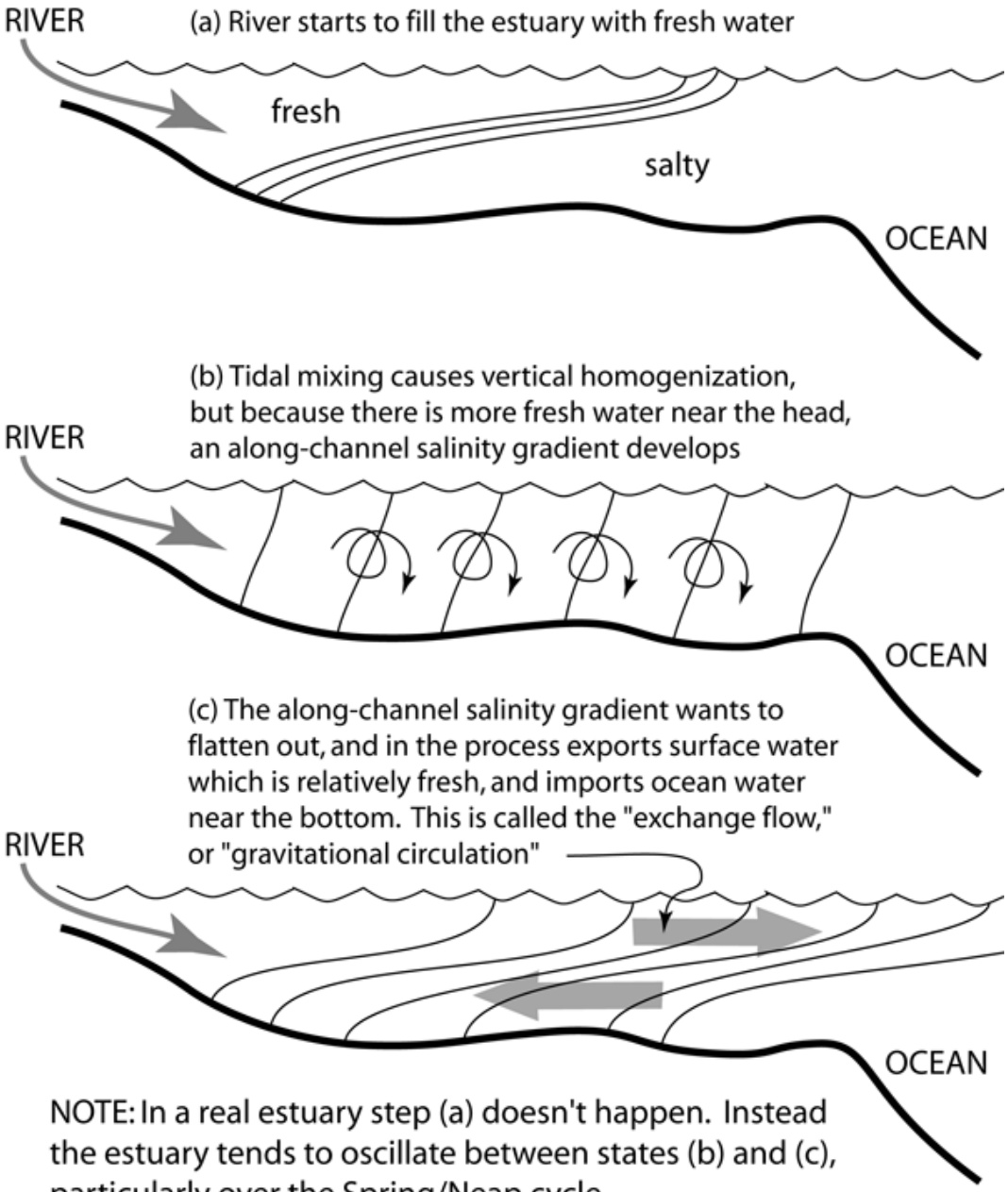
Schematic of **Tidally-Averaged** salinity and velocity structure



"Exchange Flow"

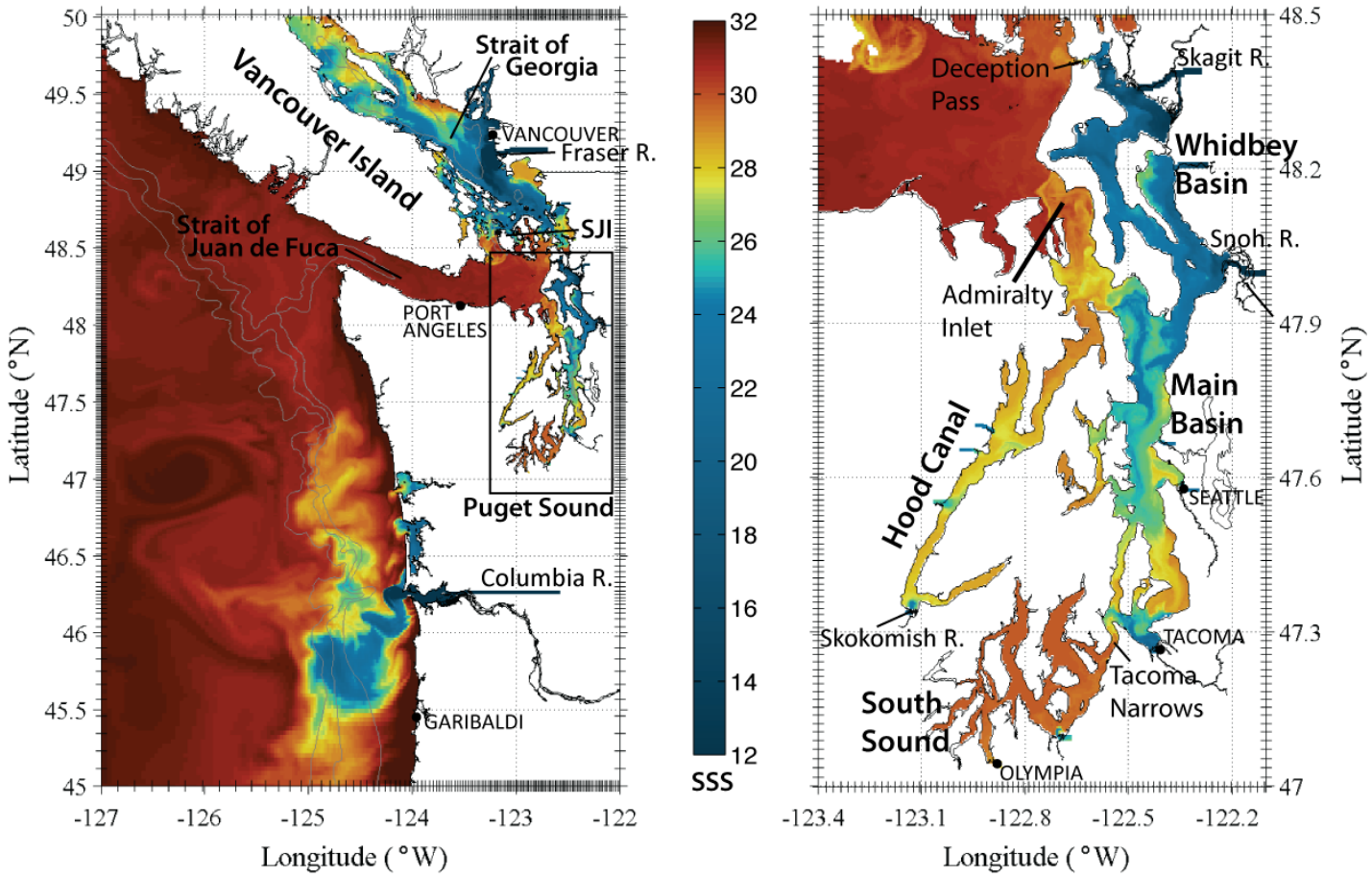
A simple "story" for why the exchange flow exists

- The along-channel salinity (and hence density) gradient is a key factor



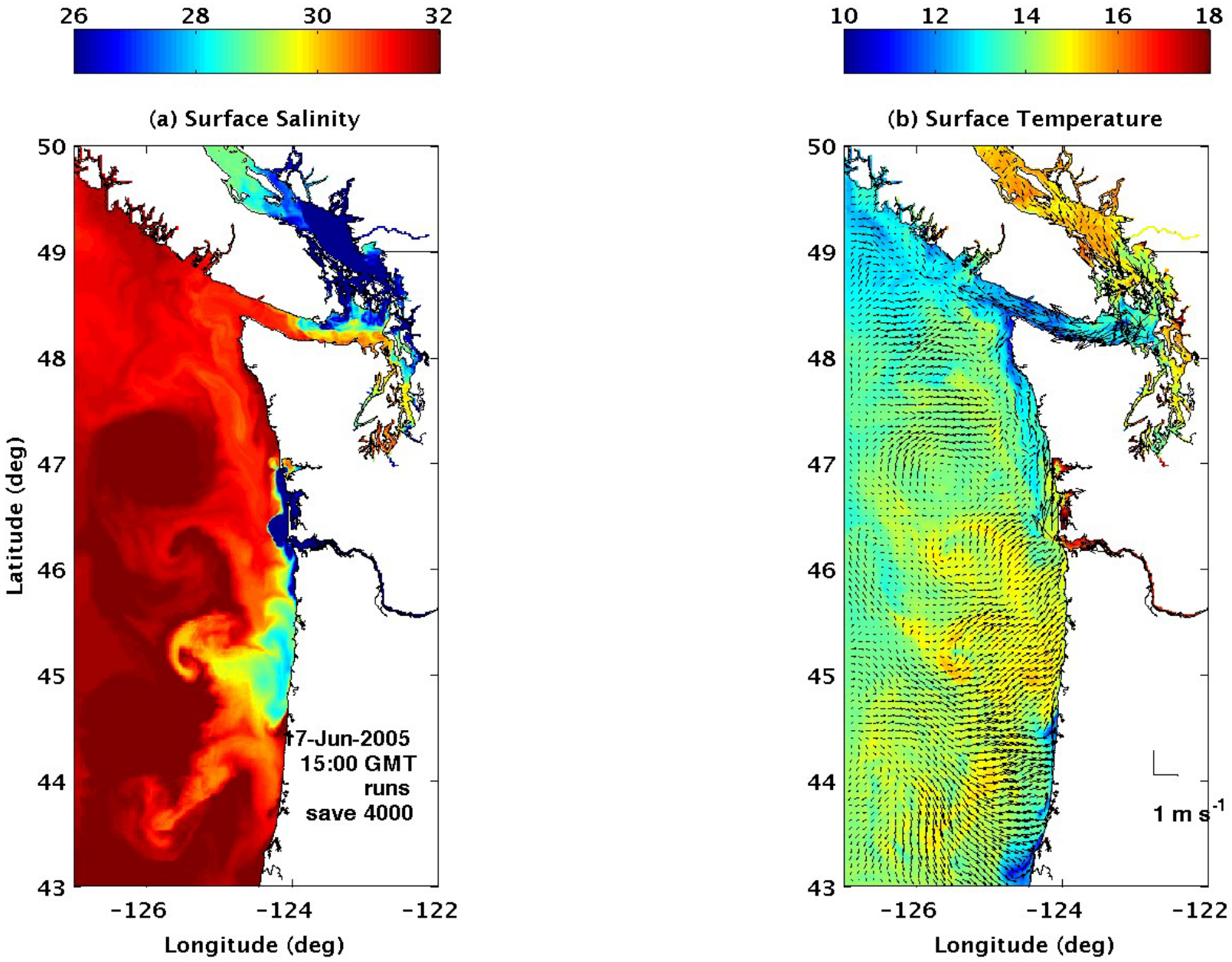
MoSSea: Modeling the Salish Sea

faculty.washington.edu/pmacc/MoSSea

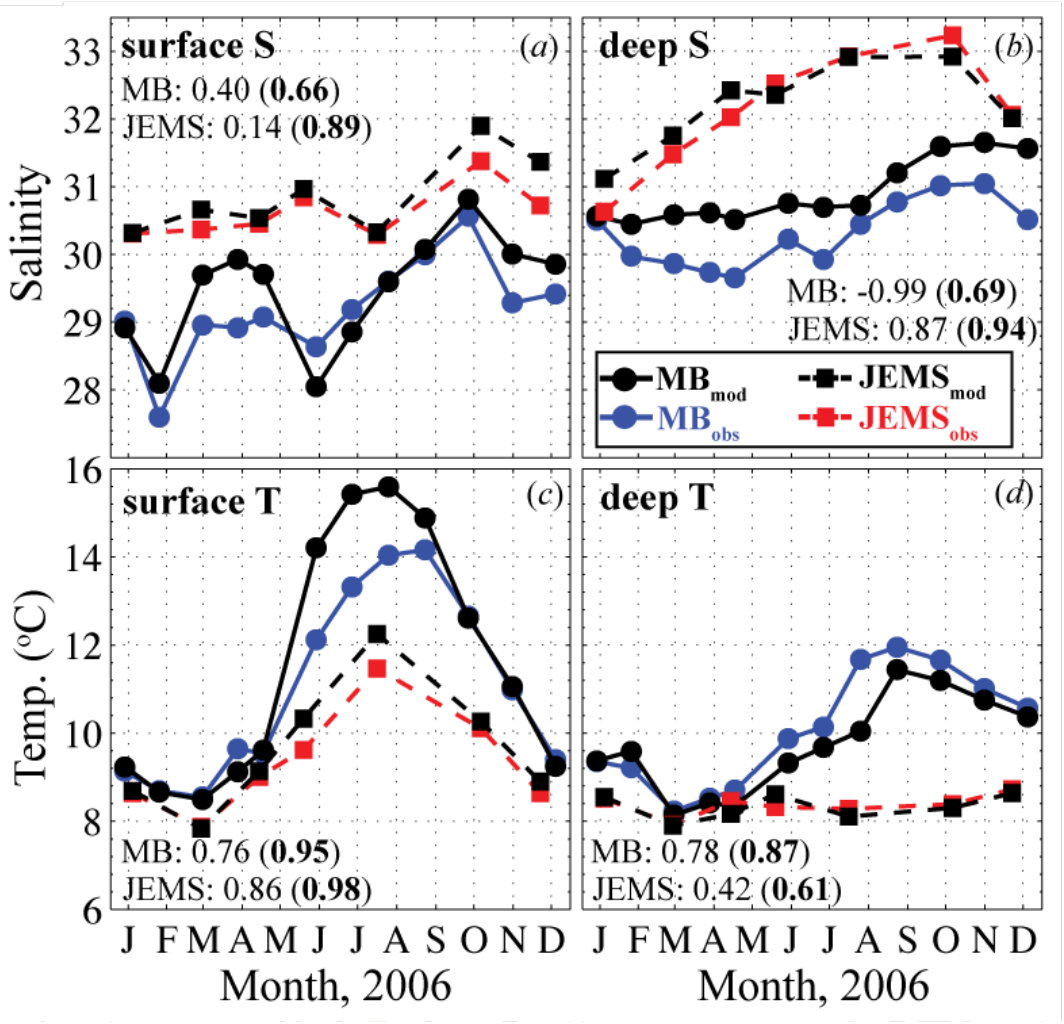


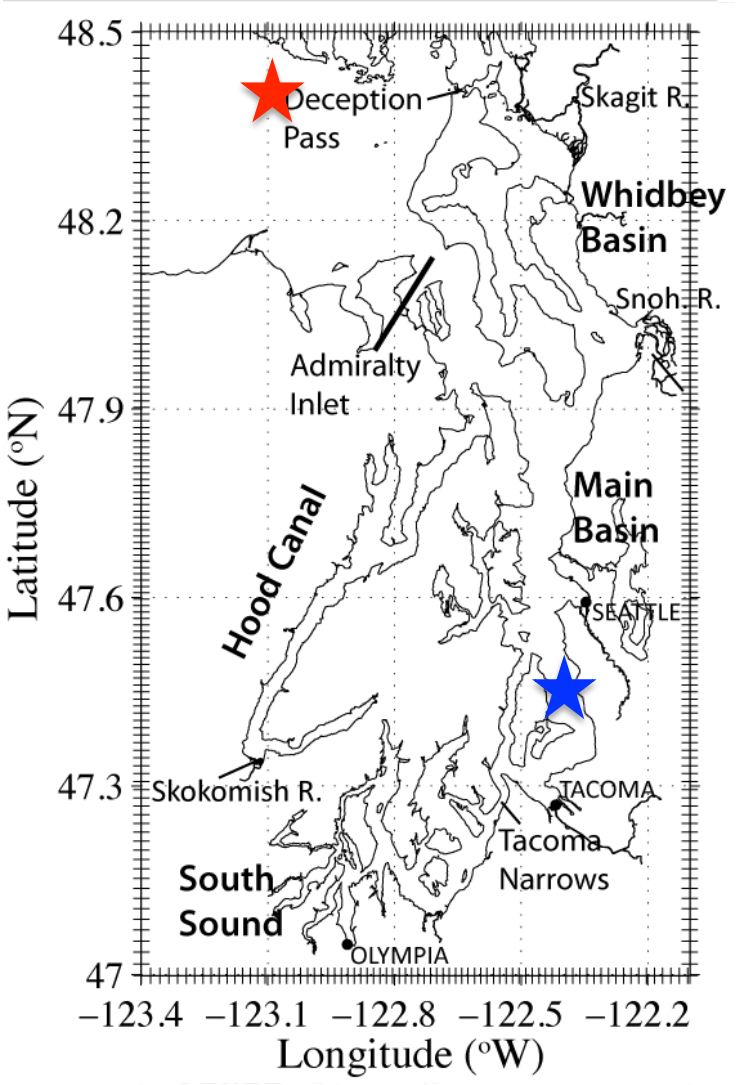
- Realistic hindcasts
- ROMS v.3
- Tides TPXO 7.1

- Rivers (16): USGS
- Wind & Heat Flux: MM5
- Ocean OBC: Global NCOM

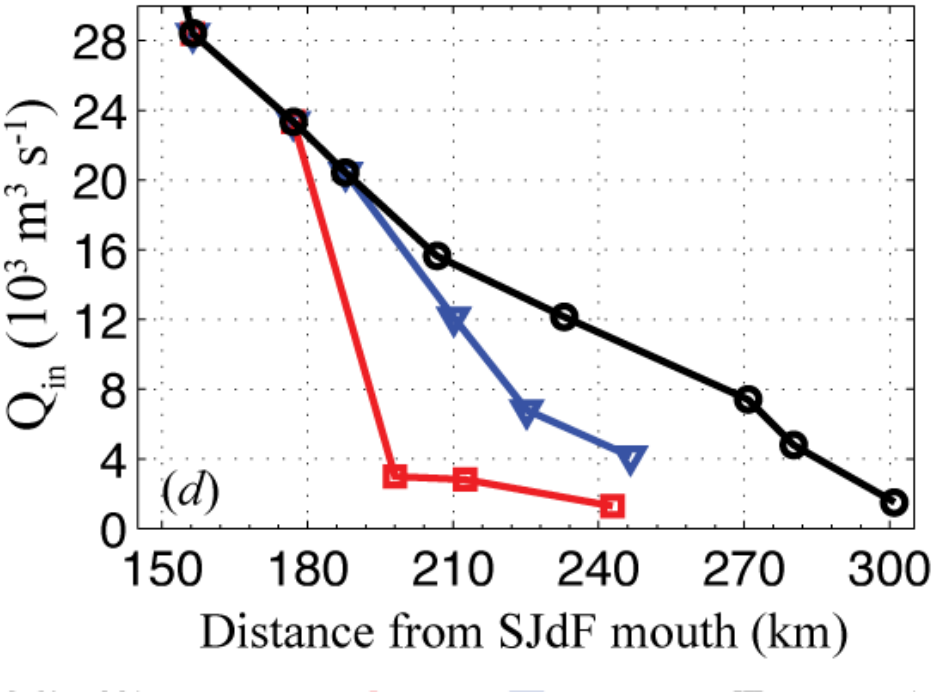

26
28
30
32
(a) Surface Salinity
50
49
48
47
46
45
44
43
Latitude (deg)
-126
-124
-122
Longitude (deg)
17-Jun-2005
15:00 GMT
runs
save 4000
10
12
14
16
18
(b) Surface Temperature
50
49
48
47
46
45
44
43
-126
-124
-122
Longitude (deg)
1 m s-1

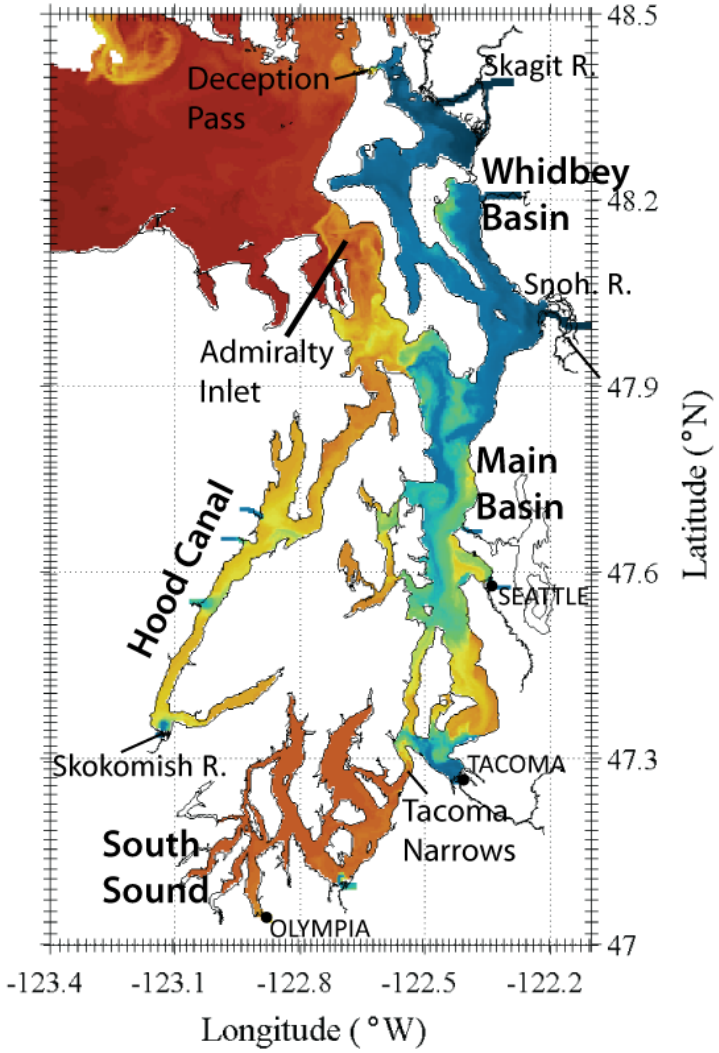
Comparison: Monthly CTD Casts



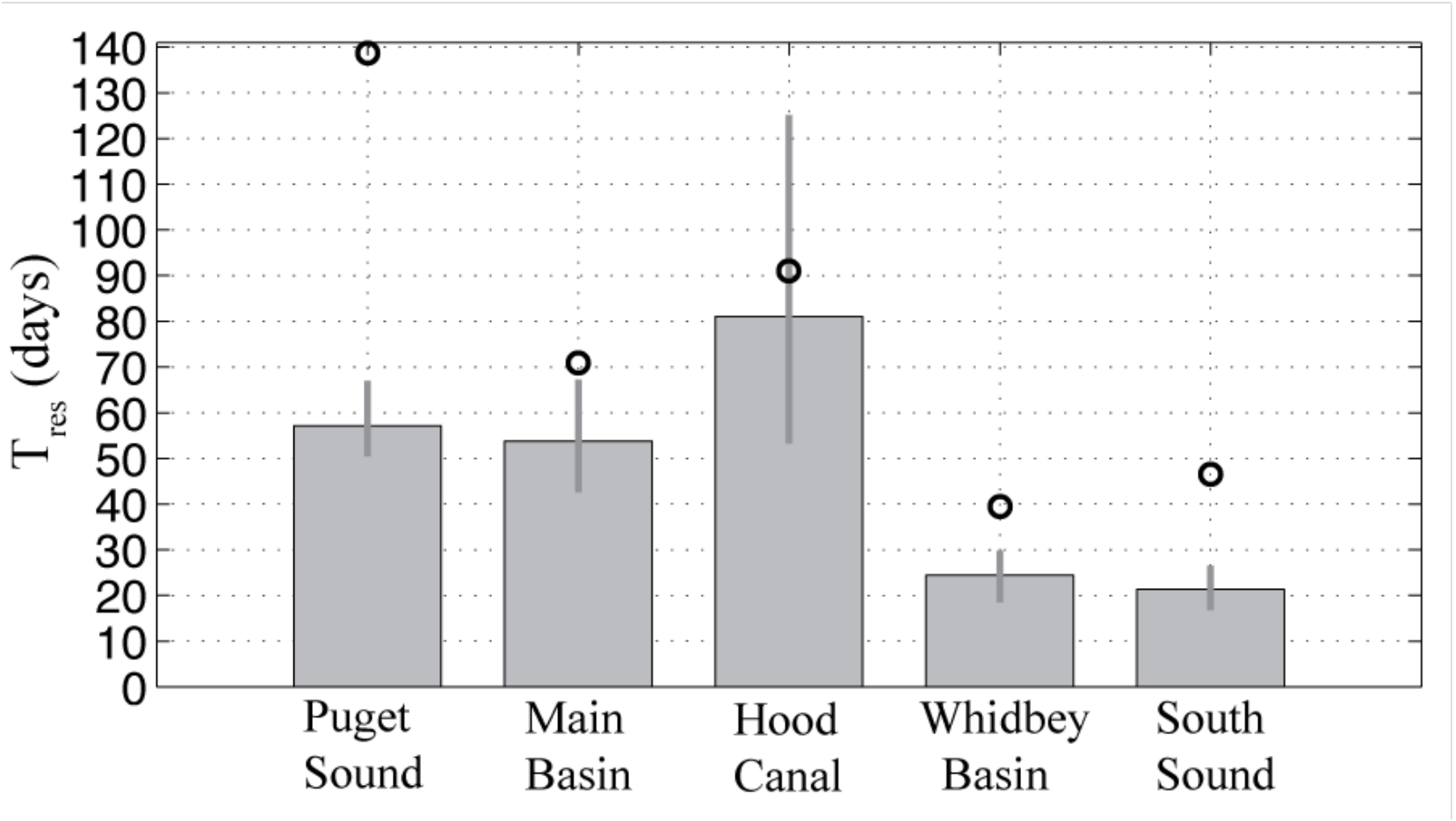


Annual-mean Exchange Flow in the Salish Sea

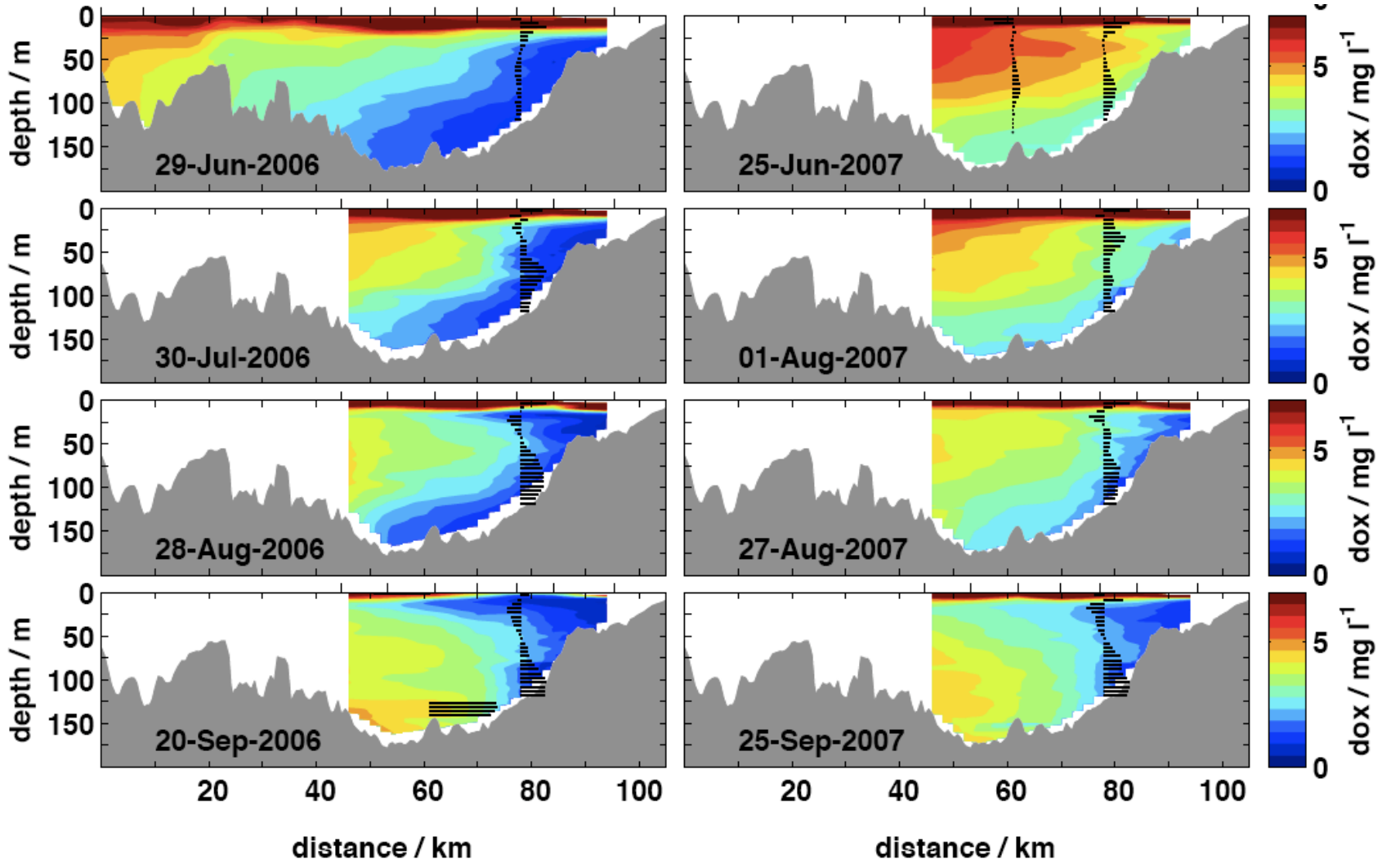




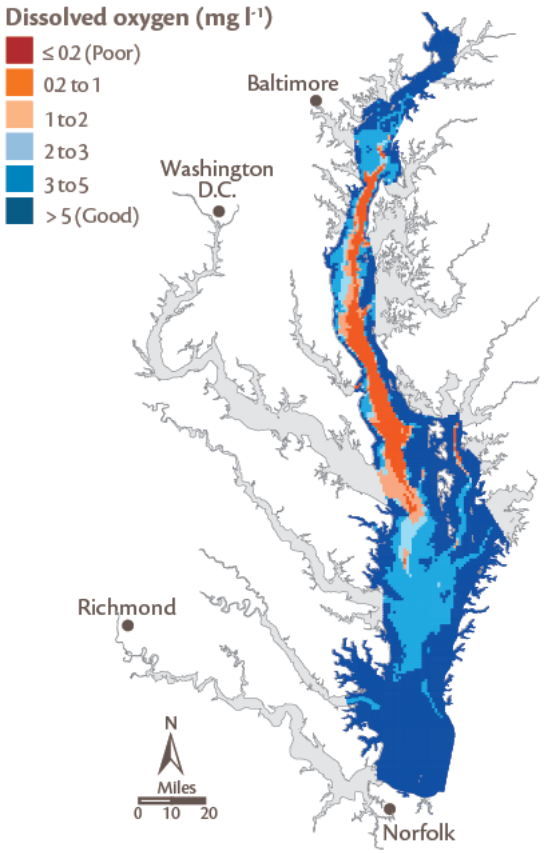
Residence Times



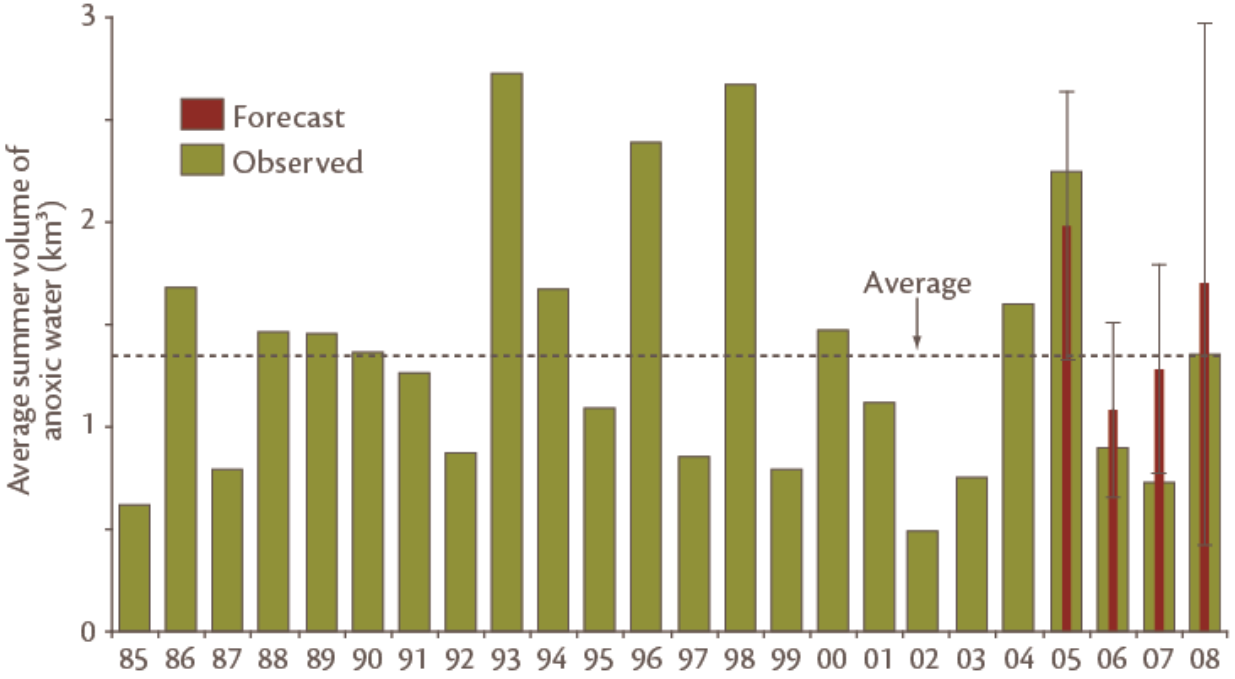
Puget Sound: Hood Canal



Chesapeake Bay



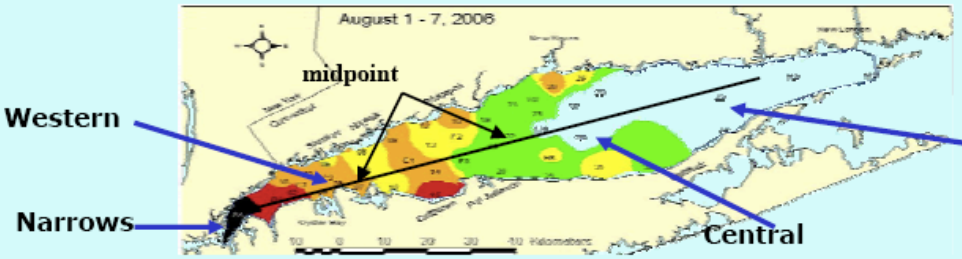
2008 summer dissolved oxygen levels for the mainstem of Chesapeake Bay. Map shows minimum values of the summer average.



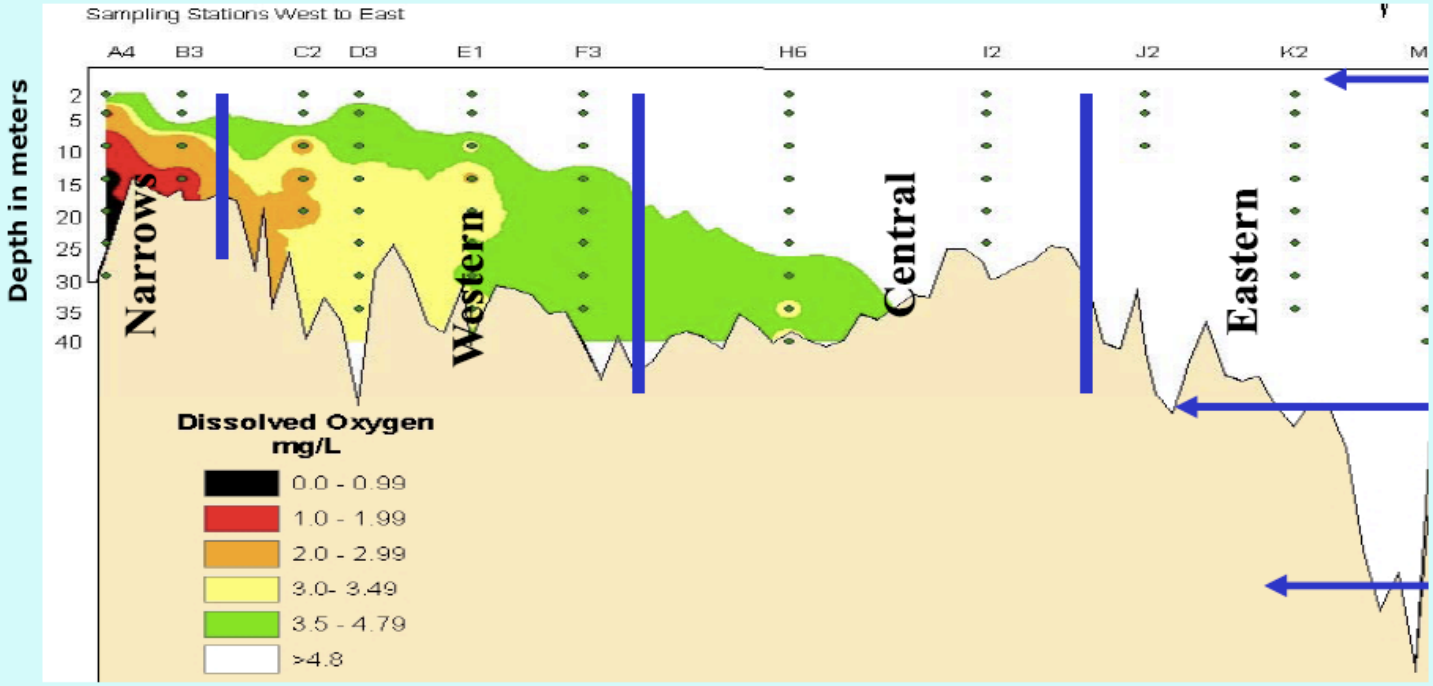
Average summer (June to September) mainstem Chesapeake Bay anoxic volume between 1985 and 2008. Red bars show anoxic volume forecasts that were provided in the proceeding spring.

Long Island Sound

DO Profiles from Surface to Bottom–Aug. 1-7, 2006



DO levels in bottom waters only



Surface

DO Levels—surface to bottom

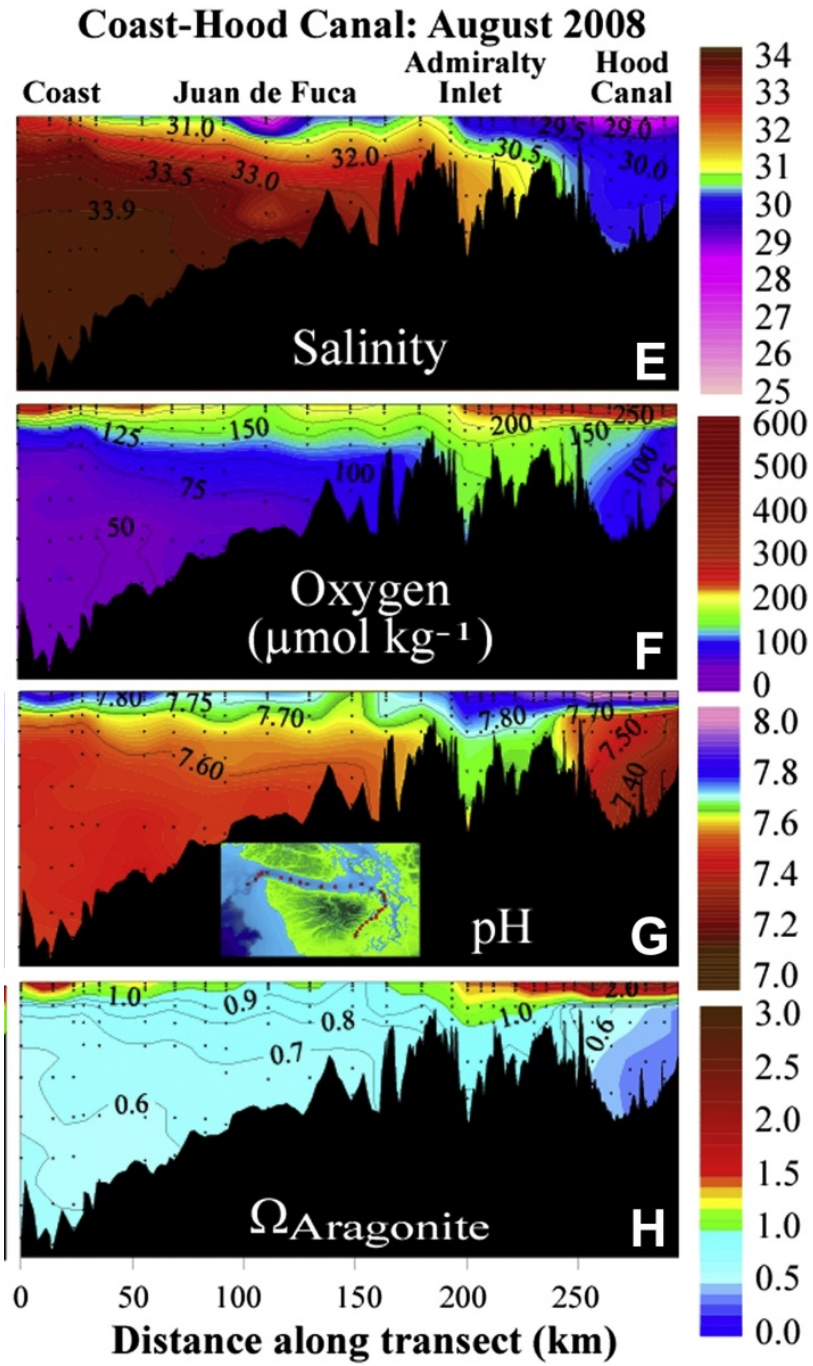
troughs represent bottom waters

Sea floor of LIS

CT DEP

Acidification in Hood Canal

Feely et al., 2010



Conclusions

- Exchange flow is ~30 times greater than the river flow in Puget Sound
- Exchange flow pulls coastal nitrate into Puget Sound
- High productivity in surface water + stagnant deep waters causes hypoxia
- Hypoxia increases acidification

LINKS

- Many papers available at: http://faculty.washington.edu/pmacc/publications.htm
- MoSSea: http://faculty.washington.edu/pmacc/MoSSea/index.html