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# Numerical Simulation of Bacteria Transport and Deposition Processes at a Chicago Beach

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# 10 years of research on 63<sup>rd</sup> Street Beach

The 63<sup>rd</sup> Street Beach of Chicago has by far the highest *E. coli* concentration among 23 Lake Michigan beaches in Chicago. Why?

TABLE 1. Descriptive Statistics for the 23 Chicago Beaches Included in the Study<sup>a</sup>

	N	geometric mean	mean (log <sub>10</sub> )	SE	variance	95% confidence intervals	
						lower	upper
Juneway	326	45.9	1.66	0.044	0.64	1.58	1.75
Rogers	327	43.8	1.64	0.046	0.70	1.55	1.73
Howard	309	45.9	1.66	0.045	0.56	1.57	1.75
Jarvis/Fargo	323	43.4	1.64	0.044	0.64	1.55	1.72
Loyola	291	52.8	1.72	0.046	0.61	1.63	1.81
Pratt	326	50.0	1.70	0.043	0.61	1.61	1.78
North Shore	324	45.7	1.66	0.045	0.64	1.57	1.75
Hartigan	326	42.6	1.63	0.045	0.66	1.54	1.72
Thorndale	323	68.0	1.83	0.040	0.51	1.75	1.91
Osterman	323	61.4	1.79	0.042	0.56	1.71	1.87
Foster	323	59.4	1.77	0.041	0.55	1.69	1.86
Montrose	328	76.7	1.88	0.039	0.50	1.81	1.96
North Ave.	326	48.2	1.68	0.041	0.56	1.60	1.76
Oak	324	46.3	1.67	0.040	0.53	1.59	1.74
Ohio	325	39.4	1.60	0.040	0.53	1.52	1.67
12th	325	55.0	1.74	0.042	0.57	1.66	1.82
31st	331	62.0	1.79	0.042	0.60	1.71	1.88
49th	234	33.8	1.53	0.054	0.69	1.42	1.64
57th	329	70.1	1.85	0.039	0.49	1.77	1.92
63rd	337	140.0	2.15	0.037	0.46	2.07	2.22
South Shore	327	66.8	1.83	0.039	0.51	1.75	1.90
Rainbow	330	68.3	1.83	0.038	0.48	1.76	1.91
Calumet	323	65.9	1.81	0.039	0.50	1.74	1.90

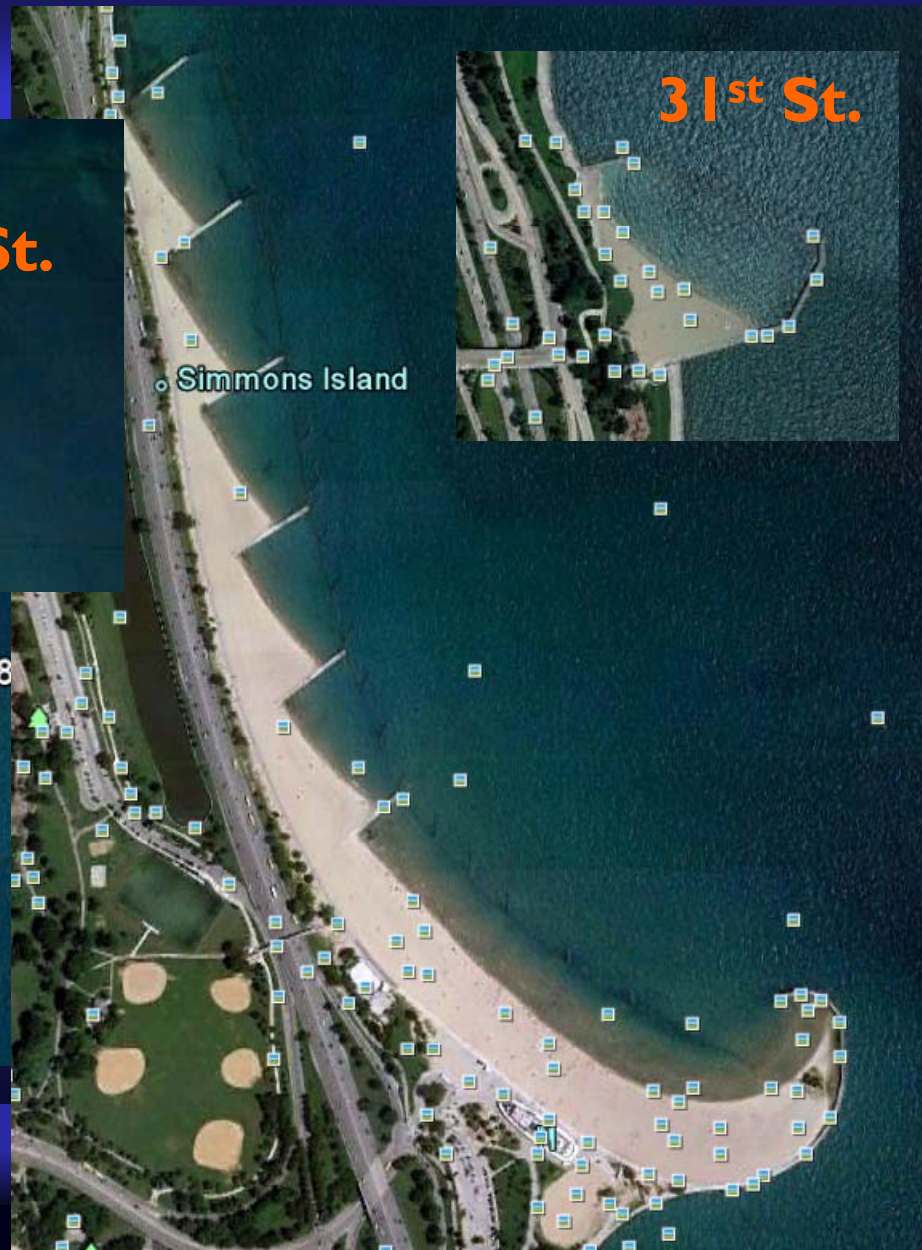
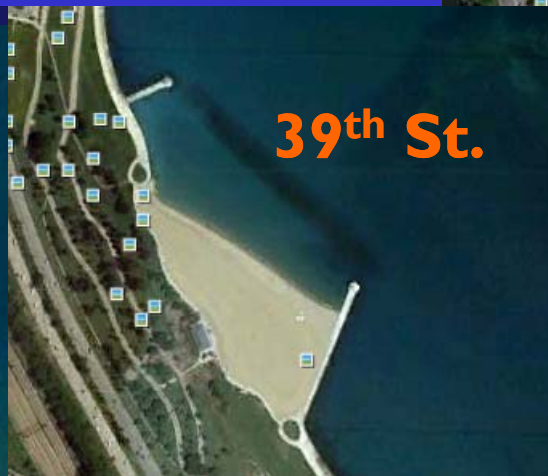
<sup>a</sup> Beaches are listed in order from north to south. N = total number of samples; geomean = geometric mean for *E. coli* concentrations of all samples; mean(log<sub>10</sub>) = mean of log-transformed *E. coli* concentrations; SE = standard error of the mean (log<sub>10</sub>).



Whitman and Nevers 2008  
(*Environ. Sci. Technol.*)

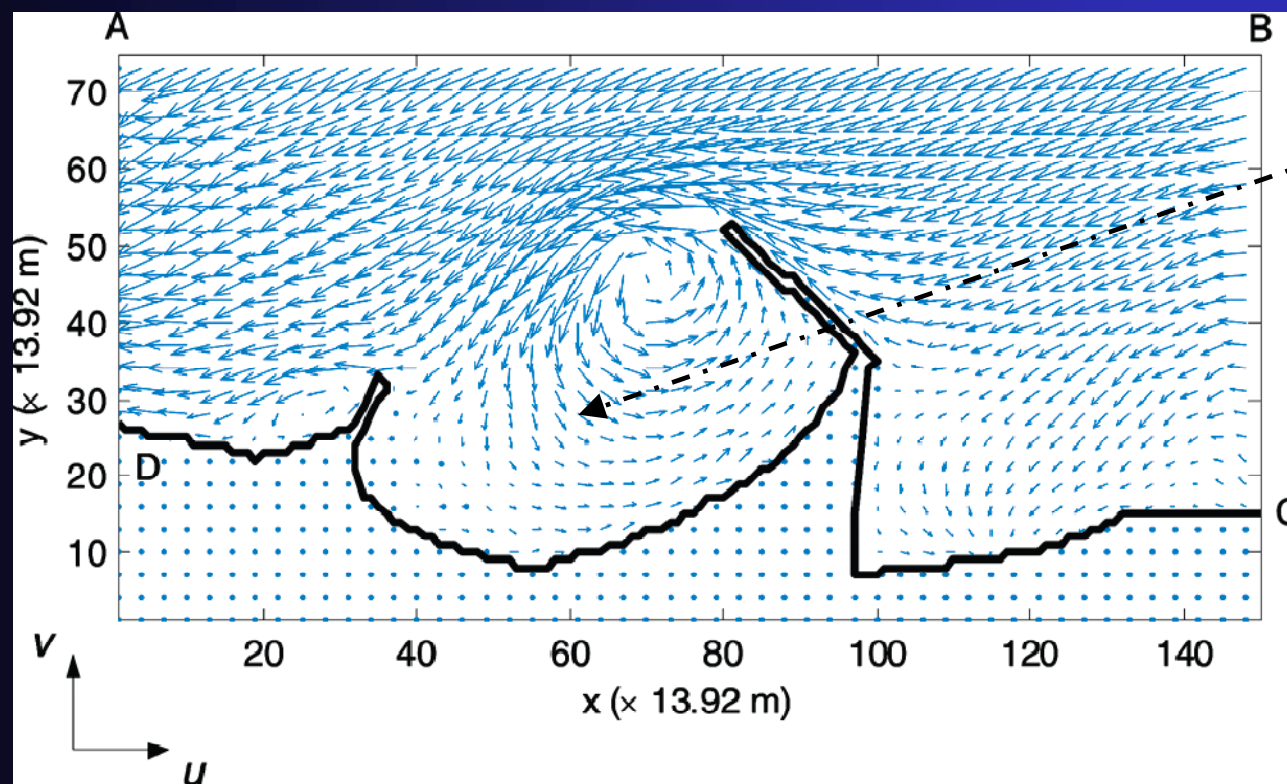


# The structure of the embayment might be a problem



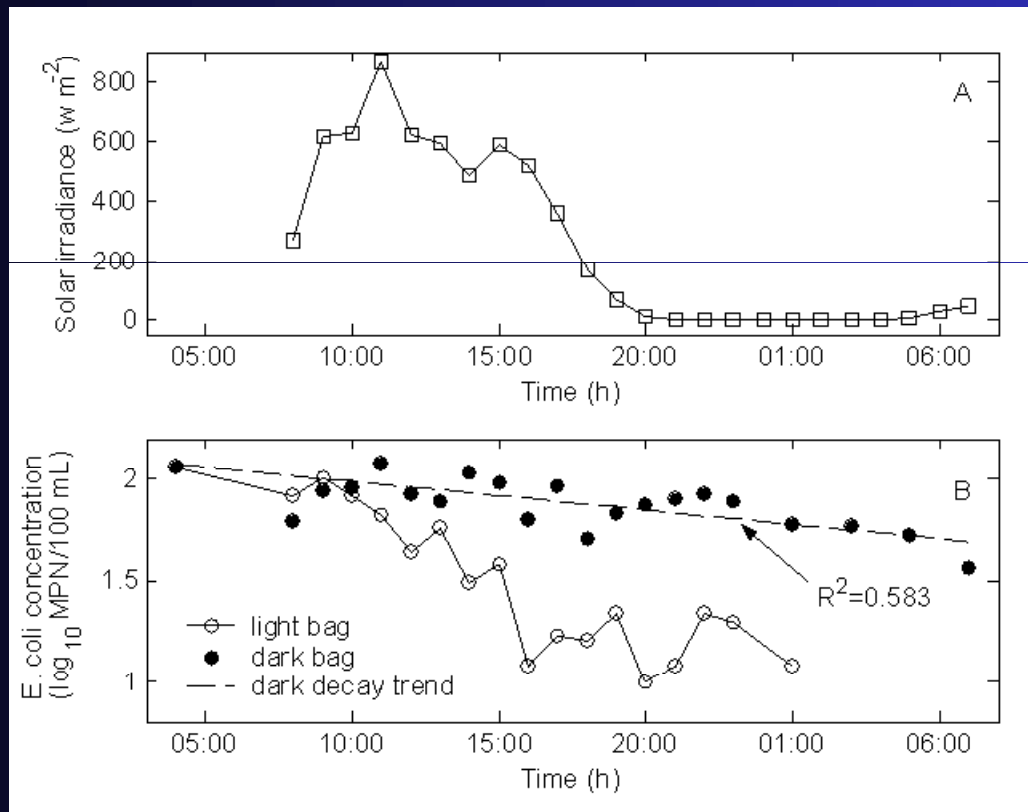
# A numerical model for current circulation in the embayment

Princeton Ocean Model was used for simulating currents around the beach



Slow currents inside the embayment, only 0.5 ~ 3 cm/s

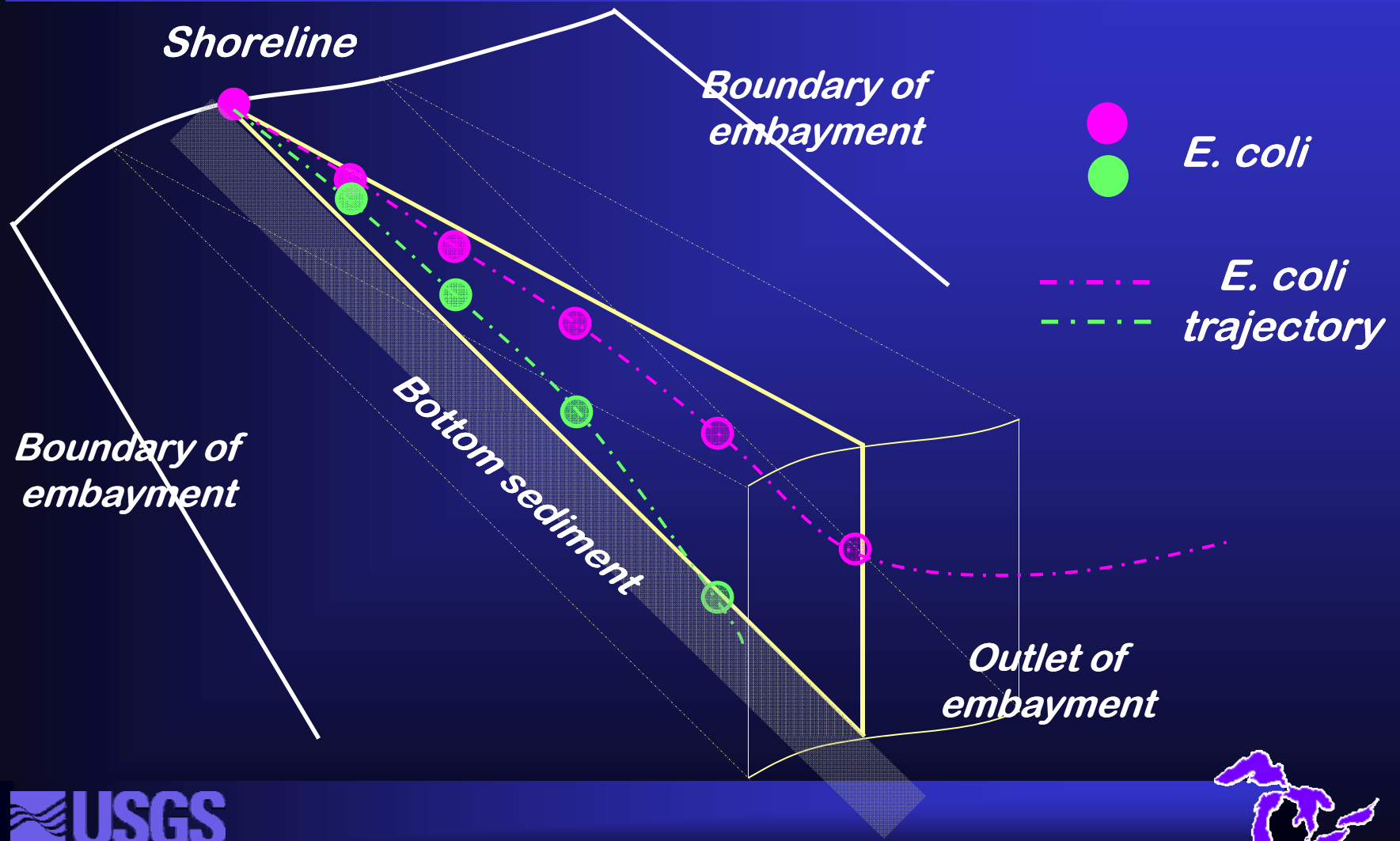
# Solar inactivation of *E. coli* in a water column



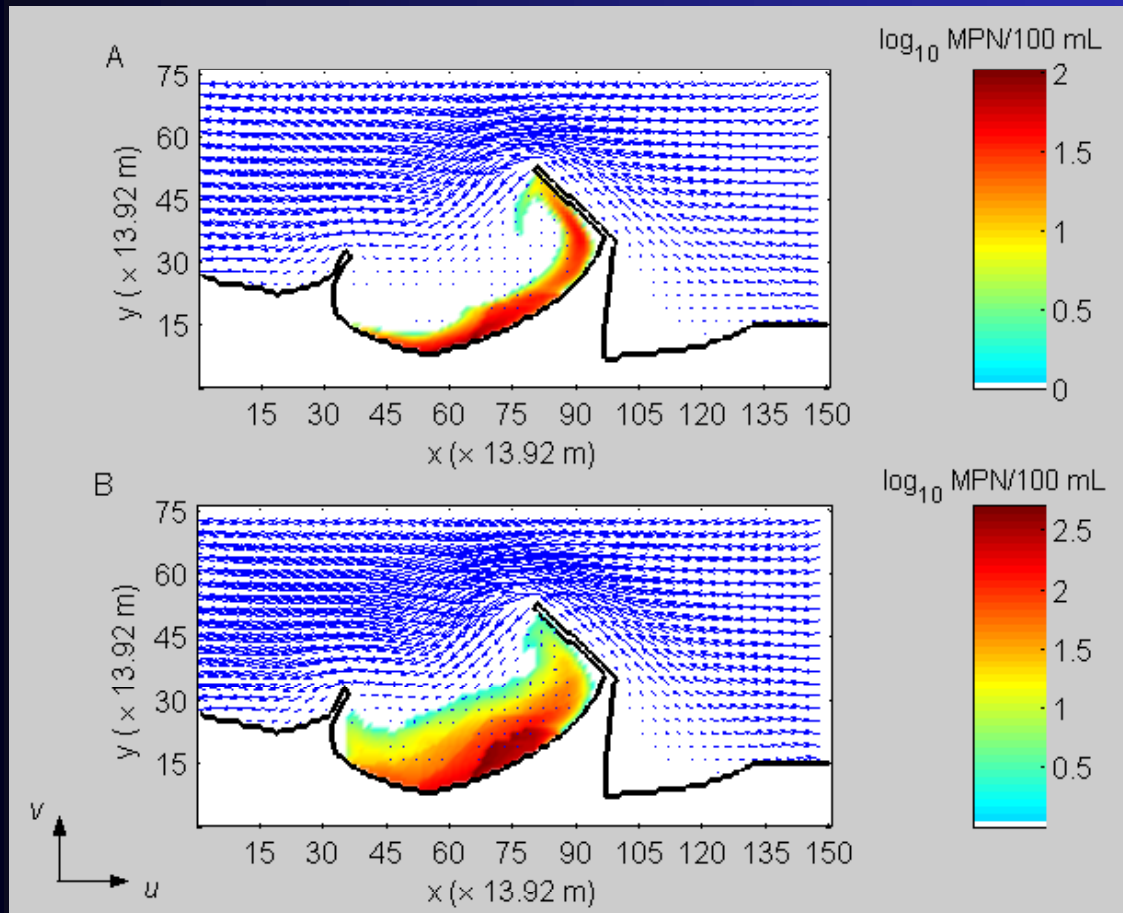
● Dark decay of *E. coli*

○ Decay due to UV inactivation

# *E. coli* transport, deposition and decay, a race



# *E. coli* budget in the embayed beach water

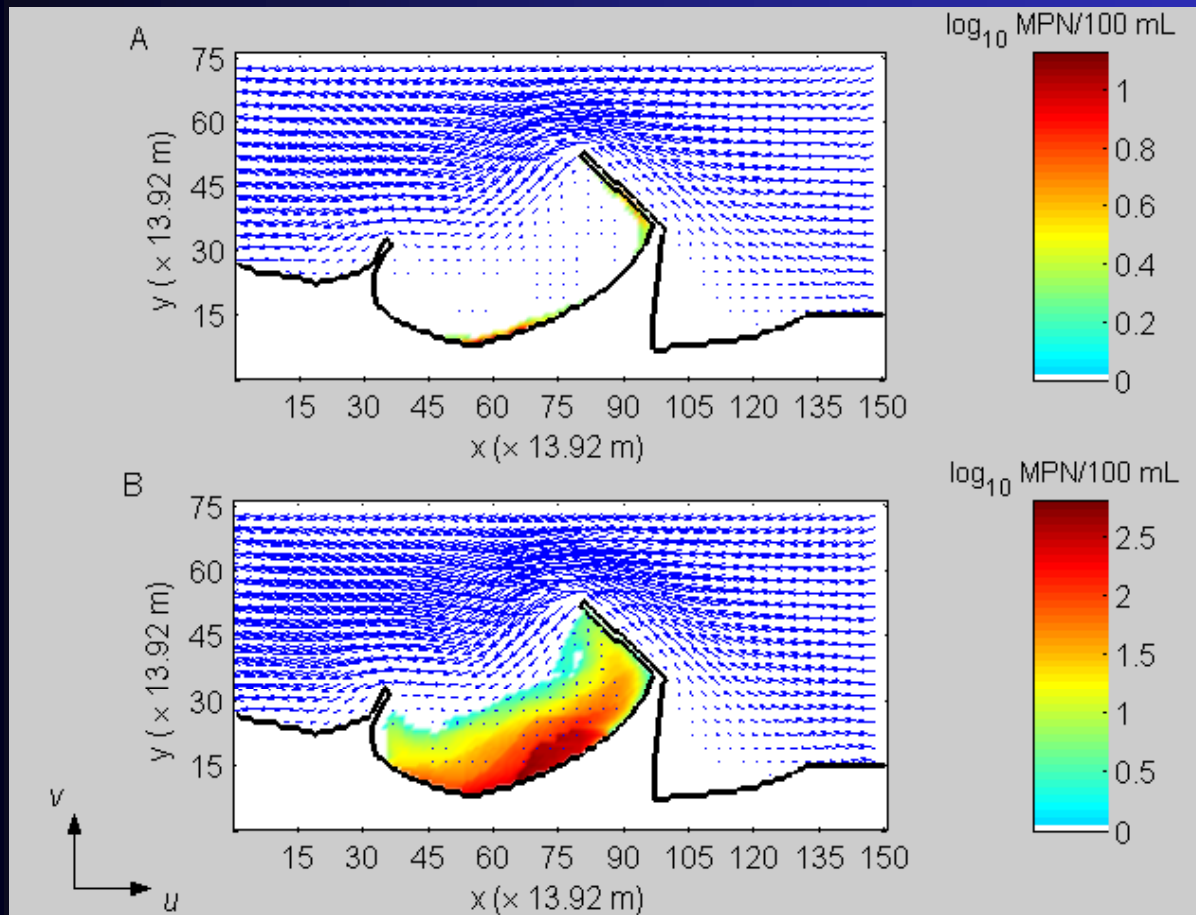


At  $t = 8^{\text{th}}$  hour

*E. coli*  
concentration in  
the water

*E. coli*  
concentration  
(still culturable)  
settled in the  
sediment

# *E. coli* budget in the embayed beach water (cont'd)



At  $t = 20^{\text{th}}$  hour

*E. coli*  
concentration in  
the water

*E. coli*  
concentration  
(still culturable)  
settled in the  
sediment