## Summer 2008 REU Program Sam Peterson Alexander Kurapov (author)

Sam Peterson enrolled in the COAS REU summer 2008 program and worked with Dr. Alexander Kurapov on the modeling analysis of currents in the wind-driven coastal ocean and more eddy-dominated coastal transition zone (CTZ). In particular he developed an algorithm for three-dimensional Lagrangian particle tracking. The Regional Ocean Modeling System (ROMS) provides circulation fields in the fixed (Eulerian) framework. We initialized and ran the model simulation with three additional tracers or "labels" (Kuebel Cervantes et al., 2003). These label fields are initialized as two horizontal and a vertical coordinate values (x, y, and z labels). Then these initial particle coordinates are advected by ROMS as passive tracers. These label fields sampled at a given point at a later time give the location of the fluid particle at the initial time.

The label tracers show a release point of a fluid particle, but the full trajectory. At the same time, this information is presented in the ROMS solution, since at any given time there must be a unique point with a given set of labels (xo, yo, zo). Together with Sam Petersen, we developed and tested a nonlinear optimization algorithm to reconstruct Lagrangian trajectories from the labels, backward and forward in time. Sam has written the Matlab code based on this algorithm.

This technique was implemented on the slope near Cape Blanco. In this area, the surface alongshore current separates in the coastal transition zone. The deep-water undercurrent is found both south and north of Cape Blanco, although at different depths (Springer et al., 2008). The particle tracking suggested that the undercurrent might not be continuous, since all alongslope particles from south of Cape Blanco deflected offshore. Sam's results facilitate interest to study deep-water pathways in the CTZ in more detail.

Kuebel Cervantes, B.T., J.S. Allen, and R.M. Samelson, 2003: A Modeling Study of Eulerian and Lagrangian Aspects of Shelf Circulation off Duck, North Carolina, *J. Phys. Oc.*, **33** (10), 2070-2092.

Springer, S. R., R. M. Samelson, J. S. Allen, G. D. Egbert, A. L. Kurapov, R. N. Miller, and J. C. Kindle, 2008: A nested grid model of the Oregon coastal transition zone: simulations and comparisons with observations during the 2001 upwelling season, J. Geophys. Res., <u>in press</u>.