**PAUL CHOBOTER**, Cal Poly State University, San Luis Obispo, California
*Dynamics and internal structure of the cross-shelf circulation during wind-driven coastal upwelling*

A two-dimensional theory of wind-driven coastal upwelling is developed that is comprised of a surface Ekman layer, an interior frictionless layer, and a frictional bottom boundary layer. The theory is built upon the Lentz–Chapman upwelling theory, which has been used to demonstrate the importance of nonlinear cross-shelf momentum flux divergence during upwelling. The new model adds to the Lentz–Chapman theory a spatially-varying structure in the interior density and velocity fields. The dynamical model for the interior flow is based upon the nonlinear upwelling theory of Pedlosky, which maintains thermal wind balance between the cross-shelf density gradient and the vertical shear in the alongshelf velocity while retaining the cross-shelf advection of density and alongshelf momentum. The structure of the cross-shelf circulation is studied as a function of Burger number $S = \alpha N/f$, where $\alpha$ is the topographic slope, $N$ is the buoyancy frequency, and $f$ is the Coriolis parameter. Predictions of the dynamical model are compared with numerical simulations using the Regional Ocean Modeling System (ROMS, a primitive-equation community model). During upwelling winds, the dynamical model predicts interior onshore flow high in the water column for large Burger number, and onshore flow in the bottom boundary layer for small Burger number, consistent with the numerical simulations and with observations.