Masters Defense

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Spin Up and Spin Down Experiments in a Closed Basin

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Abstract

It is widely recognized that the dynamical characteristics of the oceanic bottom boundary layer are important in considering such matters as sediment transport, turbulent mixing of the oceanic interior, suitability as a habitat for aquatic biota, and the specification of boundary conditions for coastal, general circulation and global climate models. Increasing concern regarding our oceanic and atmospheric environment is leading to an increased emphasis on research leading to better forecasting. This work is part of a continuing effort to better understand the residual circulation in a closed basin or in a coastal canyon and to explore the extent to which laboratory experiments can provide useful benchmark datasets for numerical models of the coastal ocean. Oceanic flows are off course turbulent and thus realistic model must include turbulence. The present work is concerned with laminar flows and thus is considered a precursor to the turbulent experiments. The physical system for the experiments carried out in ASU Environmental Fluid dynamics laboratory (EFD) consists of cylindrical tank with conical shape bottom topography. Experiments are conducted on homogenous rotating fluids concerned with the temporal development of motion fields initiated by impulsively establishing up-welling (spin down) or down-welling (spin up) favorable flows along a conical shape topography. Quantitative data was obtained by using Particle Image Velocimetry (PIV) and qualitative information was obtained by using neutrally buoyant dye tracer visualization and particle streak techniques. Homogenous spin up and spin down experiments for laminar case shows that the decay process is faster for upwelling (spin down) favorable flow than downwelling (spin up) favorable.