Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

An experimental study of the spread of buoyant water into a rotating environment THOMAS CRAWFORD, PAUL LINDEN, University of Cambridge — We present an experimental study that aims to investigate the spread of buoyant water, released from a finite potential vorticity source, into a rotating environment. The source structure is designed to simulate the discharge of a river into the ocean and as a result the freshwater enters the salt water ambient horizontally and with considerable momentum flux. The finite depth of the source gives rise to a non-zero potential vorticity as seen in the natural environment. We perform a parametric study in which we vary the rotation rate, freshwater volume flux and density difference between the incoming buoyant fluid and the stationary ambient. The parameter values are chosen to match the regimes seen in the River Rhine and River Elbe when entering the North Sea. Persistent features of an anticyclonic outflow vortex and a propagating boundary current can be identified in each experimental run and their properties are quantified. The flow is seen to become unstable for small values of the deformation radius, suggesting it has an important role to play in determining the behaviour of the flow. We also present a finite potential vorticity, geostrophic model that provides theoretical predictions for the current height, width and velocity. These are compared with the experimental data.

Paul Linden
University of Cambridge

Date submitted: 30 Jul 2014 Electronic form version 1.4