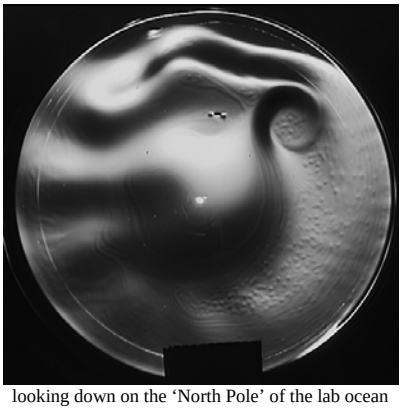
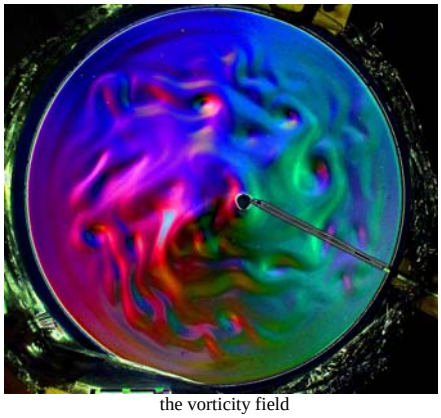
Dynamics of Oceans and Atmospheres: why are there intense jet streams?

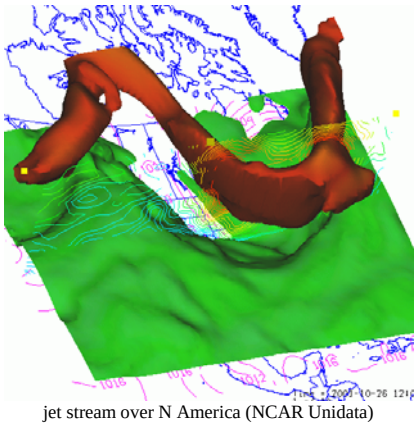
P.B. Rhines
University of Washington, Oceanography and Atmospheric Sciences

A recent Chapman Conference focused on the intense, concentrated ocean currents and wind-systems found on Earth and the giant gas planets. They are seen in all these diverse fluids, and I have argued from the underlying field theory that they emerge spontaneously from random, turbulent 'storms'. In the context of climate and global warming, these jet-like fluid circulations are key elements, yet are difficult to predict.

Experiments in the Geophysical Fluid Dynamics laboratory at University of Washington make use of a newly discovered imaging technique, 'optical altimetry', which in a sense was discovered by Isaac Newton in 1672. Videos and computer analyzed stills reveal surprising properties of these jet streams, and their strong association with the topography of the underlying Earth. We are able for the first time to image the key dynamical field, which is known as potential vorticity. Just as Maxwell's electromagnetic field unified the many eclectic experiments with magnets and electric charge, potential vorticity is a field expressing the remote interactions of vortex motions, jet streams and the key underlying wavefield, analogous to electromagnetic radiation.


looking down on the 'North Pole' of the lab ocean


the vorticity field


jet stream over N America (NCAR Unidata)