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Abrupt transitions and hysteresis in thermohaline laboratory models JACK WHITEHEAD, Woods Hole Oceanographic Institution — Steady ocean circulation models can change in three different ways as the forcing parameters are slowly altered: smooth evolution, abrupt transition without hysteresis, and abrupt transition with hysteresis. In the second, the transition point is independent upon whether the driving parameter is increased or decreased. In the third, the transition points differ depending upon whether the driving parameter approachs from one side or the other. The second and third ways are found in simplified numerical ocean circulation models that are driven either seasonally or with climate changes. Old and new laboratory experiments demonstrate both forms of abrupt transitions. A laboratory experiment that followed Stommel's box model for abrupt transitions had large abrupt transitions in temperature with salinity and clear and distinct hysteresis. Two experiments that allowed for more complex flows had a much smaller range of hysteresis but transitions were still distinct. A new experiment is reported here with virtually no hysteresis. It has a cavity immersed in a tank of fresh water at room temperature. The cavity is heated from below and salt water is steadily pumped in. The transition is abrupt, but the data have virtually no hysteresis.

Jack Whitehead
Woods Hole Oceanographic Institution

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