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Portfolio Paper

Meandering Jet in a Rotating Stratified Fluid

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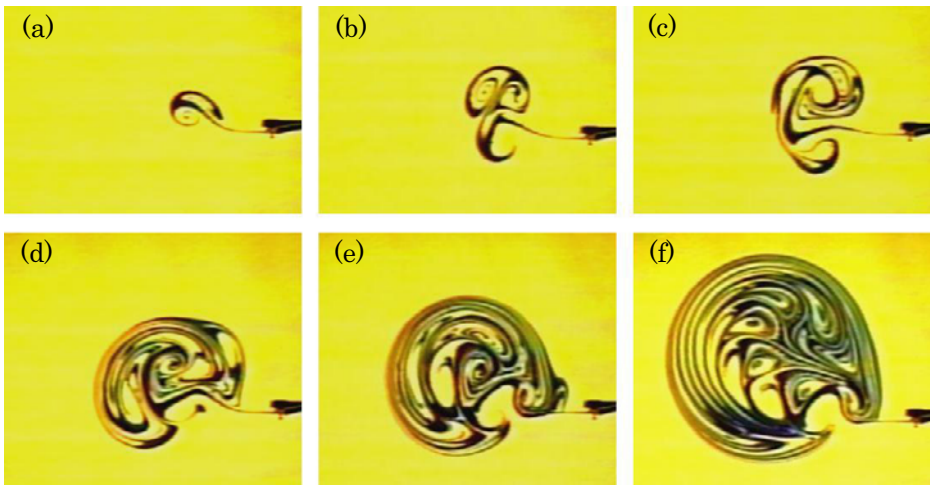

Fig. 1. In this experiment a jet from small round nozzle acts horizontally (from right to left, *Re* = 150) in the depth of a linearly stratified (N = 1.7 s^{-1}) rotating fluid. Fluid rotates anticlockwise (f = 0.2 s^{-1}). Thymol blue visualization. Surrounding fluid is slightly acidic (yellow) and the jet fluid is slightly basic (blue). Top view photographs are shown. Time from the beginning of the experiment: t = 2 (a), 4 (b), 8 (c), 15 (d), 22 (e), 35 s (f).

Fig. 2. Formed self-propagating coherent eddy at t = 60 s. The width of the frame is 30 cm.

A starting horizontal jet in a rotating stratified fluid develops either in dipolar or monopolar regimes depending on the flow parameters which are the ratio of the buoyancy frequency, N, to the Coriolis parameter, f, and the jet Reynolds number, Re. In the intermediate case the jet is meandering, switching from one regime to another (Fig. 1) with frequency f, forming with time, t, large self-propagating coherent structure (Fig. 2). Such eddies are observed frequently in the ocean. They have (linear) momentum and can drift hundreds of kilometers sometime crossing the Atlantic Ocean. A theory for such flows is given in Voropayev et al. (1997)[1].

References : (1) Voropayev, S. I., Zhang, X., Boyer, D. L., Fernando, H. J. S. and Wu, P. C., Horizontal jets in a rotating stratified fluid, Physics of Fluids, 9 (1997), 115-126.