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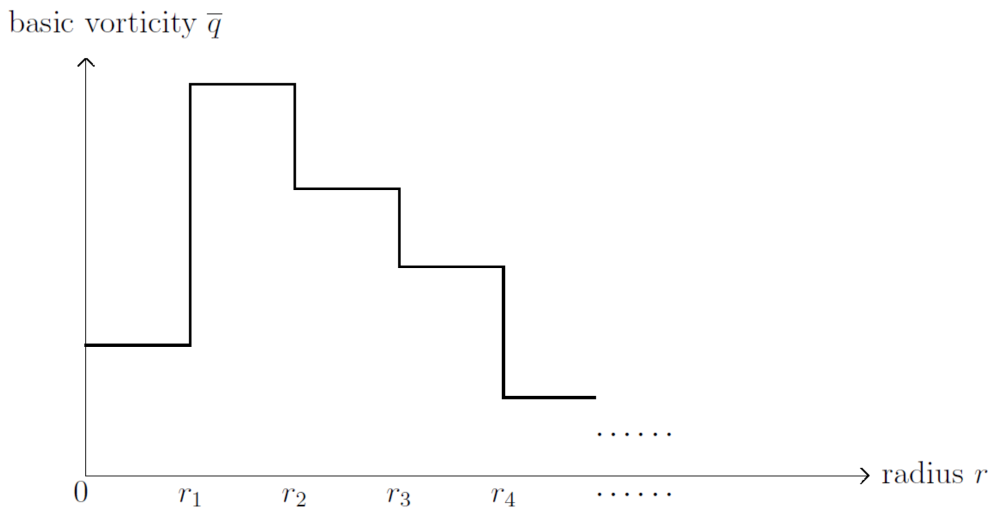

Figure 1. The basic axisymmetric vorticity $\bar{q}$ piecewise uniform in the radial direction.

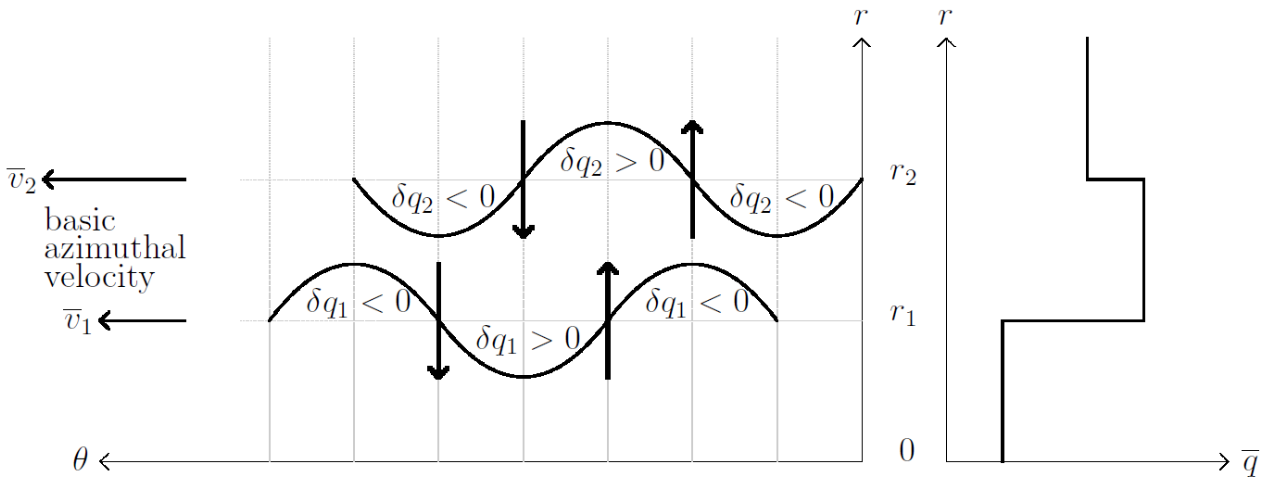

Figure 2. The exponentially growing solution as a result of the interaction of conterpropagating VRWs at r_1 and r_2. The vertical arrows represent the circulation induced by the vorticity disturbance δq.

- The initial value problem of vortex Rossby waves (VRWs) is analytically solved in a linearized barotropic system on an *f* plane. The basic axisymmetric vorticity $\bar{q}$ is assumed to be piecewise uniform in the radial direction (see Fig.1).
- For a basic vorticity $\bar{q}$ with an annular vorticity ring ($r_1 < r < r_2$ in Figs.1,2), and if the radial distribution of $\bar{q}$ satisfies a certain additional condition (the Fjørtoft condition), the solution with azimuthal wave number $|m| \neq 1$ exponentially or linearly grows in time as a result of the interaction of counterpropagating VRWs at the edges of the ring (see Fig.2).
- Although the solution with $|m| = 1$ cannot exponentially grow for any $\bar{q}$, it can grow as a linear function of time. This linear growth may be regarded as a result of the resonance between two internal modes of the system.