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The Application of Linear Quasigeostrophic Dynamics to Gulf Stream Rings

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ABSTRACT

We have used linear quasigeostrophic dynamics to calculate the motion, decay and dispersion rates of radially symmetric initial disturbances with scales appropriate to Gulf Stream Rings. Baroclinic rings translate westward at 1–3 km day⁻¹; asymmetries in the initial shape can give northward or southward components. The pressure maximum decays to half its value in about 6 months. Both short-time and long-time estimates of the translational speed and strength of the central pressure minimum are obtained. The dispersed waves can spread over much of the northwestern Atlantic (for linear dynamics). Using estimates of the number of Gulf Stream Rings present at any time, their ages, their average strength and their distribution, we have calculated the distribution of fluctuation kinetic energy from the Rings and the associated dispersed wave field. This order-of-magnitude estimate suggests that Rings and the near-neighbor dispersed waves from the Rings may be responsible for fluctuation energies comparable to those observed in the ocean.

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