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**How the Great Red Spot of Jupiter Stays Alive while Losing Energy through Viscous and Radiative Dissipation** AIDI ZHANG, PHILIP MARCUS, UC Berkeley — During the last decade, the cloud cover over the Great Red Spot (GRS) of Jupiter has shrunk significantly. This observation, along with recent observations that the GRS has been repeatedly shedding large ( $100,000 \text{ km}^2$ ) chunks of itself, has caused many planetary scientists to speculate that the GRS will vanish in the next 10 years. Here we argue against that hypothesis and demonstrate that GRS, which is a large anticyclone, maintains itself with a weak (and not directly observable) secondary circulation that is consistent with all of the observations. Numerical simulations of the anelastic ideal gas equations are used to show that this secondary circulation both re-energizes the GRS and creates new anti-cyclonic vorticity via baroclinic dynamics that can only exist in a vertically stably-stratified, rotating atmosphere. The secondary circulation brings energy from the atmosphere outside the GRS into its interior. The energy flux into the GRS balances the loss of energy of the GRS from viscosity and radiative damping. The rate of viscous loss of kinetic energy from the GRS is small compared to the rate of loss of potential and thermal energy due to radiative damping. Without the secondary circulation of the GRS, radiative damping would cause the GRS to decay in 4-5 years.

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