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Bounding flow quantities in modulated convection[1] TODD CHRISTOPHER, STEFAN LLEWELLYN SMITH, University of California, San Diego — For a given configuration in convection, it is of interest to find bounds on physically important quantities related to the temperature gradient, such as heat transfer. The motivation for the convection modeled in the present work comes from observations of springtime warming in a lake, which show convection occurring in a diurnal cycle. Analytical bounds on flow quantities can be found, and have been found, in many configurations. Here we model springtime warming in a lake by considering modulated convection with zero-mean sinusoidal forcing at the boundary. With zero-mean forcing, no net heat transfer occurs, and therefore the quantity of interest becomes the squared and averaged magnitude of the temperature gradient, also referred to as the temperature dissipation. We use the background method and the Boussinesq equations to establish for the first time an exact, analytical bound on the temperature dissipation for this configuration.

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