



Thermodynamic Stability and Hydrostatic Balance in the Atmosphere

M. Ambaum (1)

(1) Department of Meteorology, University of Reading

Here we revisit the problem of thermodynamic stability under hydrostatic balance. We follow the usual approach of finding maximum entropy profiles given certain constraints. It is suggested that all “textbook” derivations, since Gibb’s original work on this, ultimately ignore the application of hydrostatic balance when solving the variational problem. The outcome of these calculations is always the classical isothermal structure. When hydrostatic balance is taken into account properly, we find a whole class of non-isothermal maximum entropy profiles. This will have important consequences for understanding energy conversions in the atmosphere. The new approach is particularly elegant as it shares many properties of classical Lagrangian dynamics.