

Energy Conservations

Jielun Sun NCAR/MMM

Energy conservations in the stratified atmosphere are revisited. Because the atmospheric thermal structure is strongly connected with air motions particularly turbulent mixing, the traditional thermal energy conservation is challenged in explaining observed atmospheric thermodynamic structures. The kinetic energy conservation based on the momentum conservation only explains how kinetic energy is generated but not where the nonhydrostatic energy for generating the vertical component of kinetic energy comes from. Total energy conservation including atmospheric kinetic and internal energies allows interactions between thermal and kinetic energies through non-hydrostatic pressure work, which explains the atmospheric thermodynamic structure as a result of the so-called stability effect on atmospheric motions. The traditional thermal energy conservation is only valid when both thermal energy to non-hydrostatic pressure work and thermal heating associated with viscous stress work are negligibly small. Based on total energy conservation, a new thermal energy conservation is introduced with consideration of the thermal energy transfer to non-hydrostatic energy work for changing kinetic energy and reduced thermal energy available for changing internal energy. Observed close relationships between surface heating to the atmosphere, the energy transfer associated with nonhydrostatic pressure work, and turbulent kinetic energy support the interpretation of the thermal energy transfer to the non-hydrostatic energy work in the new thermal energy conservation based on the total energy conservation.

> This seminar will be webcast live at: http://ucarconnect.ucar.edu/live

Recorded seminar link can be viewed here: https://www.mmm.ucar.edu/events/seminars

Friday, March 3, 2017, 11:00 AM Refreshments 10:45 AM NCAR-Foothills Laboratory 3450 Mitchell Lane Bldg. 2, Main Auditorium, Room 1022



