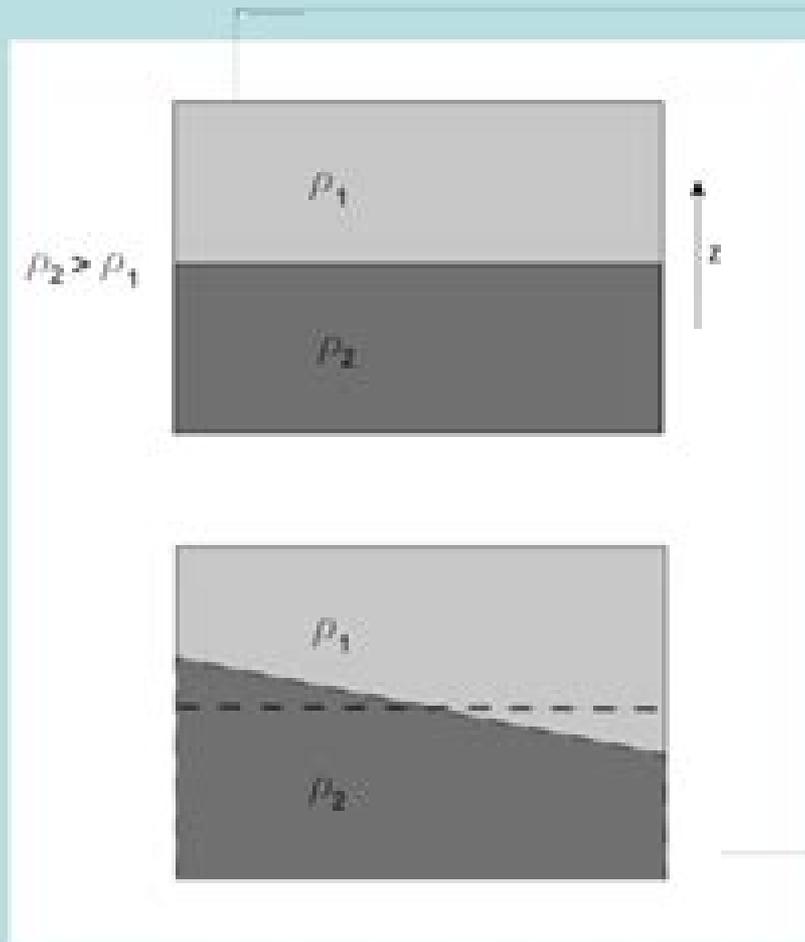


Atmospheric energetics:

where does the energy of atmospheric motions come from?



→ Flattening density/temperature surfaces always reduces potential energy

→ **Available potential energy** inherent in density/temperature gradients

→ In order to *generate* available potential energy, on average must heat where hot and cool where cold:

$$\langle JT \rangle > 0$$

→ In order to *release* available potential energy (and generate motion), on average, warm air must rise, cold air sink:

$$\langle wT \rangle > 0$$

Atmospheric Energetics

Ensheng Dong



Atmospheric Energetics:

Fundamentals of Atmospheric Energetics A. Wiin-Nielsen, Tsing-Chang Chen, 1993 This beginning graduate level text treats in detail the relations between internal potential and kinetic energy in the atmosphere The first part of the book describes the generation transformation and dissipation of the basic energy quantities in the global atmosphere and the subdivision of these forms of energy in a number of energy reservoirs The second part covers energetics in open domains and presents the major results of observational studies Individual chapters discuss energetics of the tropics and the Southern Hemisphere and of such phenomena as the jet stream and stationary eddies This will be a valuable text for advanced students in atmospheric dynamics Atmospheric Energetics Jacques van Mieghem, 1973 **EMPIRICAL AND THEORETICAL STUDIES OF ATMOSPHERIC ENERGETICS.** ,1962 Differential heating of the atmosphere by the sun has been long recognized as the source of the kinetic energy of the atmosphere However the mechanisms through which the differential heating produces and maintains the kinetic energy of various scales of atmospheric circulation remains as one of the most challenging problems of meteorology The research presented here in the form of an annual report consists of five papers representing various approaches to this basic problem **The Complete Atmospheric Energetics Experiment** Kirill I[A]kovlevich Kondrat'ev, 1973 Atmospheric Energetics as Related to Cyclogenesis Over the Eastern United States Philip Walter West, 1973 **Atmospheric Energetics in Regions of Intense Convective Activity** Henry E. Fuelberg, 1977 Synoptic scale budgets of kinetic and total potential energy are computed using 3 and 6 h data at nine times from NASA s fourth Atmospheric Variability Experiment conducted on 24 25 April 1975 Two intense squall lines occurred during the period Energy budgets for areas as small as $80 \times 10^{11} \text{ m}^2$ that enclose regions of intense convection are shown to have systematic changes that relate to the life cycles of the convection Some of the synoptic scale energy processes associated with the convection are found to be larger than those observed in the vicinity of mature cyclones Volumes enclosing intense convection are found to have large values of cross contour conversion of potential to kinetic energy and large horizontal export of kinetic energy Although small net vertical transport of kinetic energy is observed values at individual layers indicate large upward transport Transfer of kinetic energy from grid to subgrid scales of motion occurs in the volumes Latent heat release is large in the middle and upper troposphere and is thought to be the cause of the observed cyclic changes in the budget terms Total potential energy is found to be imported horizontally in the lower half of the atmosphere transported aloft and then exported horizontally Although local changes of kinetic energy and total potential energy are small interaction between volumes enclosing convection with surrounding larger volumes is quite large Spatial fields of terms in the energy budget equations are shown at three times These have good continuity and are closely related to the locations and intensities of the two squall lines Atmospheric Energetics in Regions of Intense Convective Activity Henry E. Fuelberg, 1977 Synoptic scale budgets of kinetic and total potential energy are computed using 3 and 6 h data at nine times from NASA s

fourth Atmospheric Variability Experiment conducted on 24 25 April 1975 Two intense squall lines occurred during the period Energy budgets for areas as small as $80 \times 10^{11} \text{ m}^2$ that enclose regions of intense convection are shown to have systematic changes that relate to the life cycles of the convection Some of the synoptic scale energy processes associated with the convection are found to be larger than those observed in the vicinity of mature cyclones Volumes enclosing intense convection are found to have large values of cross contour conversion of potential to kinetic energy and large horizontal export of kinetic energy Although small net vertical transport of kinetic energy is observed values at individual layers indicate large upward transport Transfer of kinetic energy from grid to subgrid scales of motion occurs in the volumes Latent heat release is large in the middle and upper troposphere and is thought to be the cause of the observed cyclic changes in the budget terms Total potential energy is found to be imported horizontally in the lower half of the atmosphere transported aloft and then exported horizontally Although local changes of kinetic energy and total potential energy are small interaction between volumes enclosing convection with surrounding larger volumes is quite large Spatial fields of terms in the energy budget equations are shown at three times These have good continuity and are closely related to the locations and intensities of the two squall lines

Scientific and Technical Aerospace Reports, 1963 **Studies of Large Scale Atmospheric Energetics**, 1969 **Studies in Atmospheric Energetics Based on Aerospace Probing**, 1969 **Atmospheric Energetics in Isentropic Coordinates** Michiko Masutani, 1987 *Atmospheric Energetics of Synoptic-scale Areas* Clifford J. Murino, Fred M. Vukovich, 1966 Spectral Atmospheric Energetics During January 1959 Paulin, Gaston, MCGILL UNIV MONTREAL (Québec) ARCTIC METEOROLOGY RESEARCH GROUP., 1968 The energetics of January 1959 are assessed through a set of spectral energy equations developed for an open atmospheric system The investigation considers two sets of data a mid January five day set with a high vertical resolution of 10 levels 1000 to 10 mb and the full month's data at three levels 500 100 and 25 mb The diagnostic omega equation is solved in Fourier spectral form and diabatic radiative effects are included for the stratosphere Strong dynamical interactions between the troposphere and the stratosphere are found in wave numbers 1 2 and 4 this is associated with geopotential flux whose convergence is mainly responsible for increases in stratospheric activity The major 25 mb eddy changes are related to wave one and two oscillations in the 500 mb block Non linear wave interactions also yield significant modifications in the eddy energies The daily spectral energetics are discussed systematically to explain the observed energy fluctuations Author Energetics of Physical Environment Kenneth John Gregory, 1987 Recent developments in physical geography have demonstrated the need for and advantages of an approach to physical environment based on energy and power as the rate of doing work This energetic approach has been used in meteorology and climatology in biogeography soil geography geomorphology and hydrology The book contains six essays which demonstrate the importance of energetics in these major branches of physical geography and how it has gained prominence in the last few years Because the approach is a feature of all branches of physical geography energetics provides

a unifying theme for the study of the physical environment Although this book is not a proceedings volume much of the material was presented at the British Association for the Advancement of Science meeting in Bristol in September 1986

The Complete Atmospheric Energetics Experiment ,1973 **Studies of Large Scale Atmospheric Energetics**
University of Wisconsin. Department of Meteorology,Lyle H. Horn,Donald R. Johnson,1967 Studies in Atmospheric Energetics Based on Aerospace Probings University of Wisconsin. Department of Meteorology,Verner Suomi,Robert J. Parent,1964 **Global Energetics of the Atmosphere** Boris M. Smirnov,2022-12-11 This book looks at global atmospheric processes from a physical standpoint using available current and past observational data taken from measurements of relevant atmospheric parameters It describes various aspects of the current atmospheric state and its future evolution focusing primarily on the energetic balance of the Earth and atmosphere and taking into consideration the multi faceted global equilibrium between these two systems carbon and water The analysis presented in this book restricts itself to those objects and processes that allow us to obtain reliable conclusions and numerical estimations in contrast to current climate models with much larger numbers of parameters for describing the same problems As a result in spite of the roughness of numerical parameters the book unveils a reliable and transparent physical picture of energetic phenomena in the global atmosphere In particular it shows that approximately only one fourth of atmospheric water returns from the atmosphere to the Earth in the form of free molecules It was shown that the contemporary warming of our planet has an anthropogenic character and that the average global temperature increases due to an increase of the concentration of atmospheric CO₂ molecules via an increase in atmospheric moisture as well as an increase in the amount of aerosols in the atmosphere Accumulation of atmospheric carbon dioxide plays a subsidiary role in this process and gives approximately one third in a change of the global temperature while an increase in the amount of atmospheric water by as little as only 0.3% per year explains the observed warming of the Earth The book shows how the greenhouse instability of the atmosphere evidently has its origins in the Eocene epoch presenting an analysis of the influence of various types of global energetic processes on the climate that differs from the official stance on these problems *Soviet Meteorology and Hydrology* ,1982 *Monthly Weather Review* ,1901

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