Unresolved Issues with the Assessment of Multi-Decadal Global Land Surface Temperature Trends / Conflict of Interest in the CCSP Report

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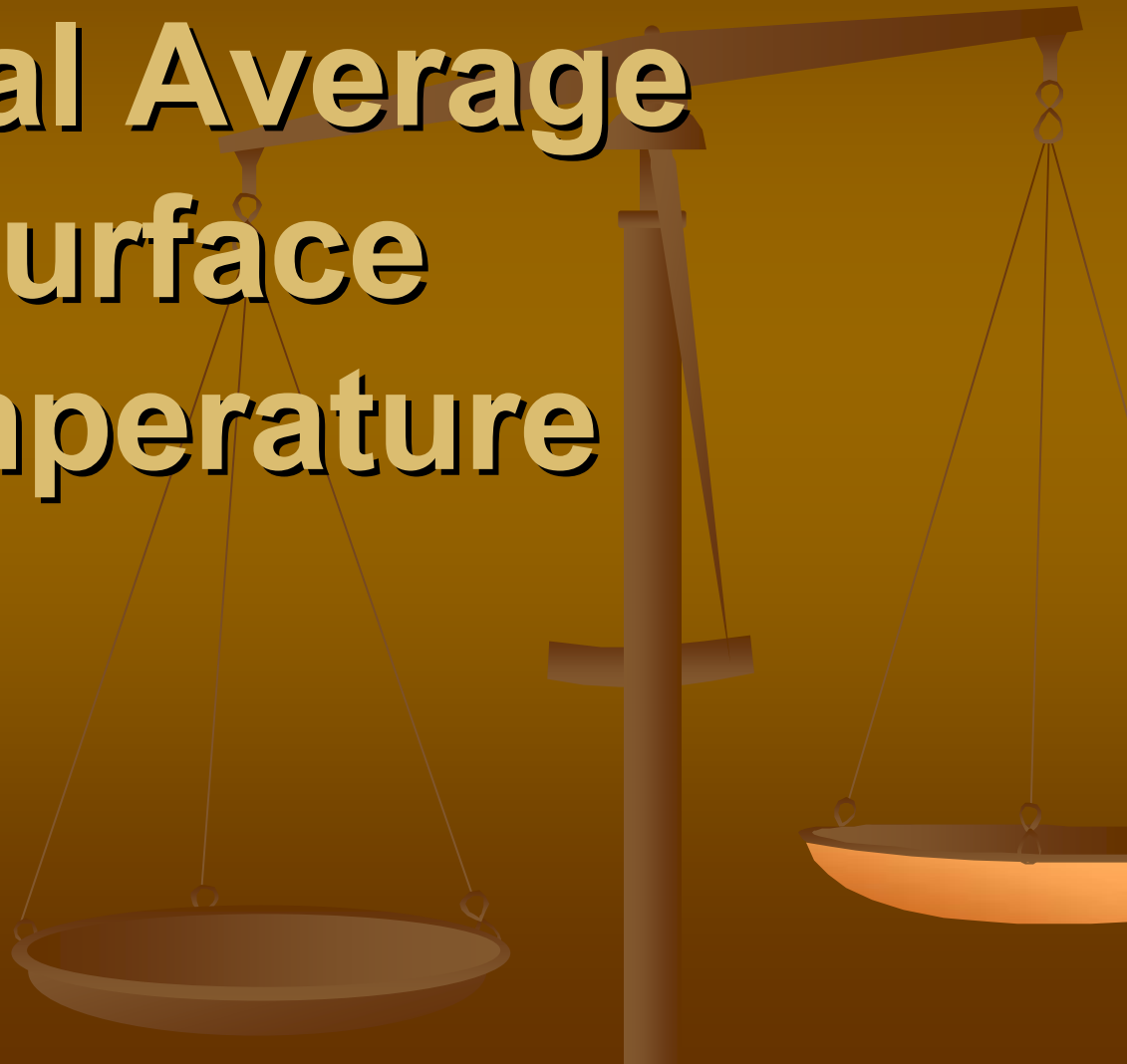
Definition of a Global Average Surface Temperature



$dH/dt = f - T'/\lambda$

- *where H…….is the heat content of the land-ocean-atmosphere system ……. This equation describes the change in the heat content where f is the radiative forcing at the tropopause, T′ is the change in surface temperature in response to a change in heat content, and λ is the climate feedback parameter*

Influence of height of surface temperature observation on trends – the identification of a warm bias in nighttime minimum temperatures

"Most of the recent warming has been in winter over the high mid-latitudes of the Northern Hemisphere continents, between 40 and 70° N (Nicholls et al., 1996). There has also been a general trend toward reduced diurnal temperature range, mostly because nights have warmed more than days. Since 1950, minimum temperatures on land have increased about twice as fast as maximum temperatures (Easterling et al., 1997). This may be attributable in part to increasing cloudiness, which reduces daytime warming by reflection of sunlight and retards the nighttime loss of heat (Karl et al., 1997)……."

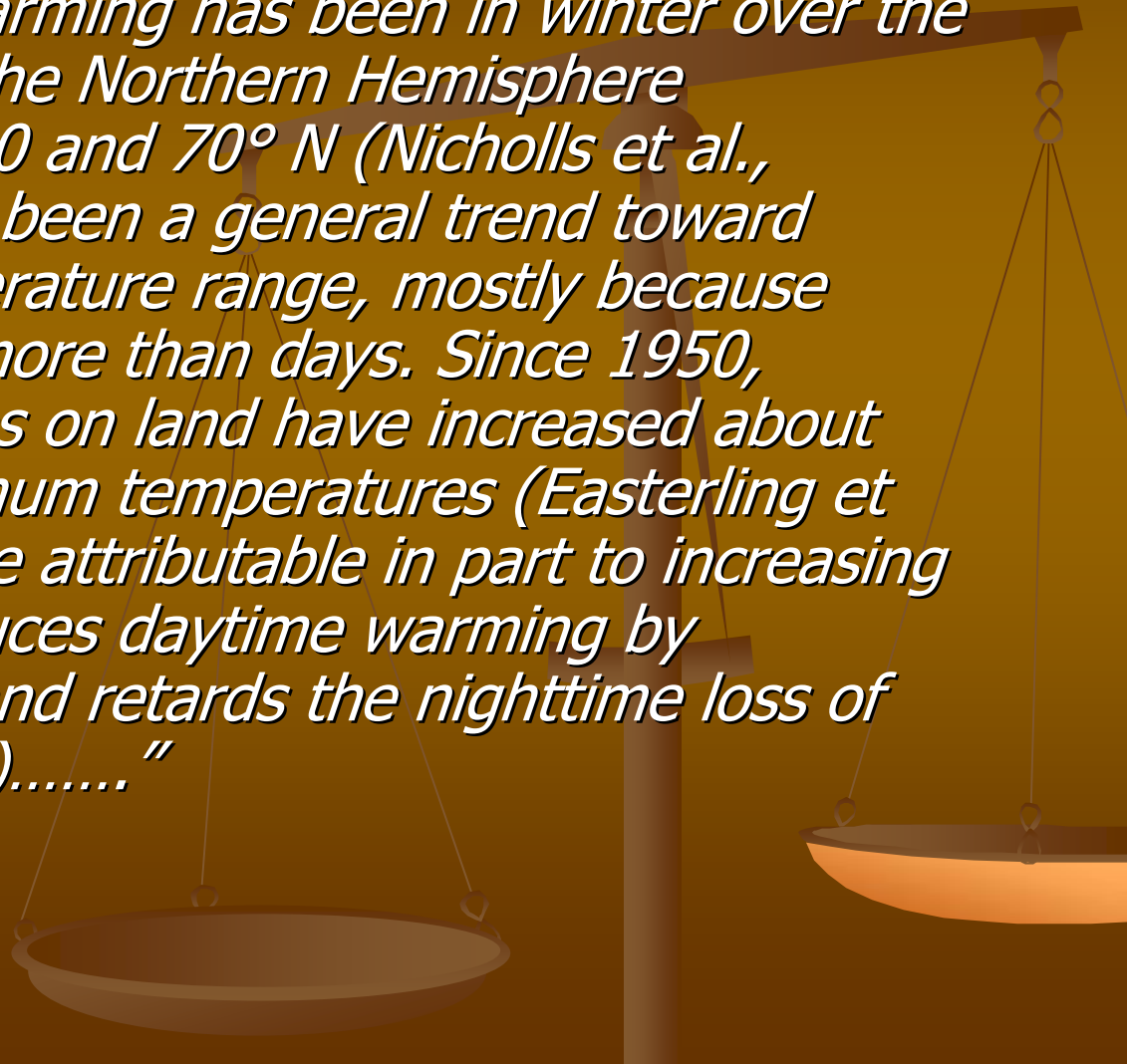
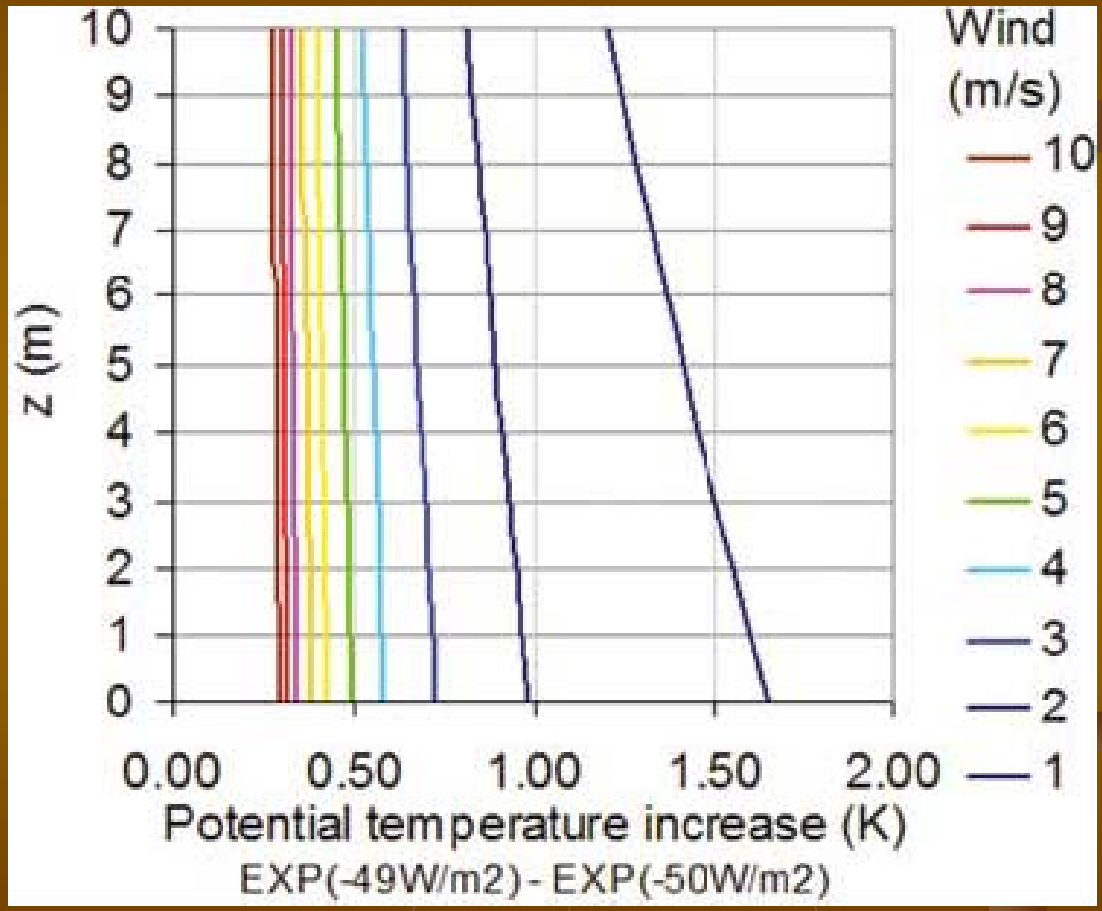
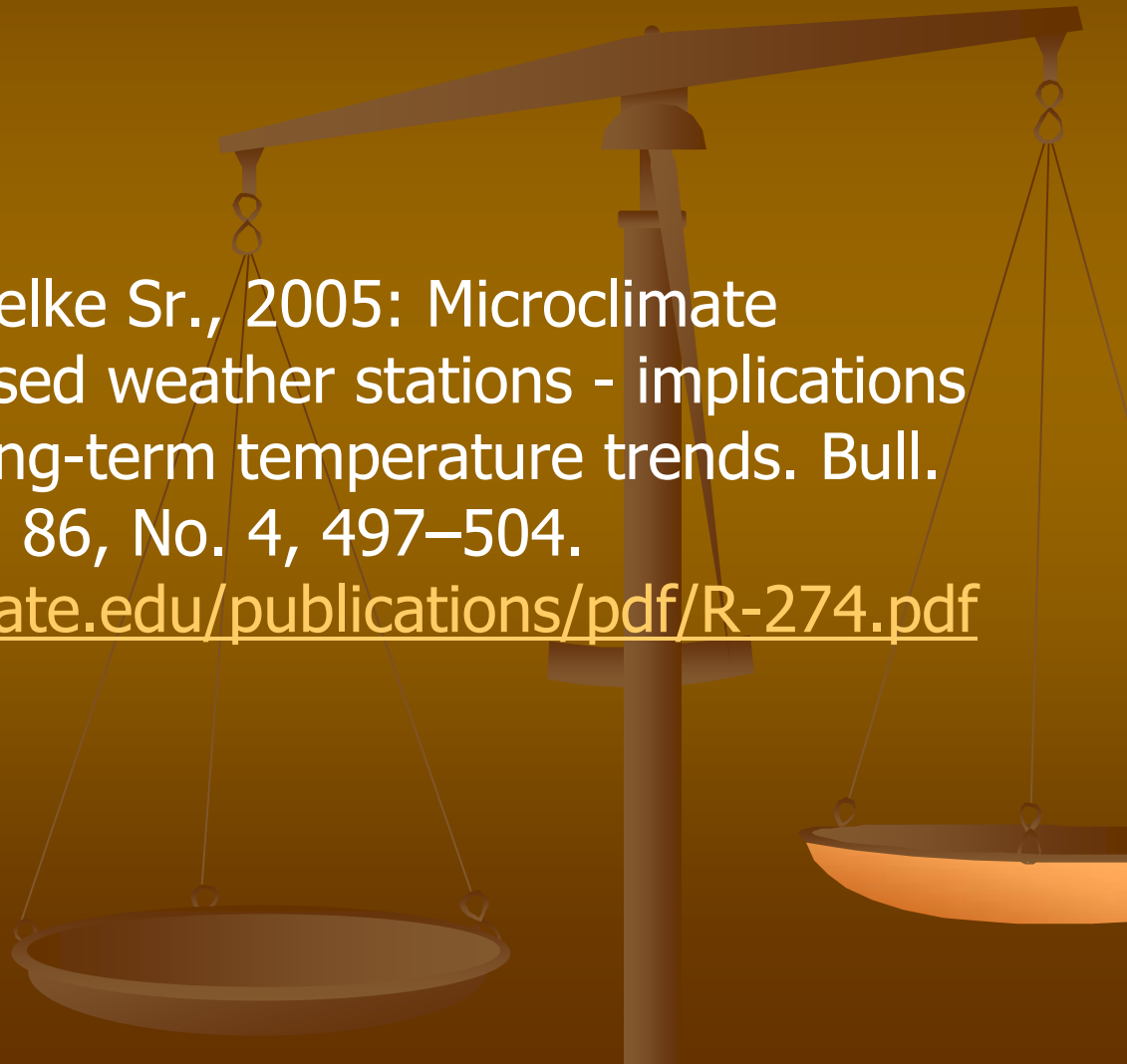


Figure 2 . Potential temperature increase at different levels from the experiment with −49 W m^{-2} cooling to the experiment with −50 W m^{-2} cooling.



From Pielke Sr., R.A., and T. Matsui, 2005: Should light wind and windy nights have the same temperature trends at individual levels even if the boundary layer averaged heat content change is the same? Geophys. Res. Letts., 32, No. 21, L21813, 10.1029/2005GL024407. http://blue.atmos.colostate.edu/publications/pdf/R-302.pdf

Photographic Documentation of Poor Sitings



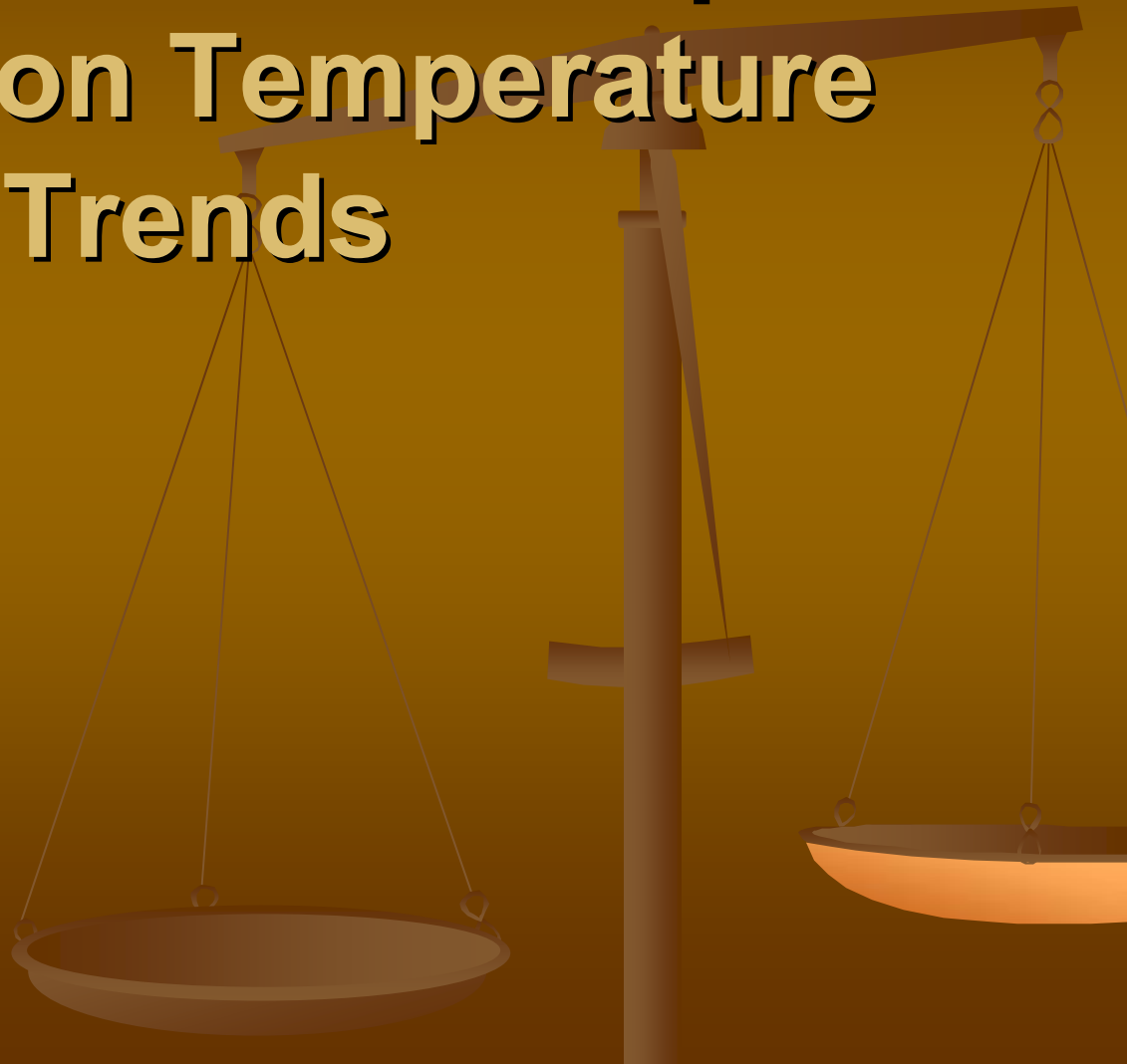
Davey, C.A., and R.A. Pielke Sr., 2005: Microclimate exposures of surface-based weather stations - implications for the assessment of long-term temperature trends. Bull. Amer. Meteor. Soc., Vol. 86, No. 4, 497–504. http://blue.atmos.colostate.edu/publications/pdf/R-274.pdf

Peterson (2006) concluded that any biases associated with the poor siting can be adjusted for

Peterson, T.C., 2006. Examination of potential biases in air temperature caused by poor station locations. *Bull. Amer. Meteor. Soc.*, accepted.

Comment on "Examination of Potential Biases in Air Temperature Caused byPoor Station Locations" by Thomas C. Peterson by Roger Pielke Sr., Christopher Davey, Jim Angel, Odie Bliss, Ryan Boyles, Ming Cai, Nolan Doesken, Souleymane Fall, Kevin Gallo, Rob Hale, Hong Li, John Nielsen-Gammon, Ken Hubbard, Niyogi, Dev, Sethu Raman and Xiaomao Lin, 2006, *Bull. Amer. Meteor. Soc.*, submitted

Influence of Trends in Surface Air Water Vapor Content on Temperature Trends

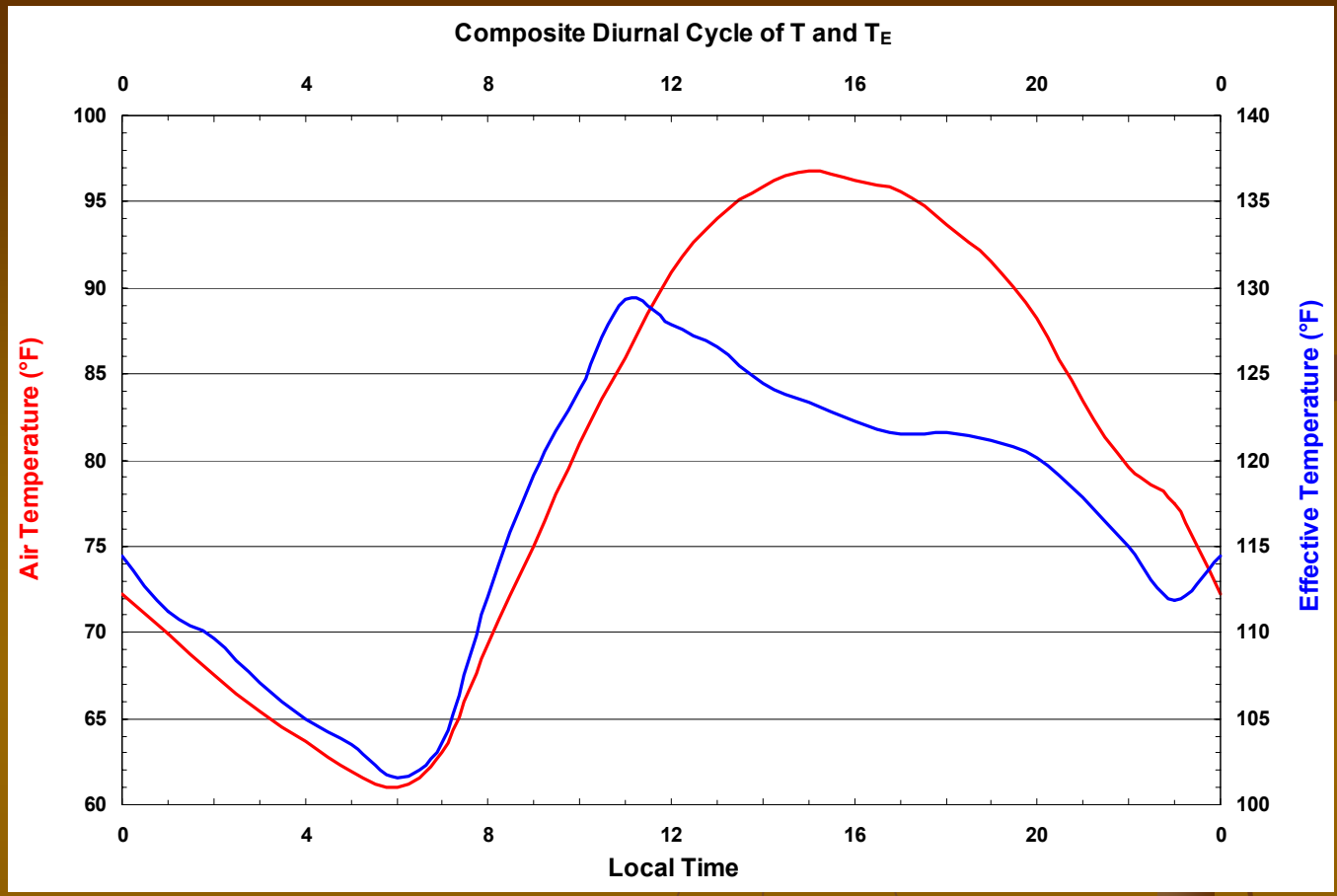


The heat content of surface air is given by

$$H = C_p T + L q$$

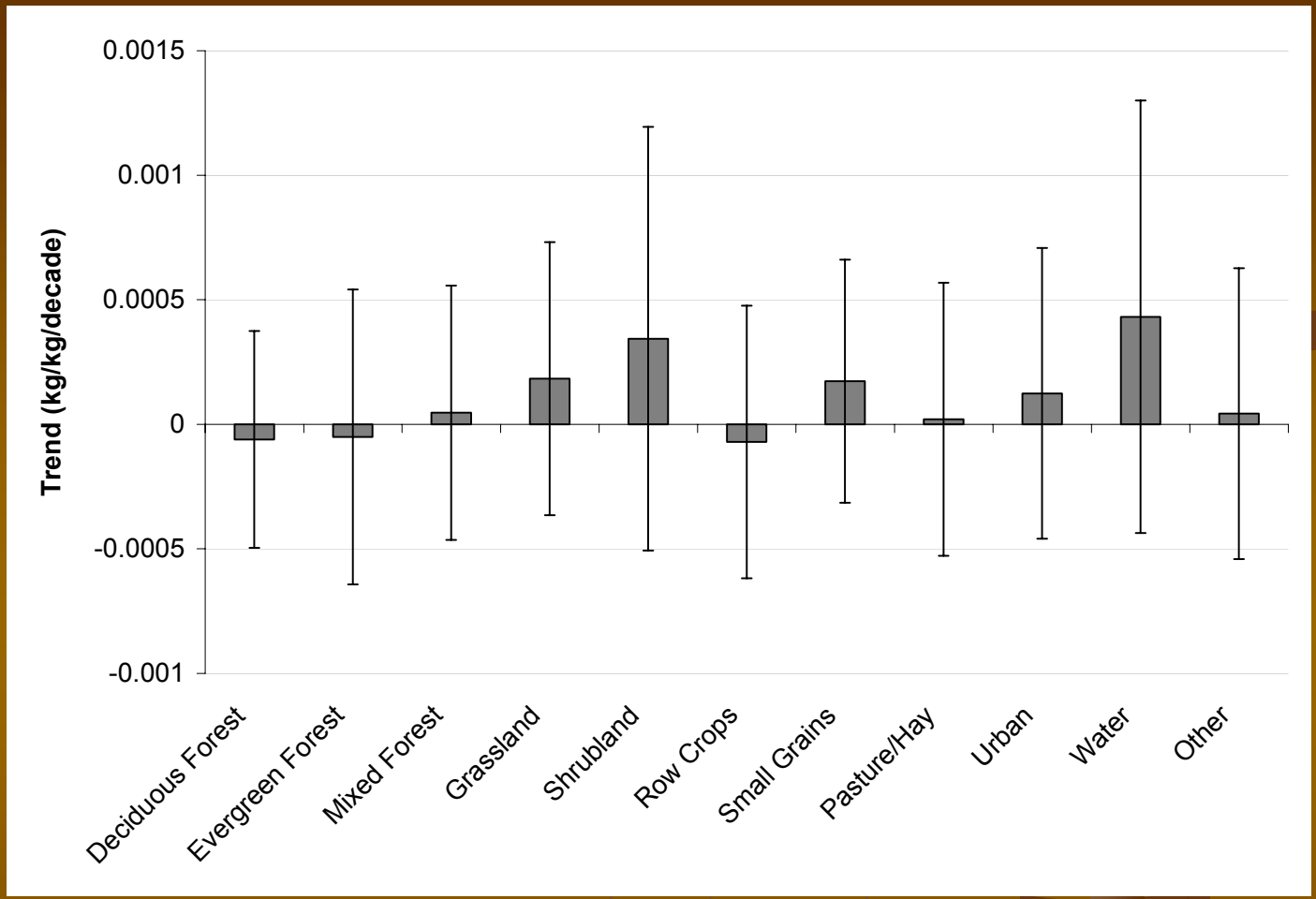
This equation can be rewritten in terms of change of δT as a function of δq as

$$\delta T = (L / C_p) \delta q$$



A daily composite of air temperature (red line) and effective temperature (blue line). The composite is created by averaging hourly data during the five days with highest air temperature in each of the three years considered in this section – fifteen days total. This shows the pattern of heating and cooling on the station's extreme hottest days. Note how the effective temperature peaks approximately four hours before the air temperature peaks. Typically, the hottest days are characterized by exceptionally low relative humidity in the late afternoon, which explains the premature drop in effective temperature.

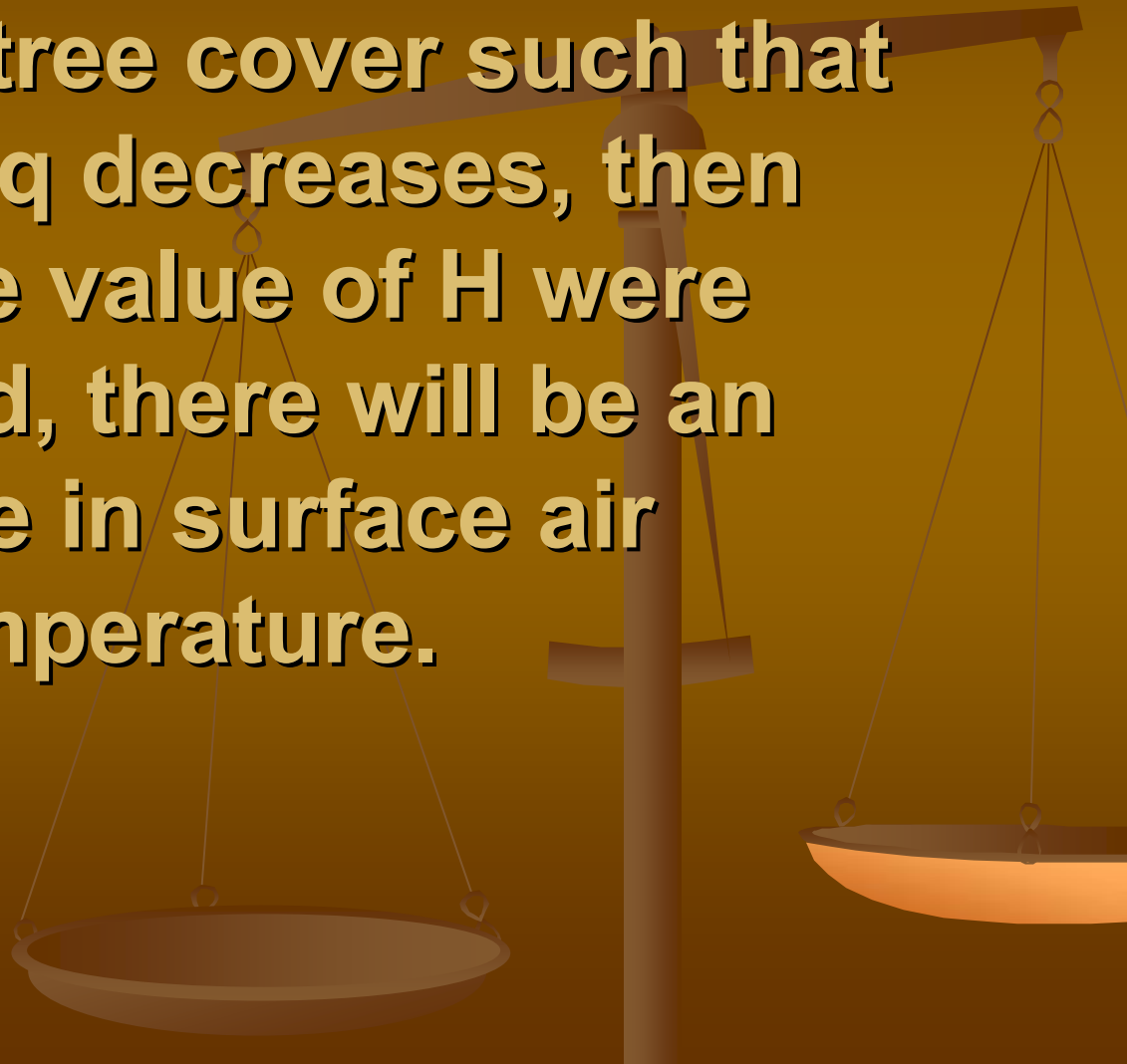
From Pielke, R.A. Sr., K. Wolter, O. Bliss, N. Doesken, and B. McNoldy, 2006: The July 2005 Denver heat wave: How unusual was it? National Weather Digest, accepted for publication. http://blue.atmos.colostate.edu/publications/pdf/R-313.pdf



Annually-averaged q trends for 1982-1997, as a function of the land-cover classes listed in Table 1. All individual trends are considered and are weighted equally.

From Davey, C.A., R.A. Pielke Sr., and K.P. Gallo, 2006: Differences between near-surface equivalent temperature and temperature trends for the eastern United States - Equivalent temperature as an alternative measure of heat content. Global and Planetary Change, accepted. http://blue.atmos.colostate.edu/publications/pdf/R-268.pdf

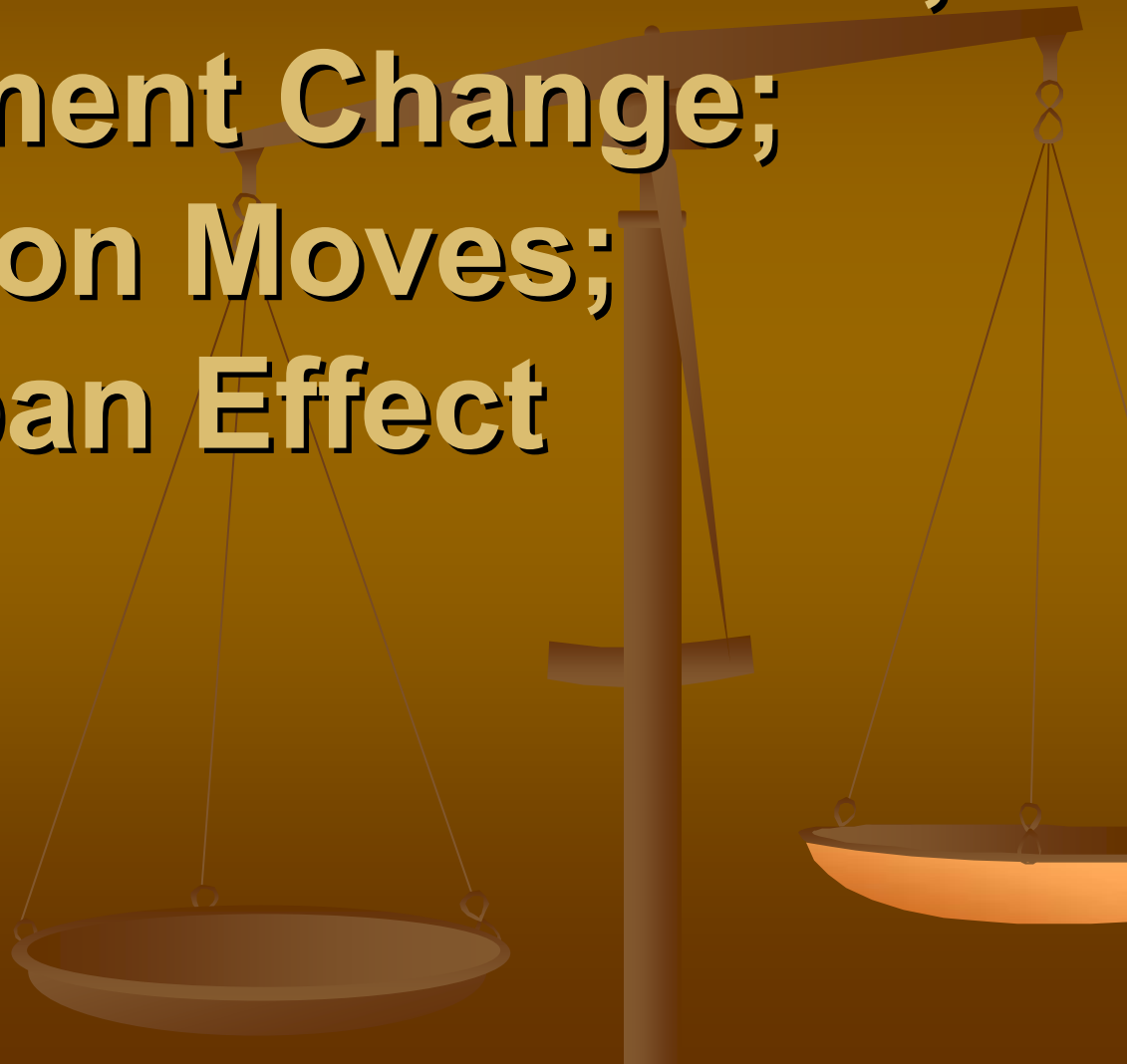
If a surface measuring site (e.g. an HCN site) undergoes a local reduction in tree cover such that as a result q decreases, then even if the value of H were unchanged, there will be an increase in surface air temperature.



Uncertainties in the Homogenization of Surface Temperature Data

Unresolved Issues with the Assessment of Multi-Decadal Global Land Surface Temperature Trends. Roger Pielke Sr., Christopher Davey, Dev Niyogi, Ken Hubbard, Xiaomao Lin, Ming Cai, Hong Li, John Neilsen-Gammon, Kevin Gallo, Rob Hale, Jim Angel (to be submitted to JGR).

Time of Observation Bias; Instrument Change; Station Moves; Urban Effect



Degree of Independence of Land Surface Global Surface Temperature Analyses

Tropical regions have sparse coverage of surface temperature data. Until further information can be obtained in these regions, the robustness of warming estimates in this region should be questioned. Thus the CCSP (2006) finding that the

"*the majority of observational data sets show more warming at the surface than in the troposphere," while " all model simulations show more warming in the troposphere than at the surface"* may be a result of the inadequate sampling of the tropical land areas.

Influence of Land Use/Land Cover Change on Surface Temperature Trends

Hale, R.C., K.P. Gallo, T.W. Owen, and T.R. Loveland, 2006: Land Use/Land Cover Change Effects on Temperature Trends at U.S. Climate Normals Stations. Geophys. Reser. Letters, Vol. 33, L11703, doi:10.1029/2006GL026358, 2006

Relationship Between In-situ Surface Temperature Observations and the Diagnosis of Surface Temperature Trends from Reanalyses

Kalnay, E., M. Cai. H. Li, C. J. Tobin, 2006: Estimation of the impact of land-use changes and urbanization on climate trends east of the Rockies. ***J. of Geophys. Res.– Atmos.***, **111**, doi:10.1029/2005JD006555.

Kalnay, E. and M. Cai, 2003: Impact of urbanization and land use on climate change. ***Nature***,***423***, 528-531.

Conflict of Interest in the CCSP Report "Temperature Trends in the Lower Atmosphere: Steps for Understanding and Reconciling Differences".

Complete report *Temperature Trends in the Lower Atmosphere: Steps for Understanding and Reconciling Differences*. Thomas R. Karl, Susan J. Hassol, Christopher D. Miller, and William L. Murray, editors, 2006. A Report by the Climate Change Science Program and the Subcommittee on Global Change Research, Washington, DC.

Santer, B.D., **T.M.L. Wigley**, **C. Mears**, **F.J. Wentz**, S.A. Klein, **D.J. Seidel**, K.E. Taylor, **P.W. Thorne**, M.F. Wehner, P.J. Gleckler, J.S. Boyle, W.D. Collins, K.W. Dixon, C. Doutriaux, M. Free, Q. Fu, J.E. Hansen, G.S. Jones, R. Ruedy, **T.R. Karl**, **J.R. Lanzante**, **G.A. Meehl**, **V. Ramaswamy**, G. Russel, and G.A. Schmidt, 2005: Amplification of surface temperature trends and variability in the tropical atmosphere. Science, 309, 1551-1556. DOI:10.1126/science.1114867.

Sherwood, S.C., **J.R. Lanzante**, and C.L. Meyer, 2005: Radiosonde daytime biases and late-20th century warming. Science, 1556-1559.doi:10.1126/science.1115640.

Mears, C.A., and **F.J. Wentz**, 2005: The effect of diurnal correction on satellite-derived lower tropospheric temperature. Science, 1548-1551. doi:10.1126/science.1114772.

CCSP REPORT

Preface . Report Motivation and Guidance for Using this Synthesis/Assessment Report by **Karl, T.R.**, C. D. Miller, and W. L. Murray, editor

Executive Summary by **Wigley, T.M.L., V. Ramaswamy**, J.R. Christy, **J.R. Lanzante, C.A. Mears, B.D. Santer**, C.K. Folland

Chapter 1 . Why do temperatures vary vertically (from the surface to the stratosphere) and what do we understand about why they might vary and change over time? by **Ramaswamy, V.**, J.W. Hurrell, **G.A. Meehl**

Chapter 2. What kinds of atmospheric temperature variations can the current observing systems measure and what are their strengths and limitations, both spatially and temporally? by Christy, J.R., **D.J. Seidel**, **S.C. Sherwood**

Chapter 3. What do observations indicate about the changes of temperature in the atmosphere and at the surface since the advent of measuring temperatures vertically? by **Lanzante, J.R.**, T.C. Peterson, **F.J. Wentz,** K.Y. Vinnikov

Chapter 4. What is our understanding of the contribution made by observational or methodological uncertainties to the previously reported vertical differences in temperature trends? by **Mears, C.A.**, C.E. Forest, R.W. Spencer, R.S. Vose, R.W. Reynolds

Chapter 5. How well can the observed vertical temperature changes be reconciled with our understanding of the causes of these temperature changes? by **Santer, B.D.**, J.E. Penner, **P.W. Thorne**

Chapter 6. What measures can be taken to improve our understanding of observed changes? by Folland, C.K., D. Parker, R.W. Reynolds, **S.C. Sherwood, P.W. Thorne**

Appendix A. Statistical Issues Regarding Trends. by **Wigley, T.M.L.**

Science Assessments Should ***Not*** Be Completed By Scientists Who Are Assessing Their Own Research

Publications and Presentations available at

Pielke Research Group

http://blue.atmos.colostate.edu

Colorado Climate Center

http://ccc.atmos.colostate.edu

Roger Pielke's Climate Science Weblog

http://climatesci.atmos.colostate.edu

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