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HIRI NEWS

HEAT ISLAND REDUCTION INITIATIVE

The Impact of Urbanization & Land Use on Climate, Updating CA Title 24, and More!

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Urbanization & Land Use Impact on Climate

Dr. Eugenia Kalnay, of the University of Maryland, joined the call to discuss an ongoing research project – recently featured in the journal, Nature – in collaboration with Florida State University's Dr. Ming Cai. Their

work establishes a new methodology for assessing the impact of urbanization and land use change (including agriculture) on Earth's surface temperatures. The research is believed to improve the accuracy of previous efforts to characterize the effect of urban infrastructure and land use on climate.

According to the journal, Nature, "Scientists have long known about these distorting effects on apparent temperature trends, and try to correct the temperature measurements made by meteorological stations accordingly. The new results show that these adjustments may have been insufficient, and that changes in land use can contribute significantly to the observed warming at the earth's surface."

Euginia told the group that her research compares surface observations over the US with the National Centers for Environmental Prediction (NCEP) 50 year Reanalysis, which is relatively insensitive to land use change.

The surface parameters in Reanalysis do not use, and are not sensitive to actual surface observations but depend on information from radiosondes and satellite soundings.

The results show that the impact of land-use changes is, in fact, comparable in magnitude to that of greenhouse gases. Prior to Kalnay and Cai's research, the impacts of changes in land use have been regarded as "noise," compared to GHG-related impacts.

Euginia said that changes in landuse may be significantly more important than previously believed, and a major anthropogenic source of surface warming.

In conducting her research, Euginia noted, the process of separating out the temperature effects from land use change and increasing GHG emissions is difficult. However, she believes her methodology provides a clearer picture of the relative impacts.

Specifically, Kalnay and Ming used "raw", or unadjusted, observations to compute trends for the pre-satellite period (1960-1979) and post-satellite period (1980-1999). Then, they linearly interpolated the stations' maximum and minimum values.

Although close to 3000 weather stations exist, Kalnay and Ming eliminated stations with sparse data. They only used sites that had 480 whole months of observations. Further, they only used sites with elevations below 500 meters.

Euginia said the daily difference between the daytime maximum and nightly minimum surface temperatures has shrunk since the 1950s. Results indicate that about 40% of the observed increase in minimum temperature is due to land use changes. In addition, most of the observed decrease in maximum temperature – and half of the decrease in diurnal temperature – can similarly be explained.

In degree-impact terms, results derived from adjusted data gives a land use change estimate of 0.147C per decade in the mean temperature.

After discussing results, Euginia mentioned proposed next-steps for their work: (1) performing a seasonal analysis; (2) studying the effects of deforestation, reforestation, irrigation, and changes in urbanization (results to date suggest a stronger land-use impact in the 1960-1970s than in the 1980-1990s); (3) comparing results with satellite data to validate results; and (4) using the new higher resolution Regional Reanalysis.

As noted previously, this research was recently published in the journal, Nature, and a summary is available at: http://www.nature.com/nsu/030527/030527_6.html

Cool Roof Update To CA Title 24

Dr. Hashem Akbari of Lawrence Berkeley National Laboratory's Heat Island Group joined the call to discuss proposed changes in how cool roofs are treated in California's Title-24 standards for non-residential buildings.

Hashem explained that currently cool roofs are treated as a compliance option; that is, no prescriptive requirement exists. The proposed changes include adding such a requirement for low-sloped roofs. It would provide exemptions for:

– non-residential buildings with sloped roofs
– high-rise residential buildings
– low-rise residential buildings
– guest rooms in hotel/motel buildings

For low-slope roofs, the proposal calls for an "overall-envelope" and performance approach that allows compliance credits and provides for penalties. The changes would also alter cool roof product requirements to include low-emittance products that have very high reflectance. Under the proposal, moderate-reflectance clay and concrete tiles would be restricted to low-rise residential buildings.

Hashem said the proposed Title 24 changes are based on the following

methodology: reviewing availability and cost data; evaluating technology and market share; and assessing product availability, cost; and useful life. The resulting data informs a building-level cost/benefit analysis, which is based on DOE-2.1E model simulations of cooling and heating energy use. A projection of state-wide savings (based on the non-residential new construction database) has also been performed.
Hashem said proposed changes to CA Title 24 hinge on the well-documented energy-saving properties of cool roofs. He said these products stay cool from a high thermal emittance and solar reflectance (or, a low thermal emittance and exceptionally high solar reflectance). The proposal's intention is to capture the resulting reductions in building cooling electricity use, peak power demand, and ambient air temperature.

Anticipated benefits of the proposal include increased human comfort, slowed smog formation, mitigation of summertime urban heat islands, and decreased waste from disposal of roofs. Costs from cool roofs may include slightly higher wintertime heating energy use and possibly higher rates of water and detergent consumption from rooftop cleaning.

Projected annual statewide savings for re-roofing, which represents 70% of the cool roof market, is:

– Electricity savings: 43.0 GWh
– Natural gas deficit: 577 ktherms
– Source energy savings: 383 GBTU
– Peak power demand savings: 26.7 MW
– Annual equipment savings: $13.3M
– TDV NPV energy savings: $66.4M
– TDV total savings (NPV energy+ equip): $78.9M
– Non-TDV NPV savings: $58.4M
– Non-TDV total savings (NPV energy + equip: $68.1M

For more information on Title 24, see: www.energy.ca.gov/title24/index.html

Conference Updates

Dr. David Sailor attended the Fifth International Conference on Urban Climate (ICUC-5) in Lodz, Poland from September 1st to 5th. The purpose of ICUC-5 was to foster a better understanding of the atmosphere in built environments, including improvements in the application of this information to city design and operation.

David contributed a paper which outlined a general methodology for constructing diurnal anthropogenic heating profiles for cities. He presented and compared sample anthropogenic heating profiles for several cities for both summer and winter conditions. David also investigated the role of anthropogenic heating in the development of the urban heat island by modeling each city and episode with and without anthropogenic heating.

Eva Wong, of EPA's HIRI program, attended the 2003 National Urban Forest Conference in Austin, TX September 17th-20th. There were 900 participants, 100 speakers, 13 tours and workshops and an exhibit hall at the conference.

For those who weren't able to attend, proceedings from American Forests will be mailed in late fall. If you would like to place an order, see: www.americanforests.org

A summary of the conference will be featured in the winter 2004 American Forests Magazine.

HIRI Program Update

Eva briefed the group on the status of the heat island guidebook and pavement initiative. Regarding the guidebook, all the raw information has been developed and is currently being edited and formatted.

In November and December, the guidebook will be sent out for an internal and external expert peer review. Comments will be incorporated in early 2004, and the revised version will be sent through an official EPA product review. If all goes well, Eva hopes that the guidebook will be out in May 2004.

In terms of the pavement initiative, Eva explained that with pavements, the issues are not as clear as with other heat island reduction strategies. Thus, the HIRI program is working with a consulting firm that has technical expertise in the the pavement arena.

This group is helping HIRI gather information on viable alternative paving technologies, and to develop a program strategy for cool paving. Work on this initiative has recently begun and is expected to continue for one year.

The next conference call is TBD. Stay tuned for the date, call-in number, and access code.