ARIZONA COUNTY URBAN HEAT ISLAND STUDY: REMOTE SAMPLING THROUGH THE USE OF GLIDER DATA

An Abstract of

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Katherine Haessler

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ABSTRACT

This research examined the Urban Heat Island (UHI) effect through the use of glider data. UHI occurs when large urban areas become warmer than surrounding areas (Howard 1833, Gelt 2006 and EPA 2008b) because of human activities. This is problematic as it is speculated that by the year 2025 eighty percent of the world's population will live in an urban environment (United Nations 2003). UHI modifies the local environment and has been seen to cause: lengthened growing seasons in plants (USEPA 2007), increased pollutions (Hung-Neng et al. 2005), increased energy use (Garcia-Cueto et al. 2007, Stone et al. 2001) and changes to the local weather patterns (Gelt 2006, Baik et al. 2001) – all effects which can be anticipated to heighten as UHI and urbanization continues.

Current UHI research methods were found to be inaccurate in the (Peterson 2003, Parker 2004 and Black 2004) studies. Peterson's 2003 study lists: "differences in elevation, latitude, and longitude, time of observation, instrumentation, and non standard siting" (pg. 2941) as primary biases that contaminate the UHI study process. This research provides a new way of researching UHI phenomenon, which mitigates these biases and brings new data to analyze the UHI phenomenon.

The research problem is that there is a significant inverse relationship between urban growth/UHI and thermal development. This paper tests the hypothesis that the UHI effect can be seen in glider data collected between 1999 and 2006 in the form of a net annual reduction in thermal height. The null hypothesis is no change or no trend/erratic data behavior. In order to test this hypothesis an analysis of variance (ANOVA) will be

used to determine if there are statistically significant differences in the mean annual altitudes achieved between years 1999 and 2006.

The study found an average altitude decrease of 33.848 feet annually between the years 2000, 2001, 2002 and 2003, which can be thought of as a .186 degree Fahrenheit increase using the dry adiabatic lapse rate (DALR) as an exchange model to convert altitude to temperature.

Phoenix, the major city in Maricopa County, has documented climactic trends showing similar increased temperatures over time.

> In 1948, Phoenix's average nighttime low temperature was 75 degrees; in 2003 it had increased to 86.7 degrees. Some researchers say that at some time in the future 100-degree nights will be the norm (Gelt 2006).

Gelt's study found that UHI effect, if an even and constant trend has caused an average temperature increase of .21 degrees Fahrenheit in Phoenix. It is interesting to note the similar findings of this and his study, which support temperature increase in the Phoenix area as well as the increment of temperature increase, .18 and .21 degrees Fahrenheit, respectively.

Though consecutive years; 2000, 2001, 2002 and 2003 show an elevation decrease in this study, it is difficult to quantify how significant this set of years is in terms of conclusively establishing UHI. Arguably the more years that concurrently follow exhibiting a similar behavior the greater the likelihood is that a trend is being observed rather than null change or erratic change. The greatest contribution of this study to the field of UHI is a tested alternative methodology that when given enough data can

disprove the (Peterson 2003, Parker 2004 and Black 2004) tenants, which currently undermine UHI temperature based research methodologies.