

# NIGHTTIME INDOOR SUMMER TEMPERATURES IN PHOENIX HOMES

## INTRODUCTION

Extreme heat is a major health concern for Phoenix residents as over 1,000 people have died since 2001 in Maricopa County due to heat-related illness<sup>[1]</sup>. In order to better understand the various ways in which Phoenix residents perceive and experience temperature, through a \$2.3 million NSF Hazards SEES grant, we have been gathering data by surveying and placing temperature sensors inside of residents' homes during the summer. The extent of this ongoing project spans three universities, many disciplines, and addresses issues of concurrent heat waves and blackout scenarios. We present here preliminary findings from our initial analysis of this continually incoming data. Specifically, we seek to characterize differences among Phoenixians' ideal, actual, and "too hot" indoor temperatures and associations between temperature and income.

## MATERIALS AND METHODS

Temperature data loggers were placed inside the households of 41 participants that agreed to a follow-up study after participating in a screening survey about extreme heat and risk perception. Data were recorded at 5-minute intervals for four weeks. We examine nighttime temperatures as they are most likely to represent times at which the participant is at home and experiencing these temperatures.

Figure 1: HOBO UX100-011 Temperature Sensor

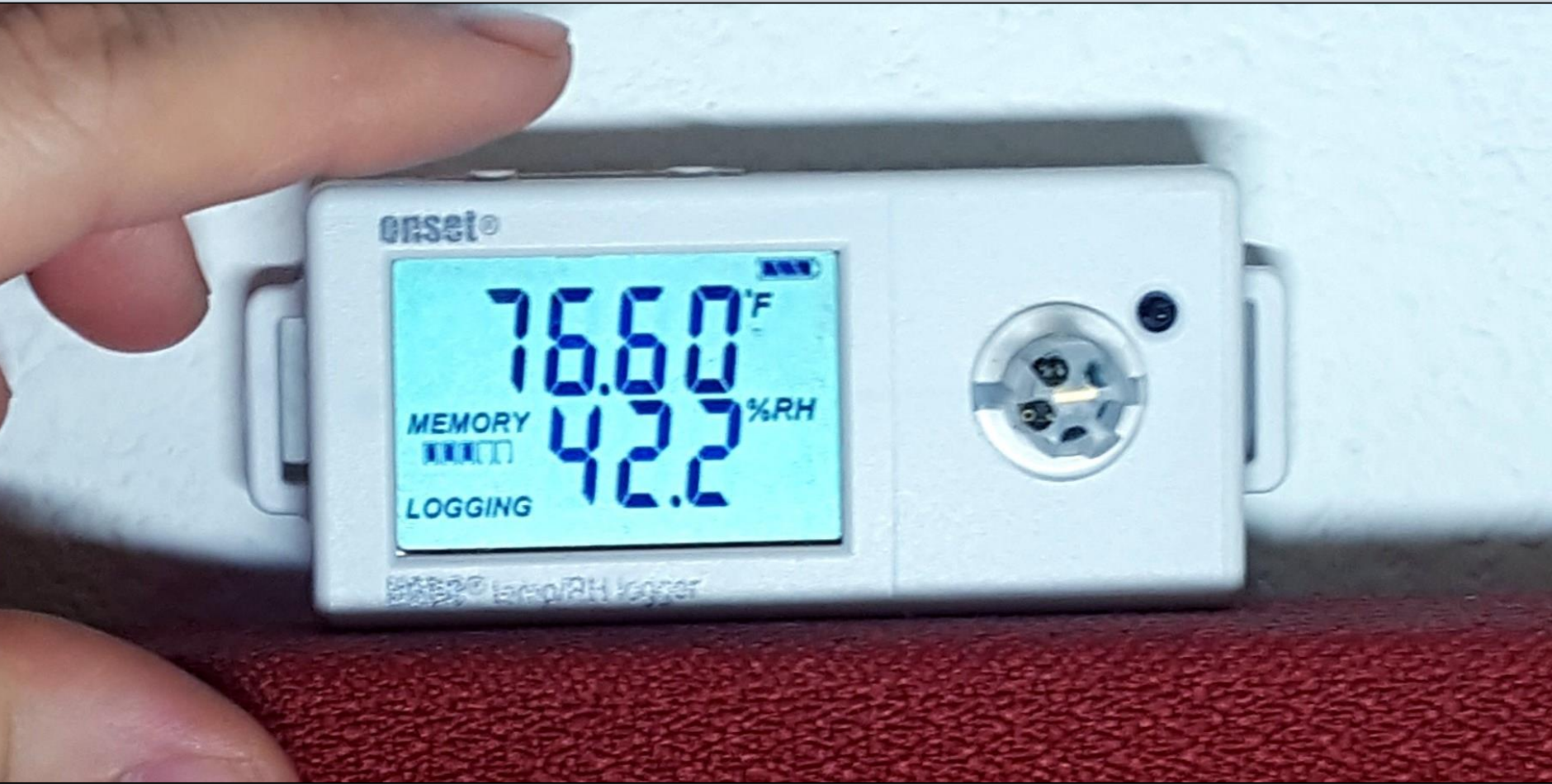
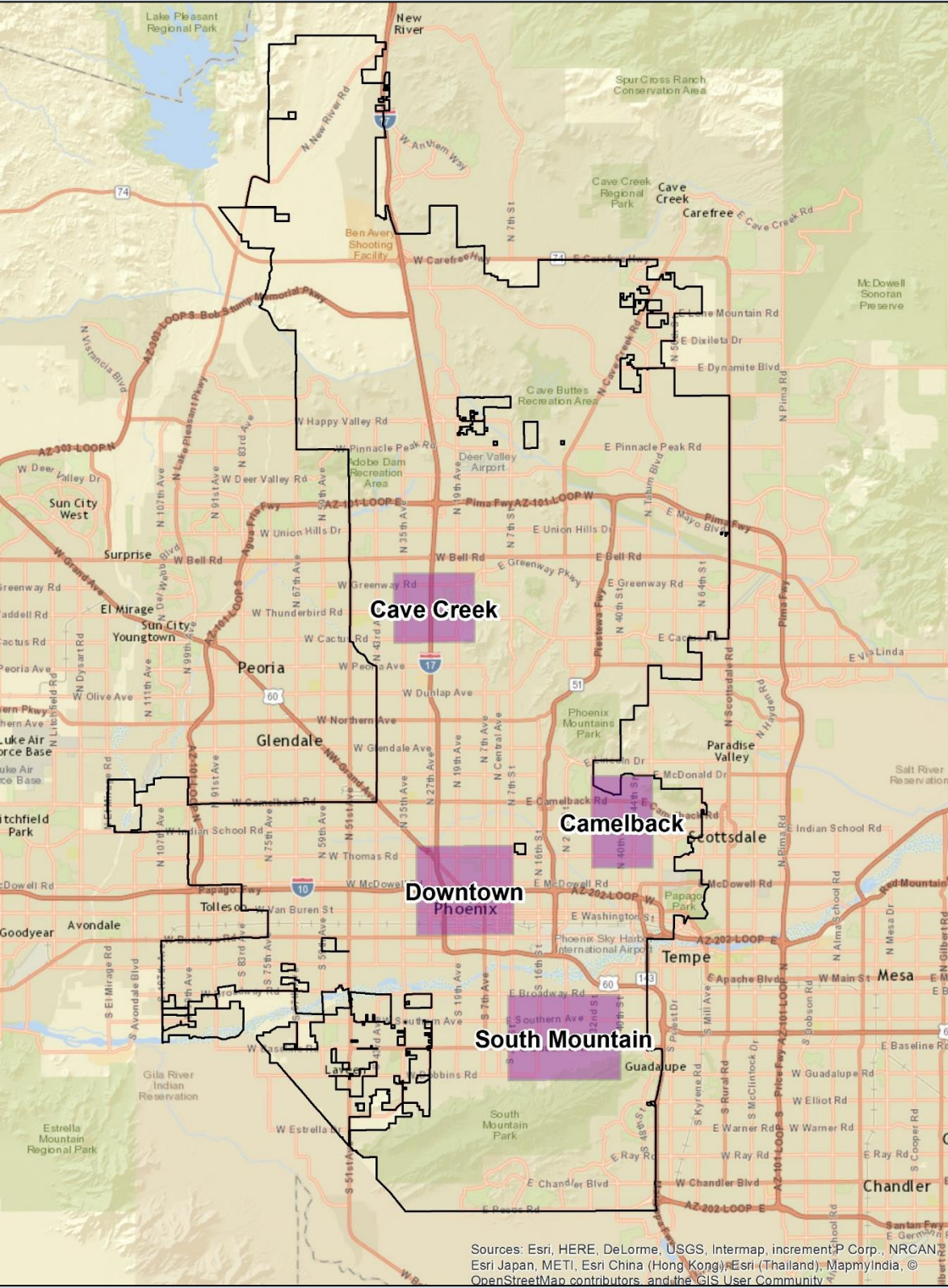


Figure 2: Study Sites



- Total # of participants: 41
- Study period: 8/21-9/19
- Nighttime defined as 8pm-8am

### Survey questions:

**"Too Hot":** At what temperature inside your home in the summer do you start to feel too hot for your comfort.

**"Ideal":** What temperature inside your current home is most comfortable for you in the summer? That is, ignoring any limitations on how much you can cool your home what is your ideal comfortable temperature?

## ACKNOWLEDGEMENTS

Special Thanks to ASU, Georgia Tech, and University of Michigan 3HEAT teams: Paul Chakalian, Liza Kurtz, Kevin Lanza, Larissa Larsen, Evan Mallen, Hana Putnam, Mario Chavez, Clarissa Sanchez, Olivia Montoya, Carly Cipinko, and Drs. Brian Stone, Carina Gronlund, David Hondula, Matei Georgescu, and Sharon Harlan

## RESULTS

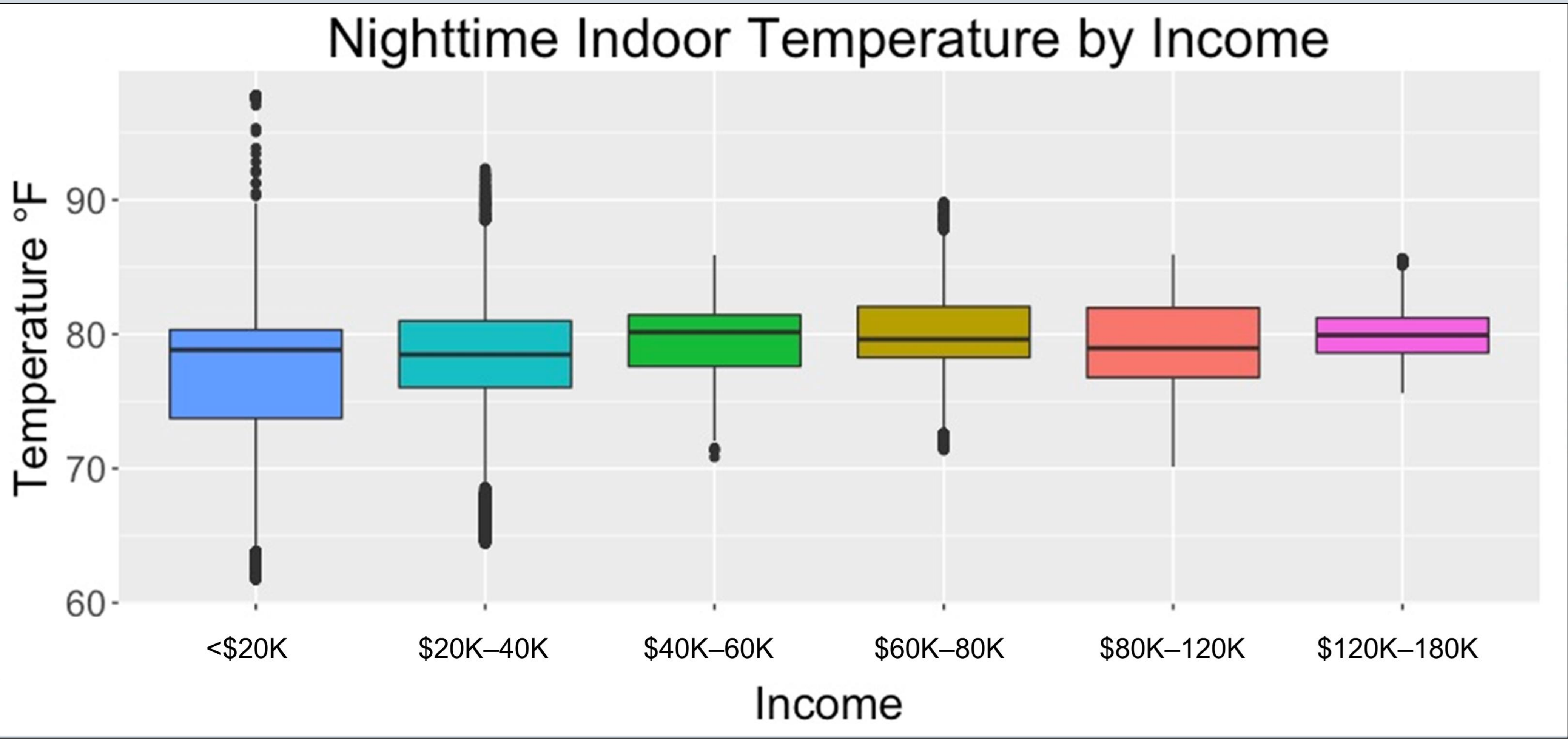


Figure 3: Boxplots of all nighttime (8pm-8am) observations over the entire study period (8/21-9/19) divided by income groups. Each group holds the same number of participants by  $\pm 2$ .

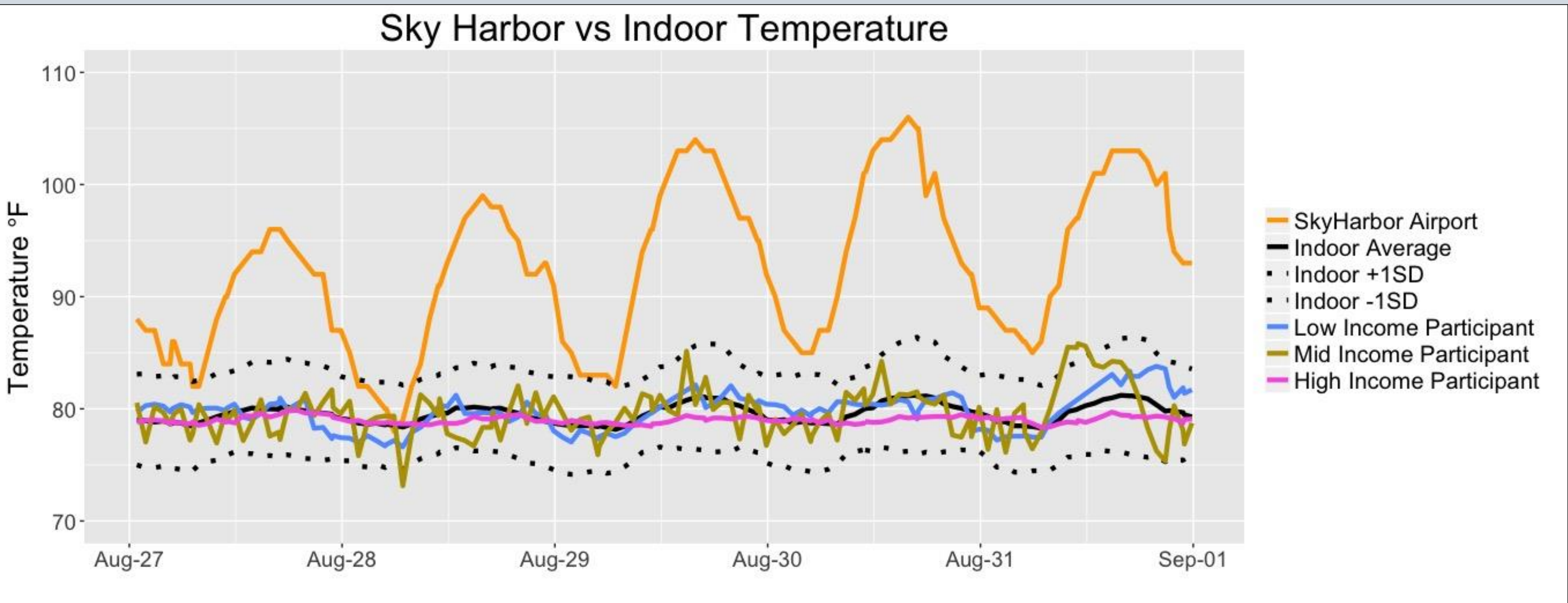
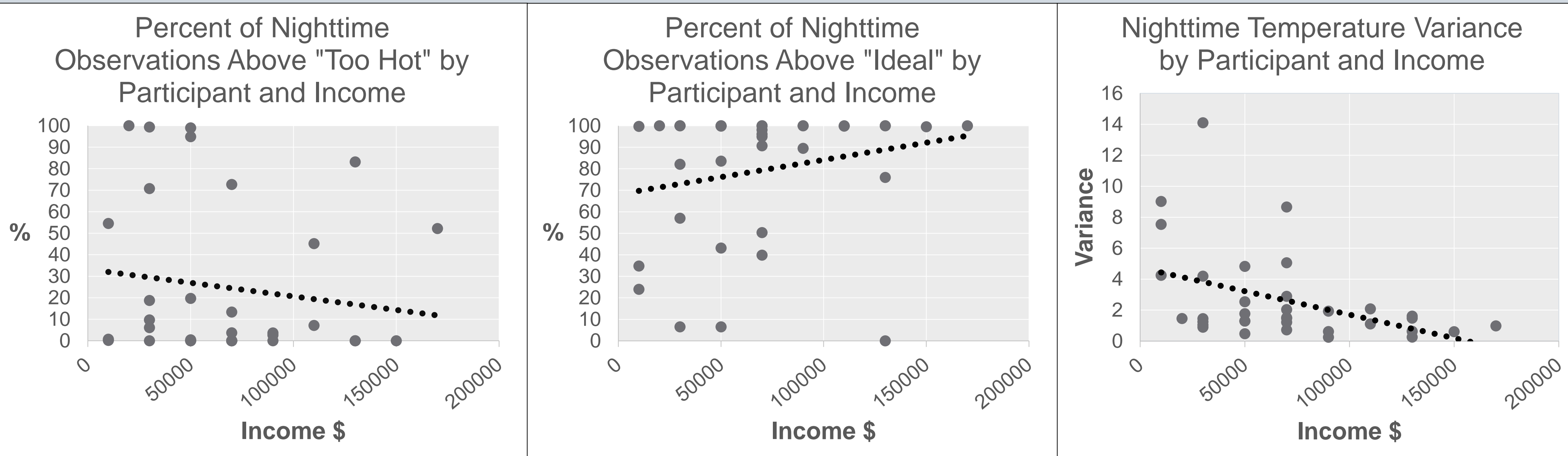


Figure 4: A sample time period (Sat 8/27 – Wed 8/31) in which outdoor temperatures varied considerably. Plotted are the average and  $\pm 1$  standard deviation of all observations, Phoenix Sky Harbor outdoor observations, and representative indoor observations from participants in three different income categories.



Figures 5, 6 & 7: Utilizing the survey questions about participants' ideal vs. too hot indoor temperatures, the percent of observations occurring above these comfort thresholds is plotted for each individual residence by their combined household income in addition to plotting individual temperature variance by income.

## CONCLUSION

Preliminary analysis suggests a connection between income and indoor temperature and comfort. Lower income households tended to have a higher percent of time above "too hot" temperatures and higher temperature variance. This pattern was not evident in a direct comparison of mean or median temperature and income. We will pursue further analysis of associations between temperature, comfort preference, other demographic factors (gender, ethnicity, age, health status, etc.), and household cooling resources.