



NASA Community Test Workshop

Survey Data and Dose Response Analysis

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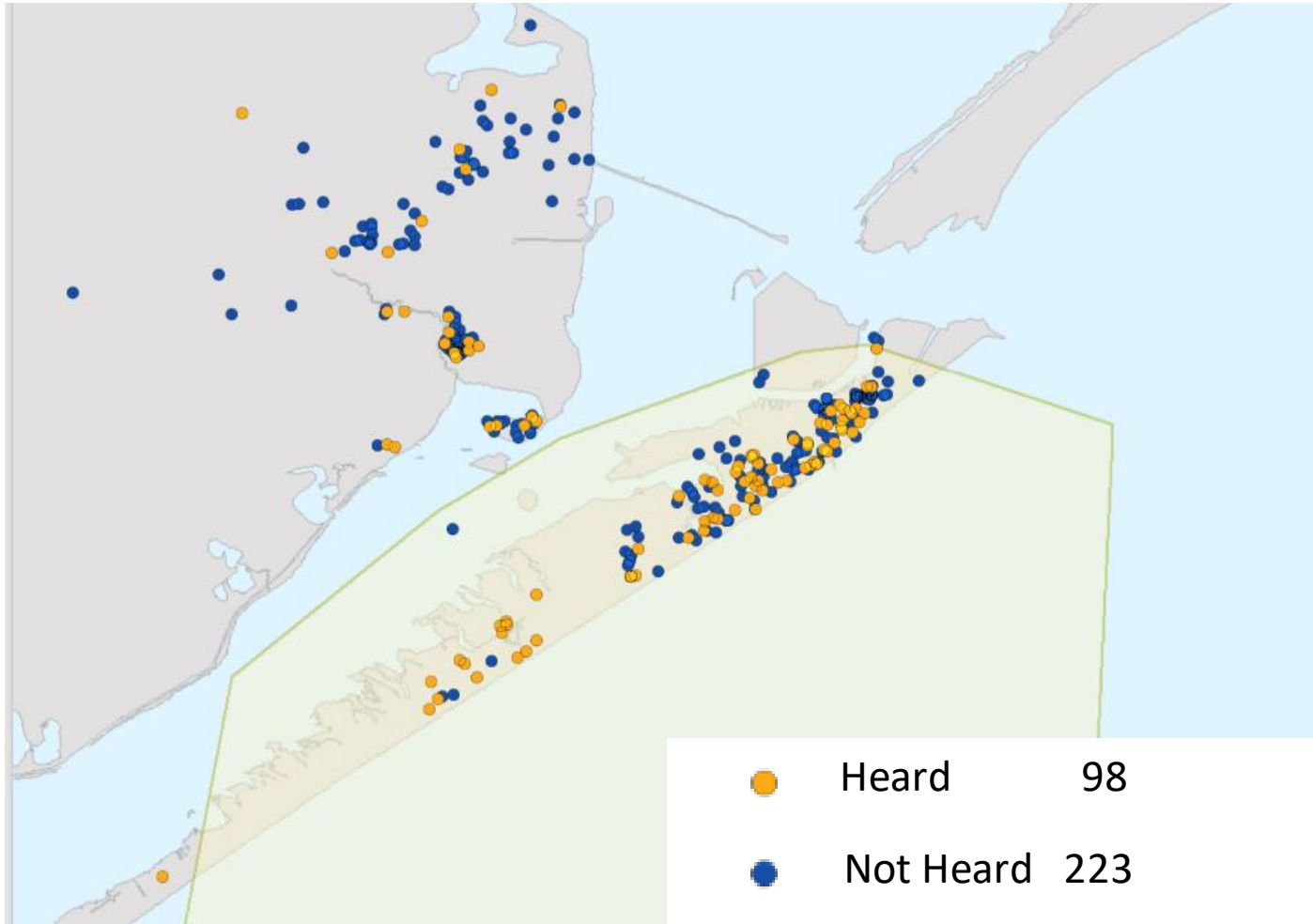
Survey Data Processing



	Potential Responses	Responses Initiated	Responses Analyzed
Single-Event Survey	25,792	11,869 (46%)	5,789 (22%)
Cumulative Survey	5,456	2,841 (52%)	2,116 (39%)

- Of the 496 survey participants, 476 initiated single-event surveys and 429 initiated cumulative surveys.
- Automated techniques needed for isolating subset of complete survey responses with valid matching noise dose.

Survey Participant Geolocation

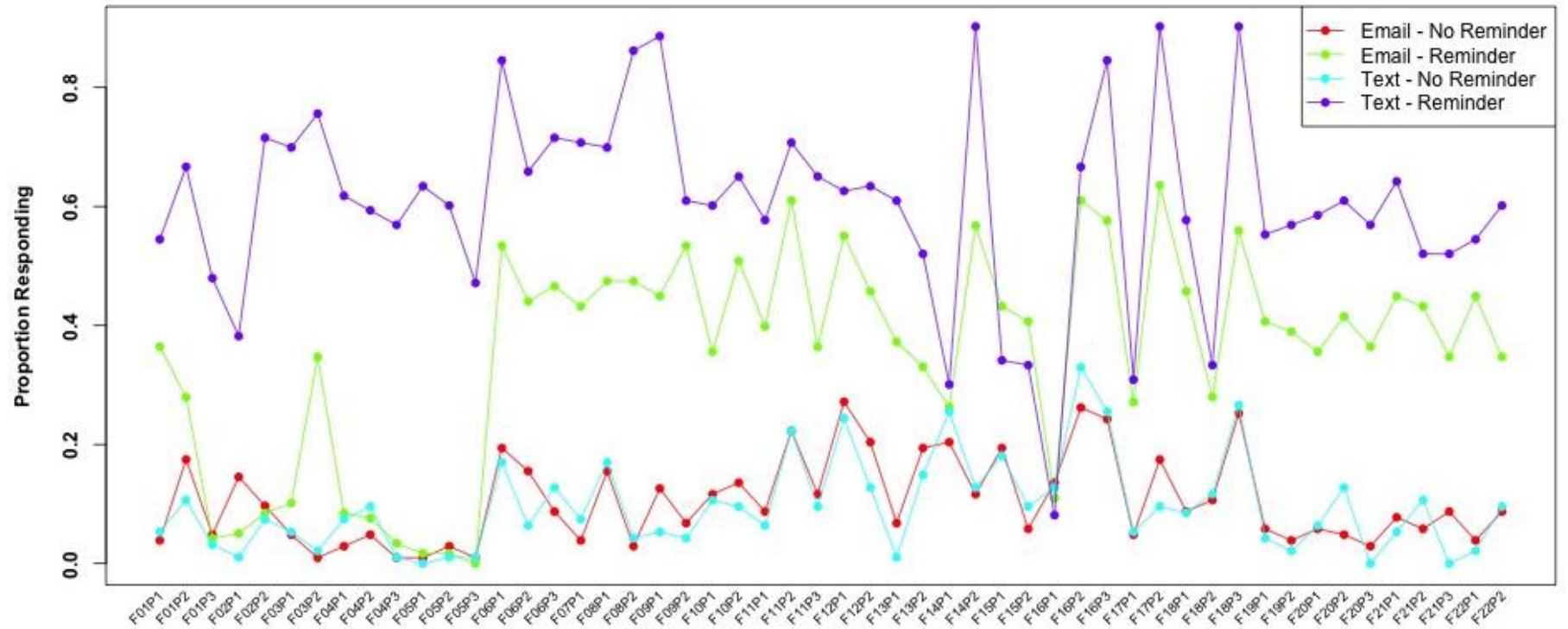
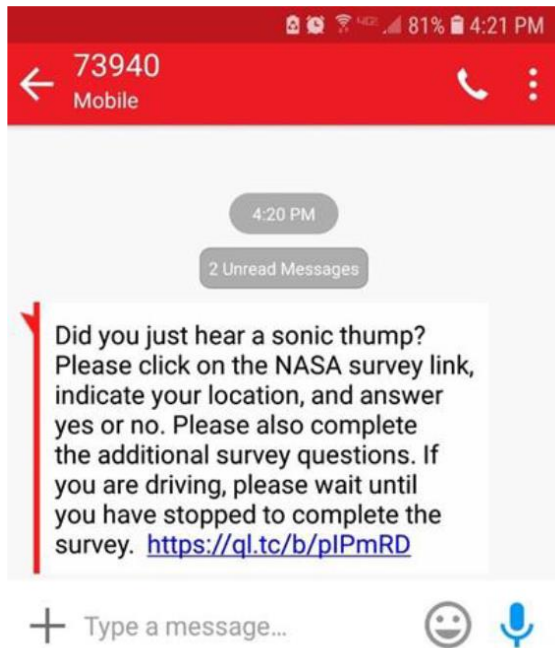


- Sonic thump noise levels varied widely across F-18 dive footprint, so participants must be located to assign a specific noise dose.
 - Automatic geolocation worked for 71% of 11,869 single-event survey responses.

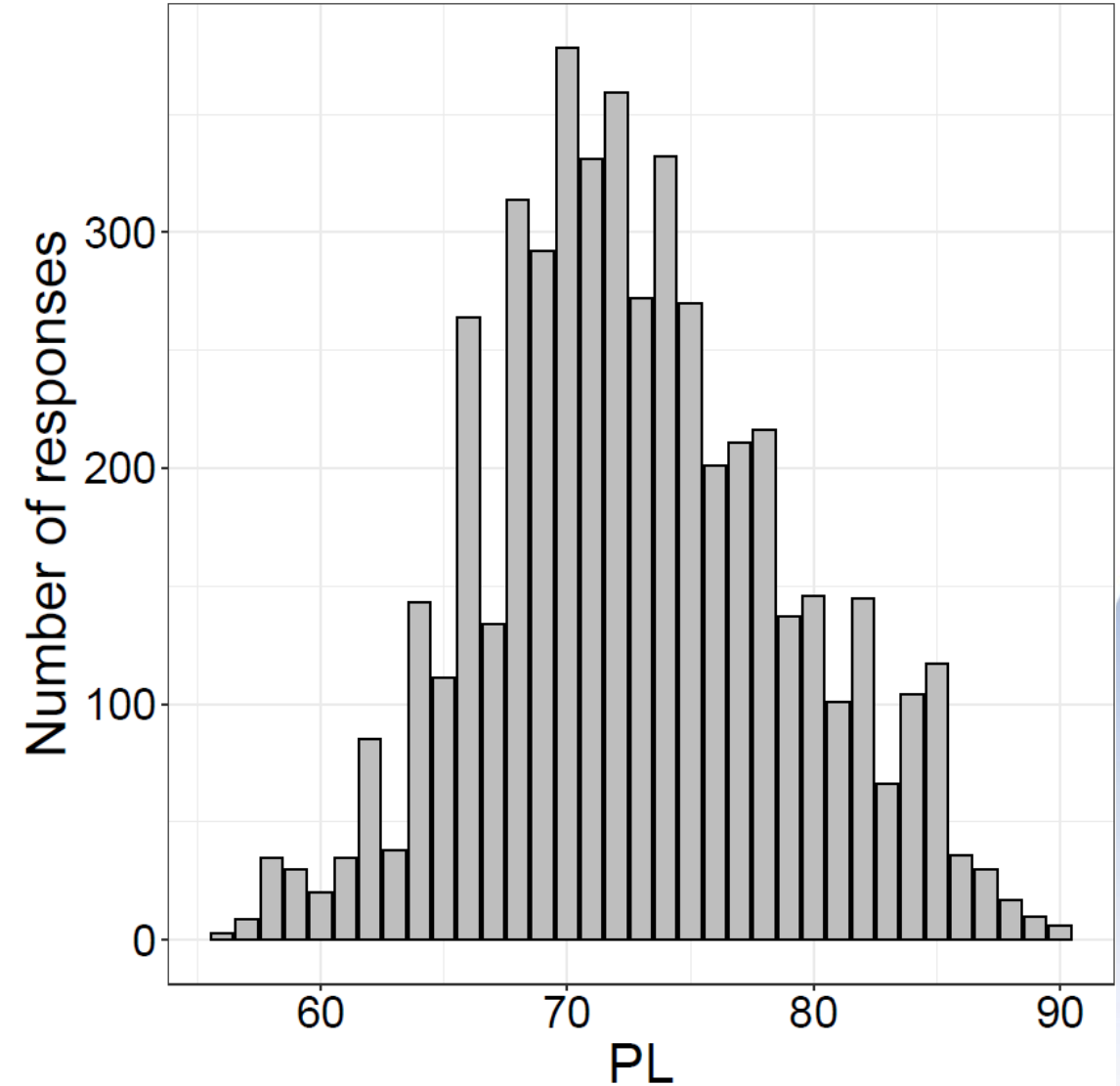
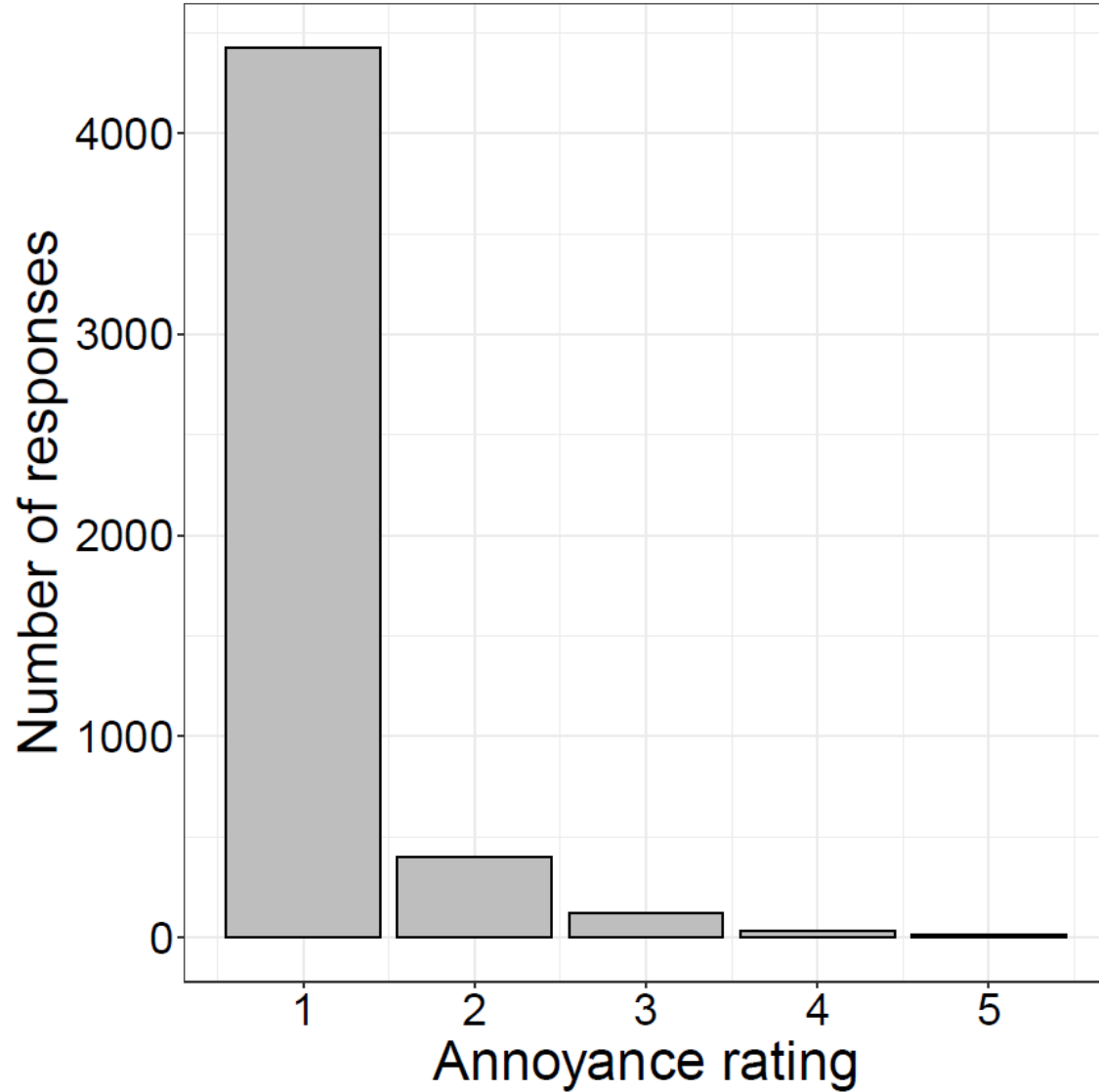
Survey Reminders



- Reminder messages improved survey completion rates, especially for thumps not heard.
 - False reminders also sent.



Survey Response Summary



Statistical Model Development



➤ Objective:

- Evaluate statistical modeling techniques for panel survey data
- Calculate summary dose-response curve from statistical models

➤ Approach:

- Fit several candidate statistical models
- Confirm that features of simulated data from each model match the observed data
- Compare relative model fits to observed data

➤ Results:

- Multilevel models fit the data better than non-multilevel models
- The best fitting models are:
 - Multilevel logistic regression (MLR) – binary data like a coin flip (HA vs not HA)
 - Multilevel ordinal regression (MOR) – ordinal data like a dice roll (1 thru 5 questionnaire response)

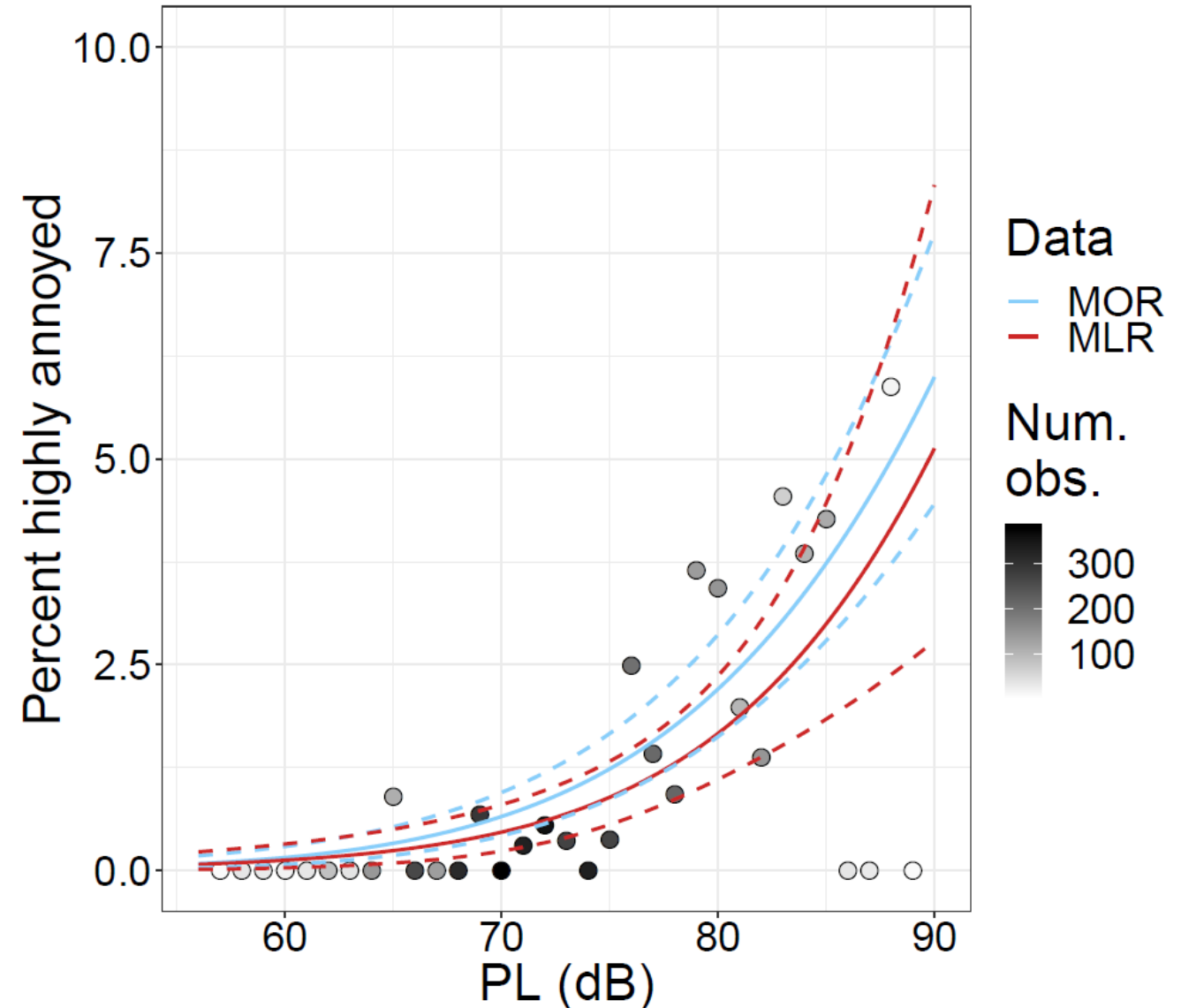
➤ Significance:

- Traditional modeling techniques for cross-sectional data not recommended for panel data
- Techniques needed to combine data from several tests into nationally representative results

Sample Dose-Response Summary Curves



- Two candidate models displayed
- High degree of overlap between MLR and MOR curves
- Summary curves overlaid on binned data
 - Curves are not best-fit lines to plotted data points
 - Each datapoint represents all noise exposures binned in 1 dB increments
- Analysis techniques also apply to cumulative dose-response data (not shown)



Additional items we would like to learn



- **What survey data would be needed in order to set regulations?**
 - **Would survey data on startle and on rattle/vibration play any role in regulations?**
 - **Would panel sample yield acceptable data?**



- Lee, J. (2019). Dose-response modeling of quiet sonic boom community response survey data (Master's thesis, North Carolina State University). Retrieved from <http://www.lib.ncsu.edu/resolver/1840.20/36354>
- Lee, J., Rathsam, J., and Wilson, A. "Statistical Modeling of Quiet Sonic Boom Community Response Survey Data," NASA Technical Memorandum (in publication)
- Lee, J., Rathsam, J., and Wilson, A. "Bayesian statistical models for community annoyance survey data" (in publication)
- Page, J.A., Hodgdon, K.K., Hunte, R.P., Davis, D.E., Gaugler, T., Downs, R.S., Cowart, R., Maglieri, D.J., Hobbs, C., Baker, G., Collmar, M., Bradley, K.A., Sonak, B., Crom, D., Cutler, C. Quiet Supersonic Flights 2018 (QSF18) Test. NASA Contractor Report (in publication).