

Introduction

- Emergence of commercially-available low-cost sensors has created the opportunity for a *wide range of stakeholders* to collect environmental data and explore air pollution issues
- Citizen Scientist often *lack the knowledge, tools, and training* necessary to employ low-cost sensors

Approach

- Develop a version of EPA's multi-pollutant **Citizen Science Air Monitor (CSAM)** using low-cost sensors to meet the needs of the community group Desarrollo Integral del Sur, Inc. (DISUR)
- Provide training to citizen scientist to conduct ~5 months of intensive air quality monitoring using the resources available on the **Air Sensor Toolbox**

Goals

- Determine the **efficacy of citizen science** involving the use of low cost air quality sensors
- Evaluate the performance of these low cost sensors deployed under harsh environmental conditions (**high relative humidity** and **costal atmosphere**)



EPA and JTI CSAM citizen training for DISUR



CSAM 303 rooftop deployment

Experimental Setup



9 CSAM Sensor Pods were deployed

- 5 measured **PM_{2.5}**, **tVOCs**, Temperature, and Relative Humidity (**PODs 30X**)
- 4 measured **PM_{2.5}**, **tVOCs**, **NO₂**, Temperature and Relative Humidity (**PODs 35X**)
- 4 were collocated with weather stations



Weather Station



Davis Vantage Vue⁴

PM_{2.5}



Alphasense OPC-N2¹

tVOCs



Baseline-Mocon²

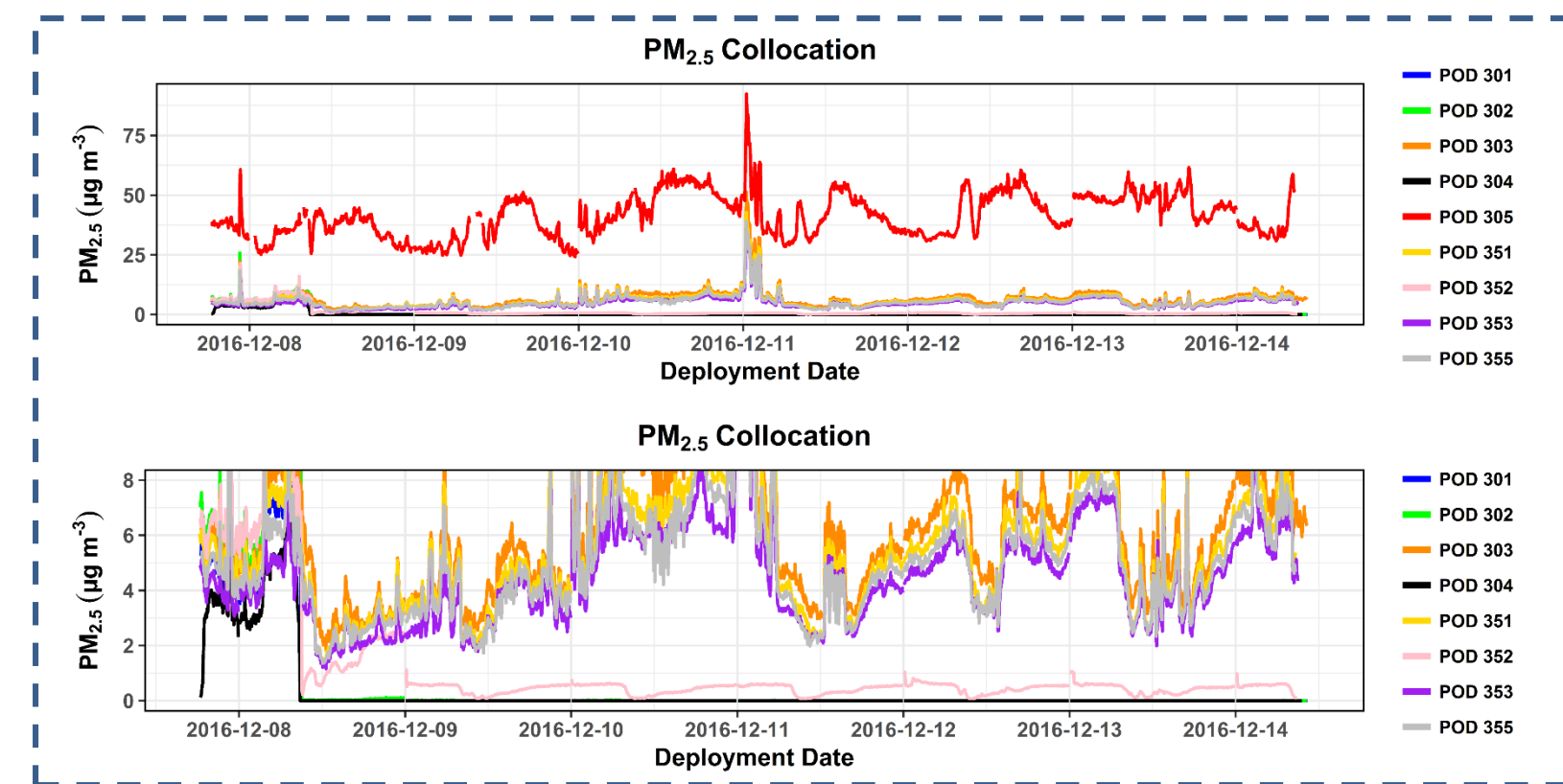
NO₂



CairClip NO₂³

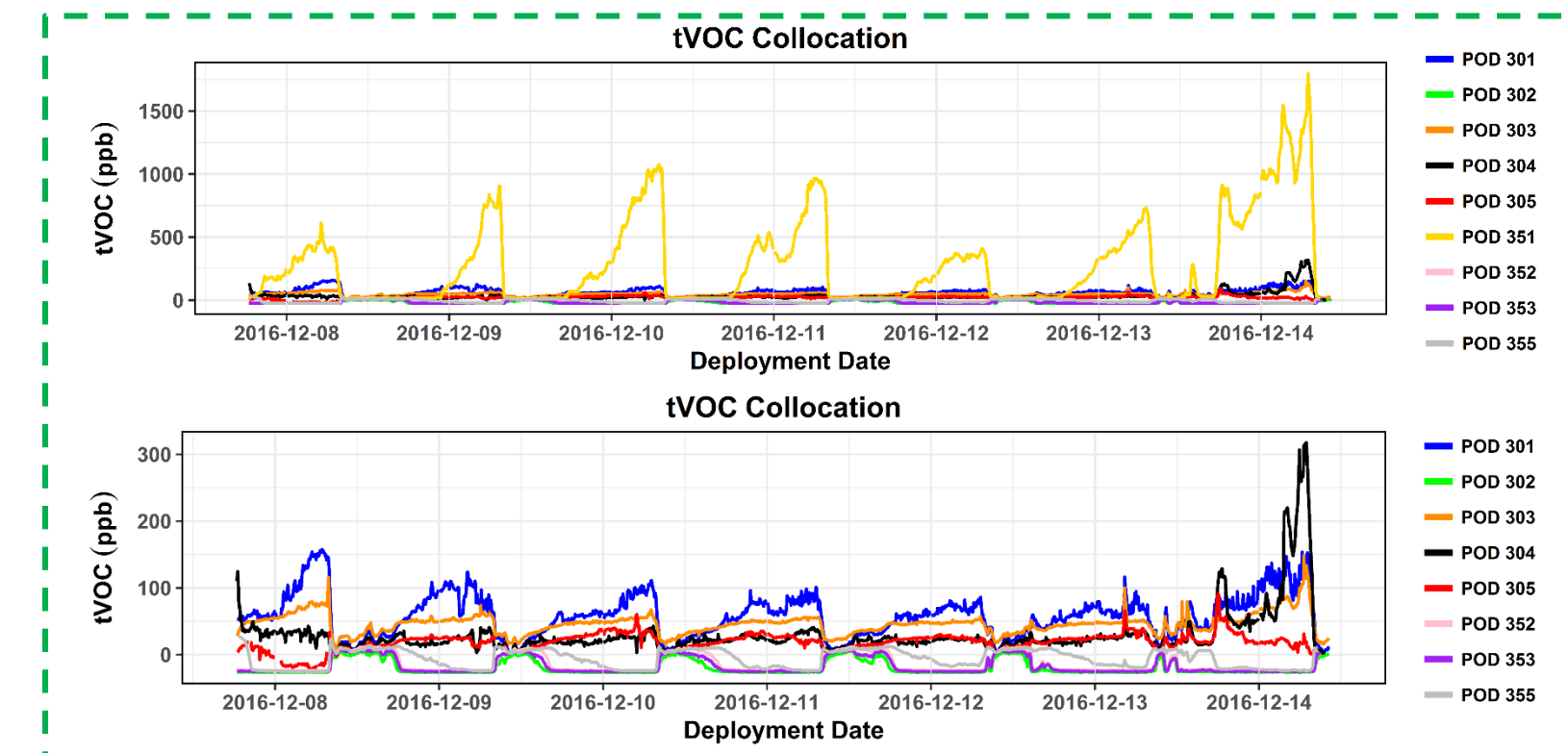
Collocation

- CSAM Sensor Pods were collocated for 1 week at a local Puerto Rico regulatory site near Ponce
- No regulatory data was available for collocation



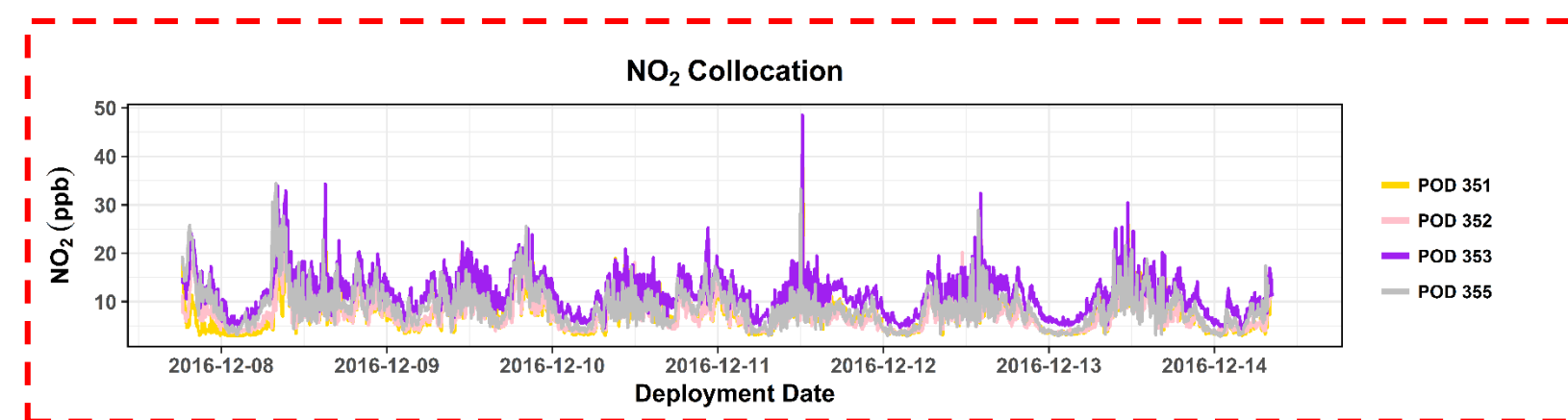
PM_{2.5}

- POD 305's** response is elevated relative to other Sensor PODs
- PODs 301, 302, 304, and 352** initially in agreement but then fail



tVOCs

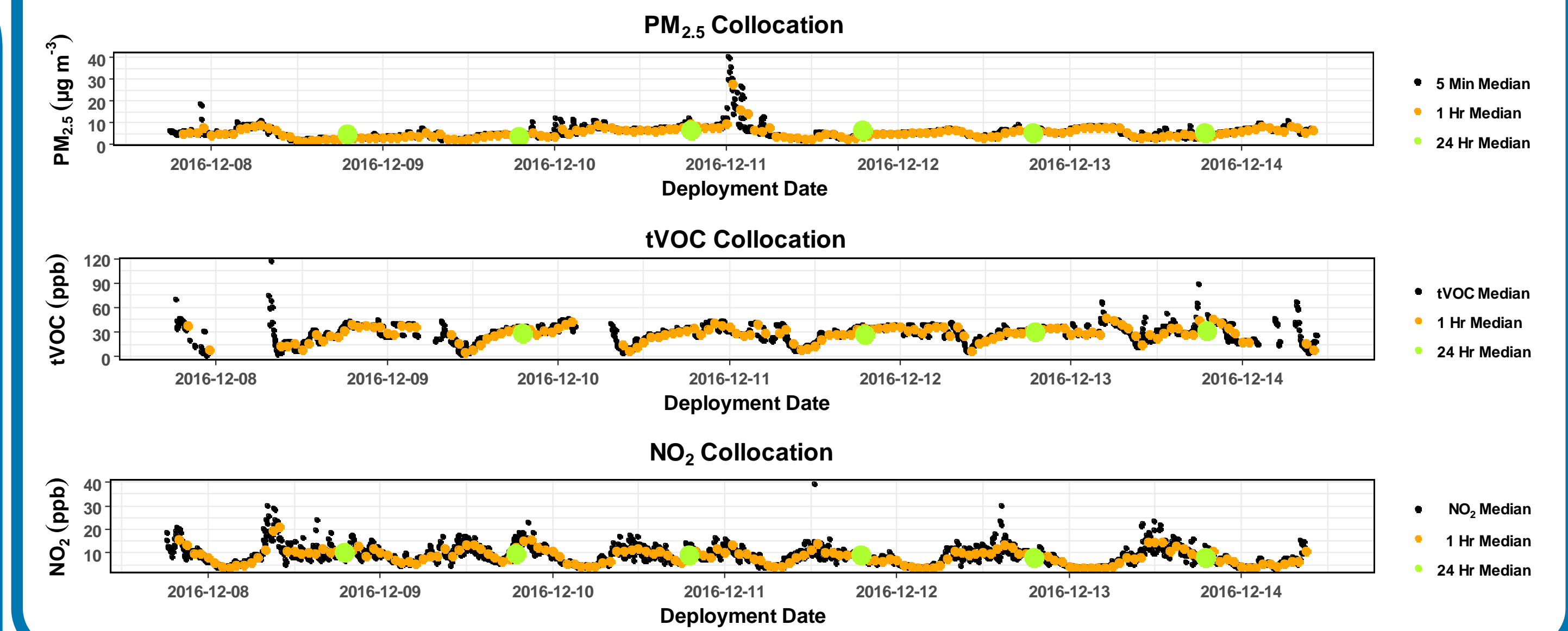
- POD 351's** response is elevated relative to other Sensor PODs
- PODs 302, 352, 353, and 355** plateaus at negative values



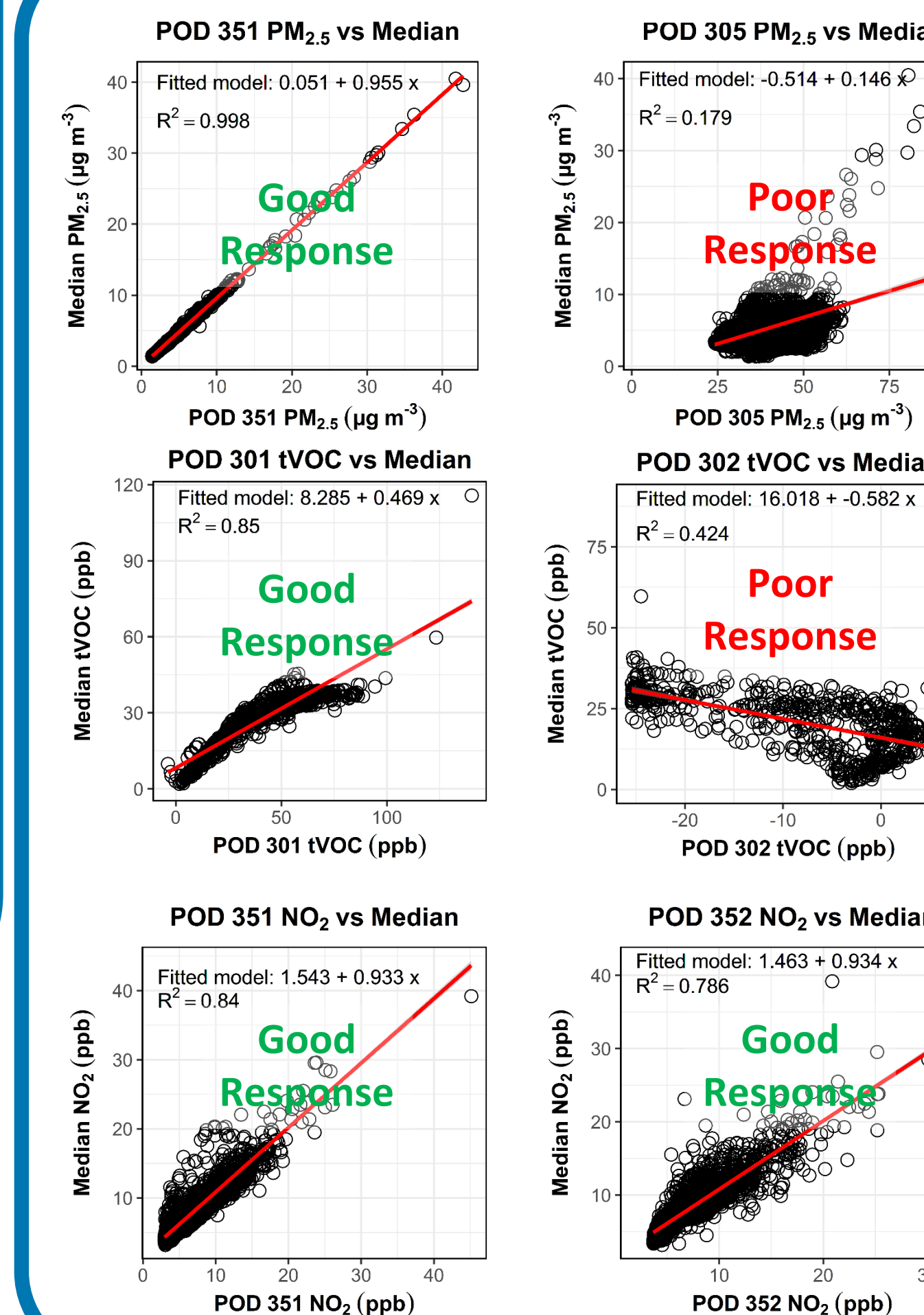
NO₂

- All** Sensor Pods show a consistent response

Median Response



Normalize to Median



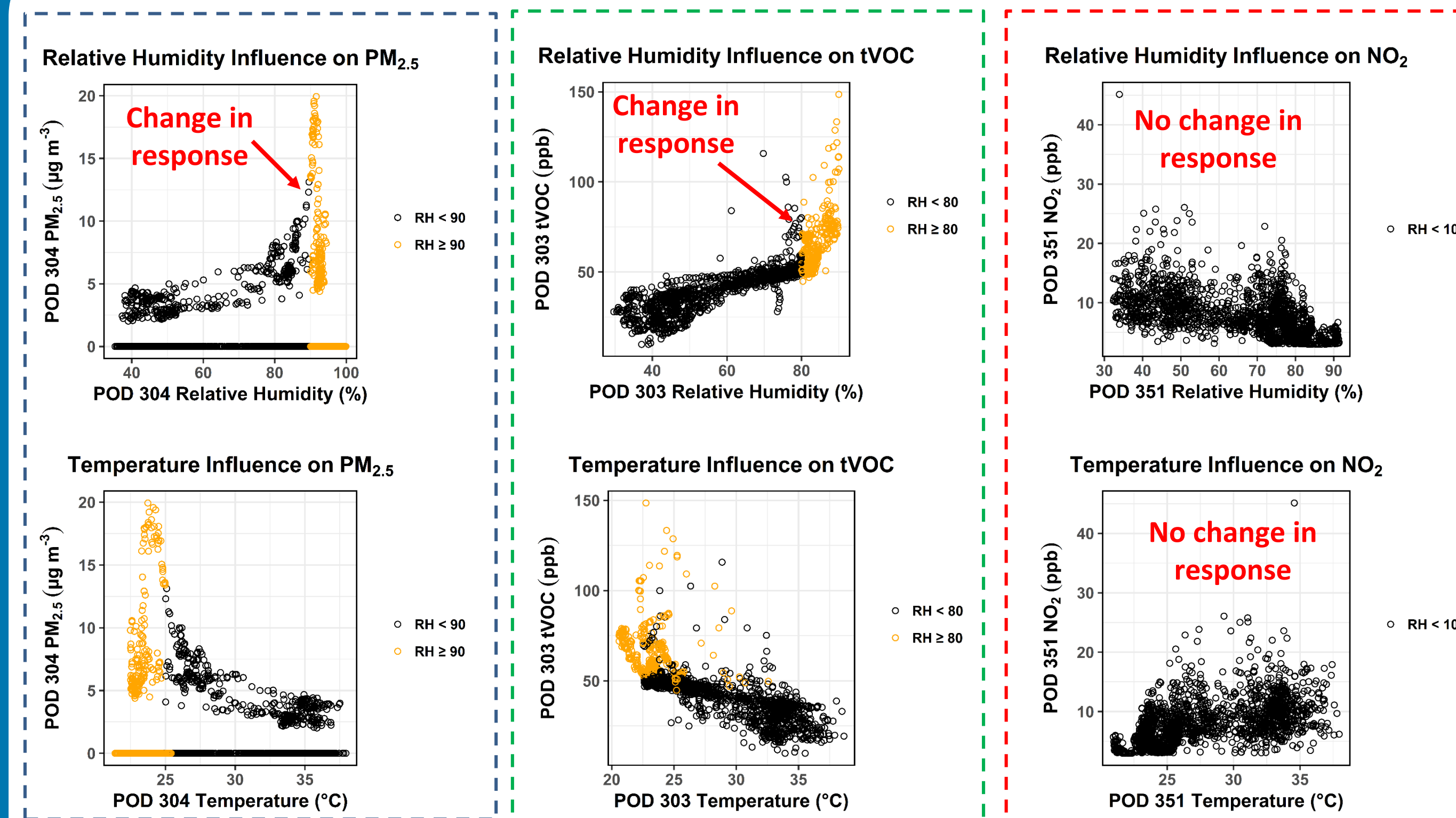
- A linear regression was used to normalize each pollutant to the median response
- Any linear regression with an $R^2 < 0.5$ was excluded from the study
- The following Sensor Pods were excluded:

PM_{2.5}

tVOCs

- POD 305 $R^2 = 0.18$**
- POD 302 $R^2 = 0.42$**
- POD 351 $R^2 = 0.22$**
- POD 352 $R^2 = 0.33$**
- POD 355 $R^2 = 0.16$**

Environmental Influence



- PM_{2.5}** measurements were excluded when *relative humidity* was $\geq 90\%$
- tVOC** measurements were excluded when *relative humidity* was $\geq 80\%$
- NO₂** measurements were **not excluded** due to environmental conditions

Future Work

- Evaluate local meteorological trends such as rainfall, temperature, humidity, wind speed, and direction
- Assess the correlation between pollutant concentrations and meteorological conditions
- Identify time periods associated with citizen scientists' observations recorded in field logs

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 - Baseline-Mocon - <http://www.baseline-mocon.com/index.html>
 - CairClip NO₂ - <http://cairclip.com/en/>
 - Vantage Vue Weather Station - <https://www.davisnet.com/solution/vantage-vue/>

Disclaimer

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