Citizen Science and Government Collaborations: Developing Tools to Facilitate Community Air Monitoring

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Disclaimer: Material presented is for informational purposes only. EPA does not recommend nor endorse any particular sensor product or data management platform.
Low Cost Sensors & Real-time Data
Sensor Applications

- Lower cost sensors → greater access to air pollution data at more local scales
- Potential applications for air monitoring:
  - Personalized health information → Inform individuals about their personal exposures to air pollutants, particularly susceptible populations
  - Empower communities to gather information about exposures
  - Raise awareness and educate individuals and communities about air pollution issues
  - Supplement national, state and local monitoring networks
  - Monitoring during acute events, such as wildfires
• Common hurdles:
  • Uncertain data quality
  • Data interpretation
  • Acceptance and application

• How to best address hurdles:
  • Discussions with manufacturers
  • Continued evaluation of sensors
  • Standards for sensor performance
  • Partnerships and engagement with government, academia and the public
  • Pilot efforts
EPA Recognizes Community Interest in Applying Emerging Technologies

• New technologies are advancing and revolutionizing regional, community, fence-line and personal monitoring. Ongoing or recent research includes:
  – Smart City Challenge – 2 communities engaged (Baltimore, Lafayette)
  – STAR Grant Program – 6 academic/community partnership grants
  – Community-specific research opportunities (Village Green Stations)
  – Multiple Region-based community air monitoring projects
Questions to Consider when Designing a Citizen Science Study

• Why are we doing this?
• How are we going to do this?
• What type of useful and valid data do we need to collect or use?
• Where should we collect our data?
• What resources (equipment, people, money) do we need to do this?
• What will we do with this information?

Check out EPA’s Citizen Science webpage for more information: https://www.epa.gov/citizen-science
EPA/Community Collaboration Example: Ironbound Community Collaboration

• Overall goal was to characterize urban pollution using portable sensors, especially near roadways
• EPA provided full day of citizen training on air sensor setup and use
• Four sensors were deployed by citizens in the Ironbound community
  • 21 locations over 6 months
• Study results empowered residents to address air quality concerns with local officials
EPA/Community Collaboration Example: DISUR Puerto Rico

- Overall goal was to analyze local pollutant levels and determine the area’s main sources of pollution
- EPA provided full day of citizen training on air sensor setup and use
- Ten sensors were deployed by citizens in the Tallaboa-Encarnación community
EPA/Community Collaboration Example: Community-led Sensor Evaluation

- Project goals: Help citizen scientists and community groups learn how to use sensors and effectively evaluate their reliability and performance via collocation with reference instruments.
- Project partners: Eastern Band of Cherokee Indians, Clean Air Carolina (CAC)
- Tools from this project are available on Air Sensor Toolbox page
  - Excel Macro to compare data, Training Guide on Sensor Collocation
Instruction guide for conducting a successful collocation evaluation of air sensors with regulatory grade instruments, provided as a PowerPoint presentation for easy reading and ample visual tools.

**Topics covered:**
- Background
- Low-cost sensors vs reference instruments
- Introduction to collocation
- Planning collocation
- Making measurements
- Data recovery and review
- Data comparison
  - Introduction of Macro Analysis Tool (MAT)
- Using sensors effectively

Project partners provided feedback on instruction Guide and MAT, which was used by EPA to improve and finalize these products.
Easy-to-use spreadsheet based **macro analysis tool** for performing data comparisons and interpreting the results. Tool tackles one of the biggest hurdles in citizen-led air monitoring projects – working with the data.

Example Outputs:

- **Time Series**
- **Correlation**
Lessons Learned

• A number of things could go wrong with a study…
  o Citizen scientists can drop out of a study
  o Data quality could be compromised
  o Sampling and analytical equipment can fail or get damaged
  o Data loss
  o Other unforeseen circumstances

• Always good to have an alternative plan for the “what-ifs”
• Clear roles and responsibilities
• What questions can and can’t be answered by the collected data
Air Sensor Toolbox for Citizen Scientists

- Air Sensor Toolbox web page provides citizen scientists and others resources on air sensors
- Air Sensor Guidebook is one of the most popular resources in the Toolbox
- [https://www.epa.gov/air-sensor-toolbox](https://www.epa.gov/air-sensor-toolbox)
Questions?

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