

Building Capacity to use Satellite data for Air Quality Monitoring in Africa

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Workshop on a Pilot Design for Air Quality in Africa
June 8-11, 2021

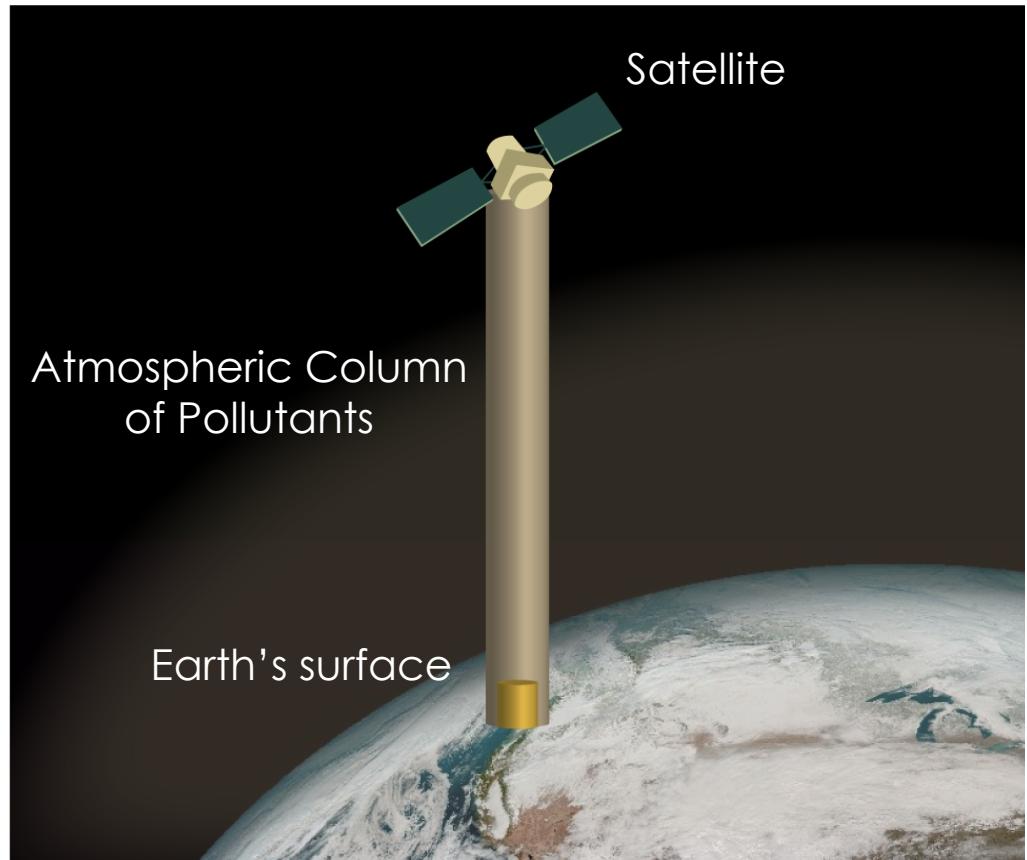
University of Maryland Baltimore County and NASA GSFC

Barriers to use of Remote Sensing Data

1. **Data and Access:** spatial/temporal resolution, inability to find the data I need, difficult data formats, accuracy, working with column measurements
2. **Confidence:** uncertainty in long term data continuity, limited ground truthing
3. **Knowledge Gaps:** understand data strengths & limitations, how to use it for research and decision-making, conduct the analysis and interpret the results
4. **Technical:** computationally intensive, download of large data files, capacity limitations

Working with Satellite 'Column' Data

- Data users need information on current and future air quality conditions *at ground level, and specifically the concentration of pollutants* (fine particles, trace gases)
- *But ground level pollution is not measured directly by the satellites: satellite instrumentation measures the total amount of pollution between the surface of the earth and the satellite (atmospheric column)*
- *While it is possible to obtain information about ground level pollution from satellites, it is a complex process that is beyond the capability of most users*



Applied Remote Sensing Training Program (ARSET)

<http://appliedsciences.nasa.gov/arset>

@NASAARSET



- Cutting edge remote sensing education through online and in-person trainings since 2009
- Basic, intermediate, and advanced levels
- Free access to live sessions, recordings, and training modules
- English and Spanish (working on French and Portuguese....)

Next Air Quality Training:
Global Air Quality Forecasting,
September 2021

Air Quality



Disasters



Land and Fires



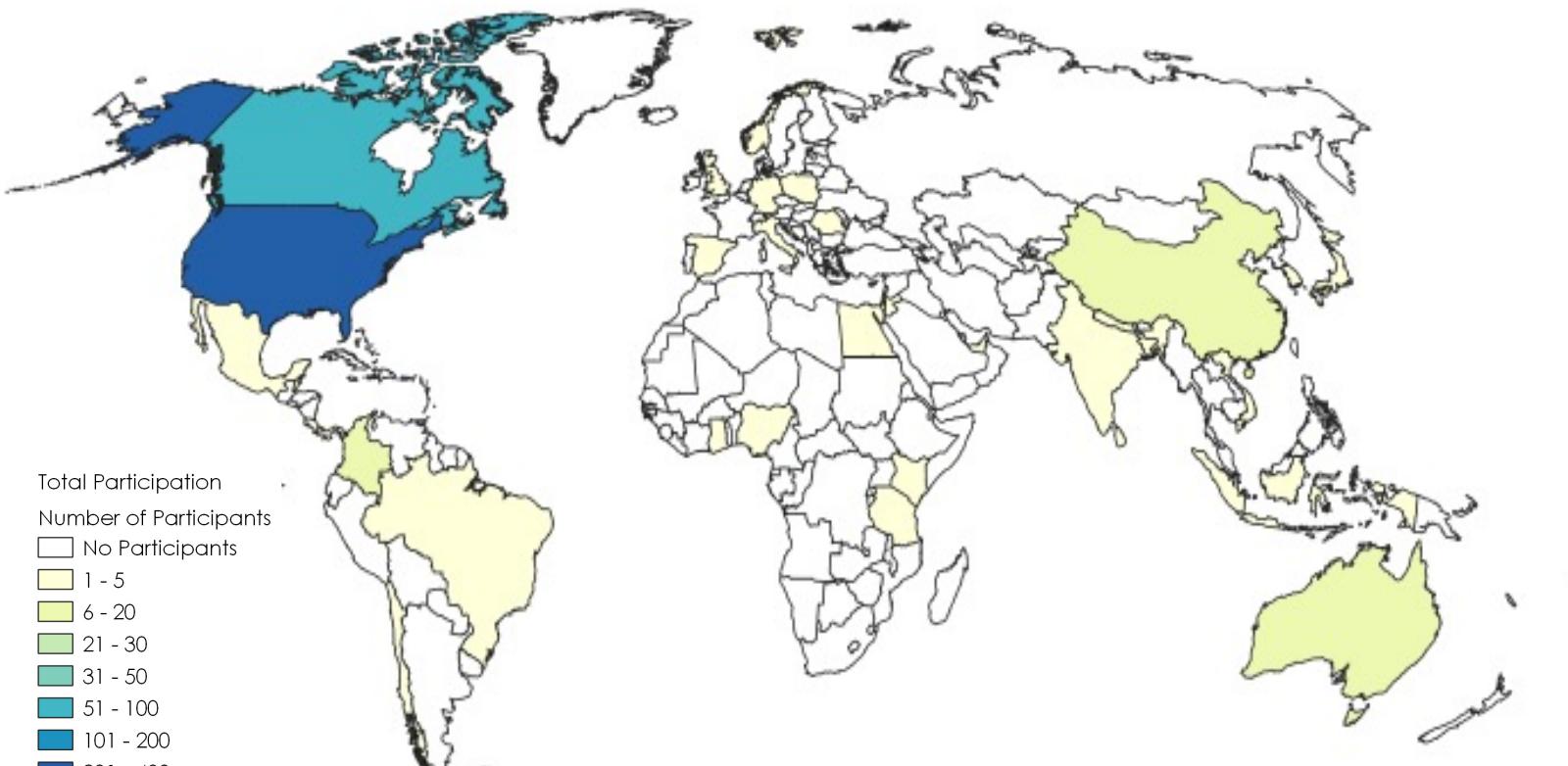
Water



Global Participation

Live Training in English and Spanish since 2009

2009-2012



153 trainings



62000+ participants



176 countries



11000+
organizations

Academia (40-50%)
Government (35%)
NGOs, Private Sector (20%)

Barriers: Survey data from ARSET participants in Africa

RESPONDENTS FROM AFRICAN NATIONS: PERCEPTIONS OF BARRIERS TO GREATER UTILIZATION OF REMOTE SENSING DATA

N= 141 - 144 (2018 - 19)

Frequency and/or timing of satellite overpasses is insufficient



Spatial or vertical data resolution is insufficient



Uncertainty in long term data continuity or availability



Lack technical support to handle this data



Lack confidence in RSD due to limited ground-truthing



Finding data among many data archives and web portals



Remote sensing data is not accurate enough



Data format is too difficult to use



Similar analysis for Spanish speaking countries at Prados et. al., 2021, <https://doi.org/10.1093/MGRS.2021.3060777>

Training Best Practices

- Provide a roadmap on the use of data for environmental monitoring, management, and communications
- Identify *barriers* and *user needs*
- Identify a regional focus and collaborators
- Provide guidance on relevant data; how to obtain and interpret it
- Present tools for data access and analysis:
 - Web based (Worldview)
 - Desktop (QGIS, Google Earth Engine)
 - Scripting (python, R)

NRT Global Flood Mapping

Advanced Webinar: Investigating Time Series of Satellite Imagery
Apr 15 & 17, 2019

10 Years of Training

9. Ensure you are using Google Chrome and visit the Change Mapper User Interface again: <https://emaprlab.users.earthengine.app/view/l-gee-change-mapper>
10. Keep the Define Year Range as default.
11. Under Define Date Range (month-day) change the Start Date to 07-01 and the End Date to 08-01 so that you are only examining changes in the vegetation health that occurred in July of each year.
12. Under the Define Pixel Coordinates (optional) section enter -105.77267 next to Longitude and 40.08256 next to Latitude.
13. Keep all other settings as default. Scroll down, click Submit, and wait for the map layers to load.

The first thing you may notice is that the **Year of Detection** is quite varied here. This means that disturbance in this region is occurring in many years.

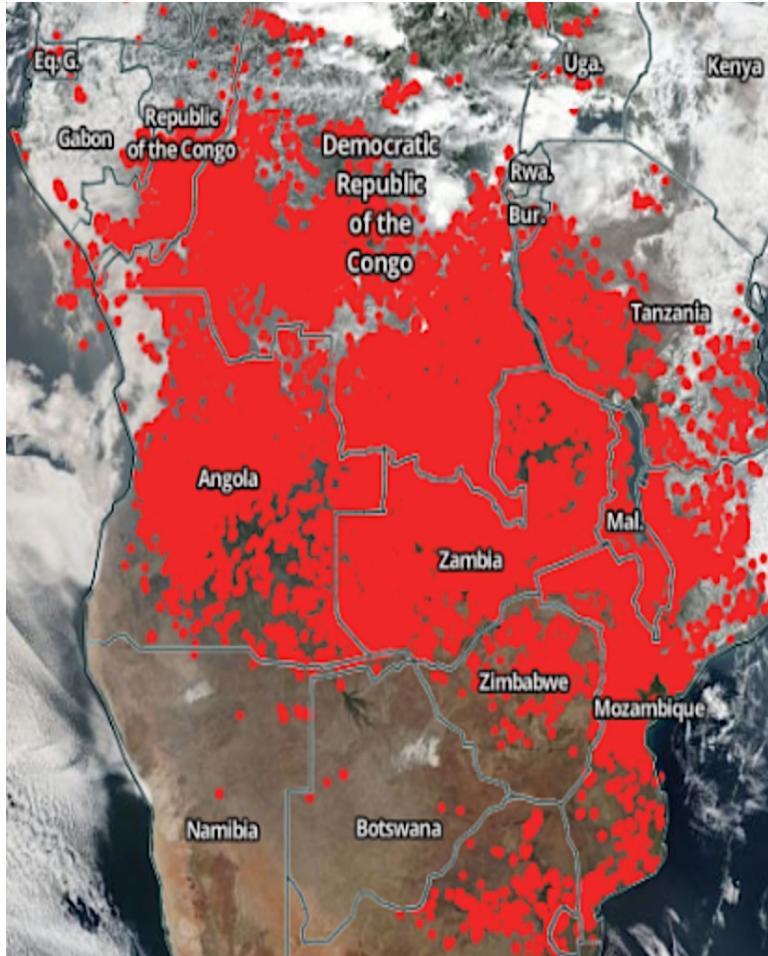
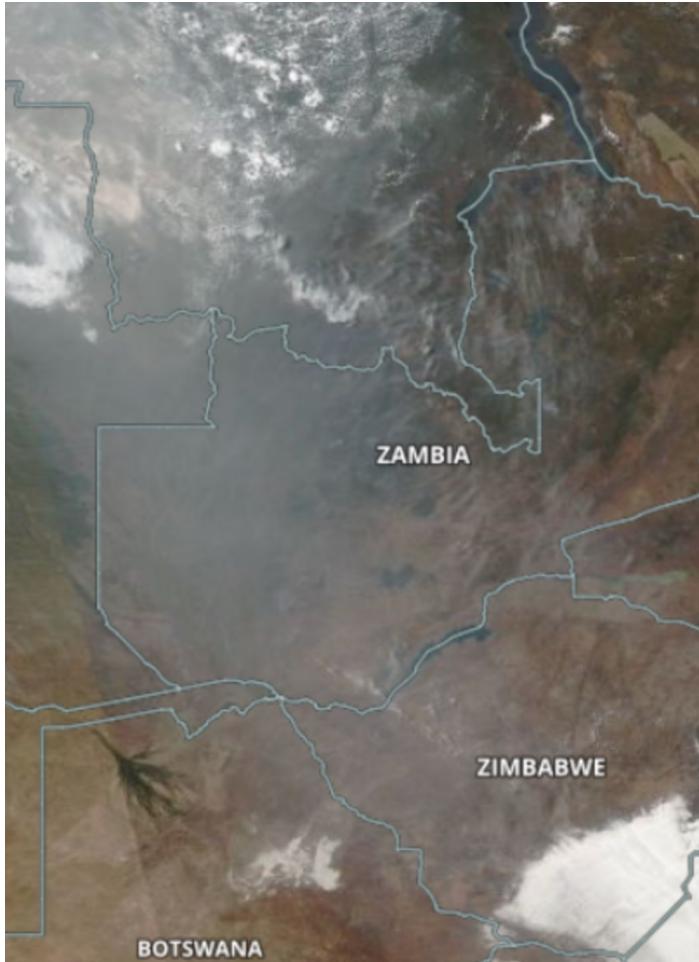
14. Hover over the **Year of Detection** until the gear symbol appears, then click on that to display the legend for that layer.
15. Change the **Range** to: 2000-2017, click **Apply**, then **Close**. Wait for the map layers to reload.

You can also filter the date range within the **Feature Panel** on the left.

<http://arsset.gsfc.nasa.gov/>

Training Best Practices

Case Studies and Hands-on exercises tailored to regional needs



Access and interpretation of satellite imagery:

FIRMS

Worldview

and many others

“Expanded” CityAQ Initiative Pilot Study

A NASA Health and Air Quality Applied Sciences Team (HAQAST) Project

Goal: enhance air quality decision making in world cities

Will tentatively include Kigali, Rwanda

Other cities in Mexico, Ecuador, Brazil, Colombia

PI: Bryan Duncan
Co-Is: Ana Prados, Kevin Cromar, Christoph Keller, Emma Knowland

Current CityAQ:

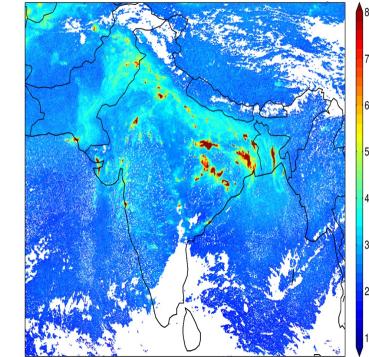
NASA Forecast System
(tailored forecasts)

Machine Learning

Ground Monitoring

“Expanded” CityAQ

Satellite Data



Low Cost Sensors

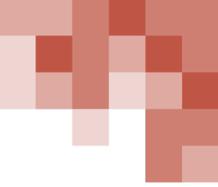


Interested in finding out more about Expanded City AQ or becoming a part of it?

Contact me or Bryan Duncan

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Contact:

Dr. Ana. I. Prados

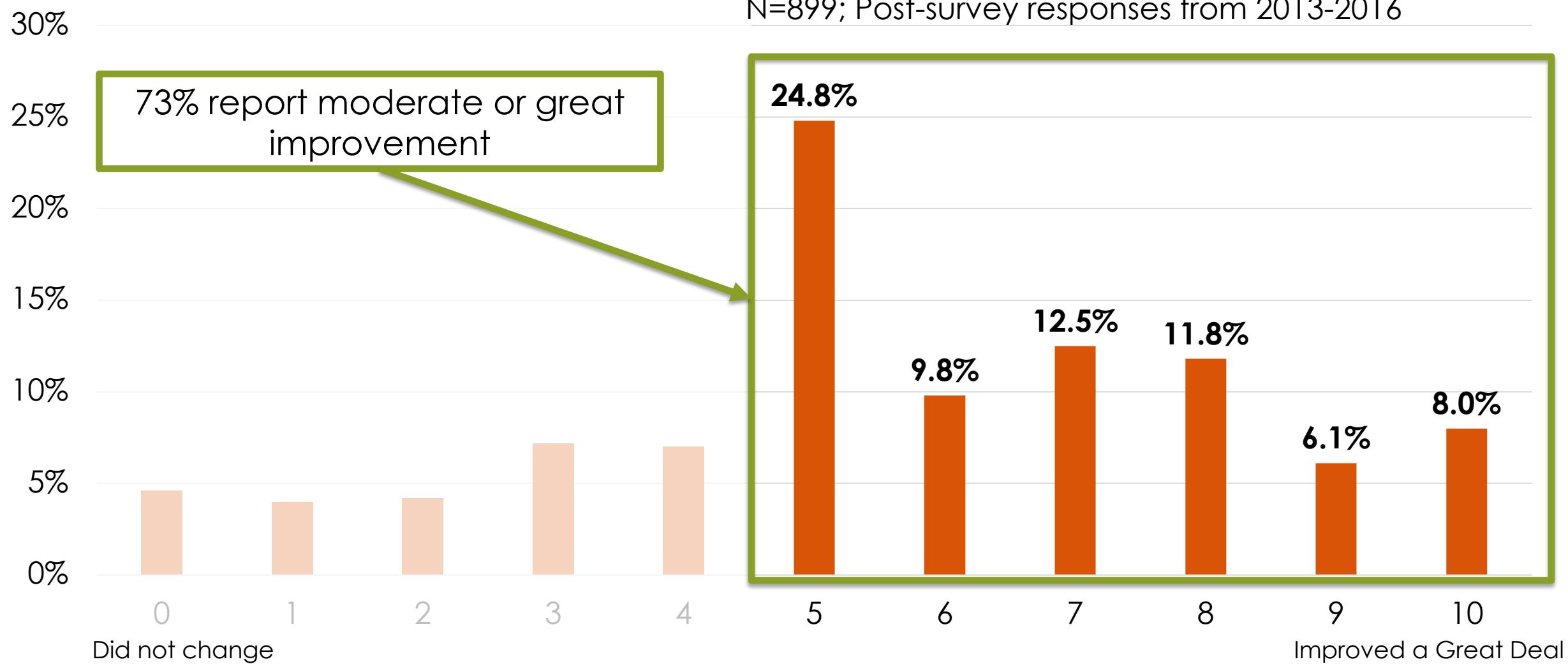
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Extra slides

Improvements in Decision Making



Prados et. al., 2019, <https://doi.org/10.3390/ijgi8060261>

2021 ARSET Trainings: Air Quality

Pre, During and Post Fire Monitoring with NASA satellite and model data:

May 2021

- 6 sessions (two each for pre, during and post fire monitoring, 2 hour each), live in English and Spanish
- Satellites/Sensors: MODIS, VIIRS, GOES, OMI, OMPS, Landsat, GPM IMERG, SMAP, Merra, GEOS-5, LDAS
- Content: access and analysis of satellite data for 3 case studies: California fires 2020, Mexico - May 2019 (tentative), Africa (TBD)
- Motivation: increased frequency of fires and associated impacts due to climate change,

Global Air Quality Forecasting

September 2021

- 3 Sessions, 1.5 hours each
- In collaboration with GMAO
- Content: Currently available global air quality forecasts and how they use satellite and ground observations to improve and evaluate their forecasts
- Motivation: In ARSET surveys conducted post-training, global and regional air quality forecasting is consistently one of the most selected topics among AQ training attendees. In addition, the NASA GMAO has a newly available global composition forecast.