Monitoring Regional Air Quality to Address Air Pollution in National Parks through the Application of NASA Earth Observations

Abstract

Good air quality is critical for the Intermountain Region of the National Park Service (NPS) to uphold legal mandates, such as the Clean Air Act, to protect park visitor health, the ecological health of the park flora and fauna, and the preservation of the vistas of the parks for the present and future generations. Unfortunately, nitrogen dioxide (NO_2) harms air quality related values and the health of guests that visit the parks. This project utilized the Ozone Monitoring Instrument aboard Aura, a NASA Earth observation satellite, to create spatial and temporal trend maps as well as visual displays of NO_2 data from January 2005 to December 2017. Through applying NASA Earth observations, the NPS can complement their ground-level data from monitoring programs. This uncovers trends of persistent concentrations of NO_2 in the Intermountain Region and its surrounding areas. With the help of NASA Earth observations, the NPS is able to determine source regions of NO_2, allowing them to develop mitigation strategies and create long term management action plans involving visibility, air quality, and the parks' natural resources.

Objectives

- **Assess** historical trends in NO_2 concentrations across the Intermountain Region
- **Locate** sources of NO_2 that are impacting the Intermountain Region to enhance intra-park monitoring
- **Provide** tools to protect national park resources and increase understanding in visibility and atmospheric pollutants

Methodology

Data Acquisition
- Aura OMI
  - Cloud-screened Tropospheric NO_2 Data
- EPA CASTNET,
  - NO_2 observation recordings

Data Processing
- Implemented Python
- Projected and Masked Data
- Created Binaries of cells for valid looks
- Calculated Min, Max, Range, Mean, Median, Standard Deviation, Coefficient of Variation

Data Analysis
- Data correlation analysis
- Trend Maps
- Visual Displays of data comparisons

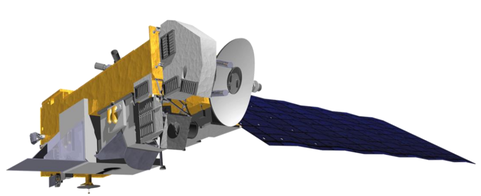
Study Area

Intermountain Region, United States of America

Project Partners

National Park Service, Intermountain Region

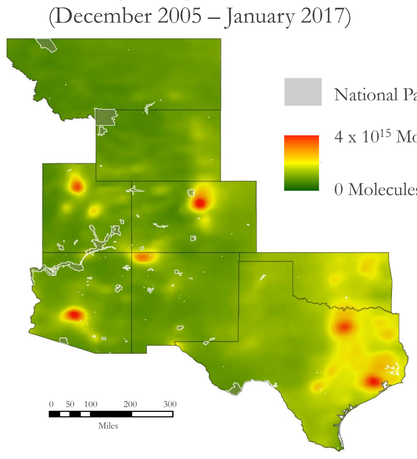
Earth Observations

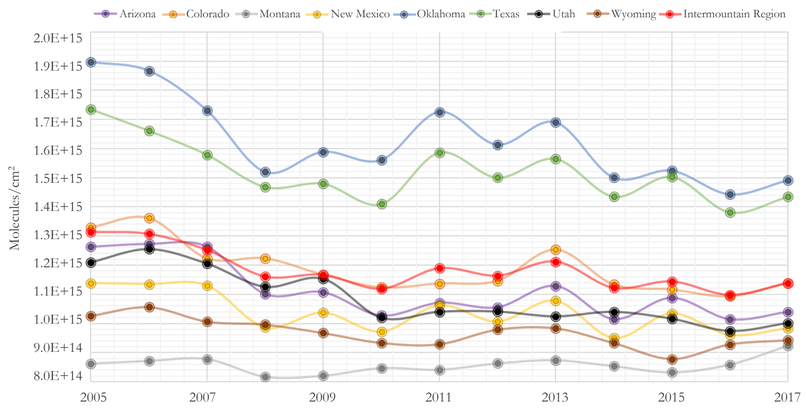


Aura OMI

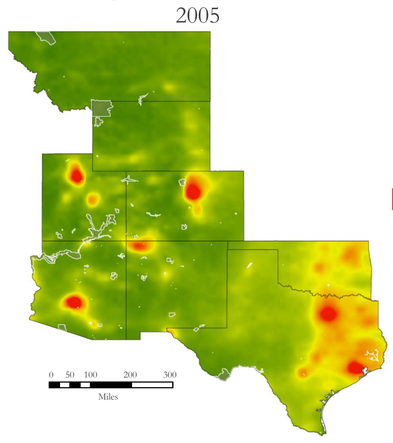
Results

Average NO_2 Concentration
(December 2005 – January 2017)

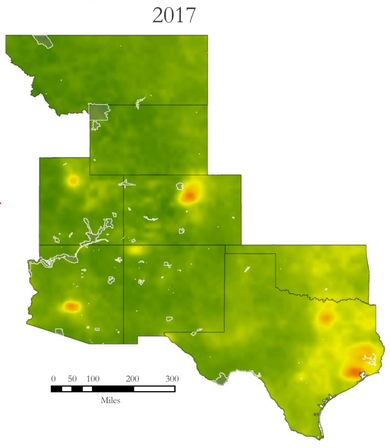




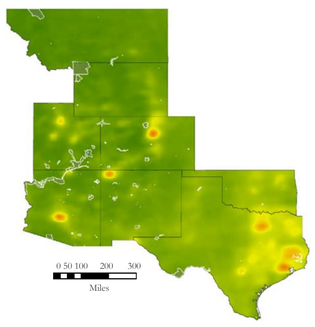
Average NO_2 Concentrations
2005

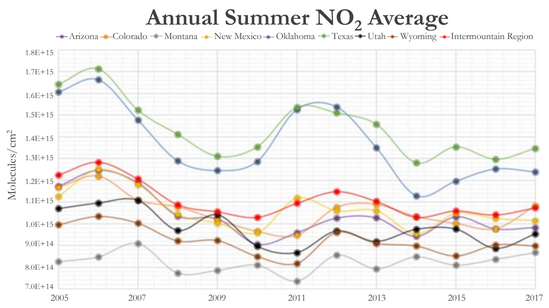


Average NO_2 Concentrations
2017

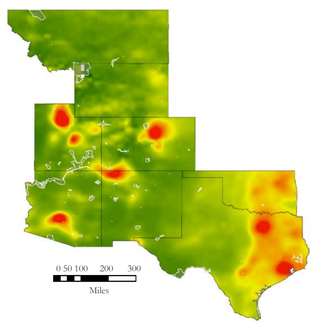


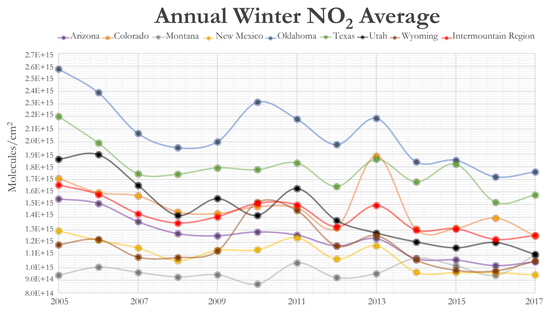
Summer
June 1 – August 31
2005 – 2017

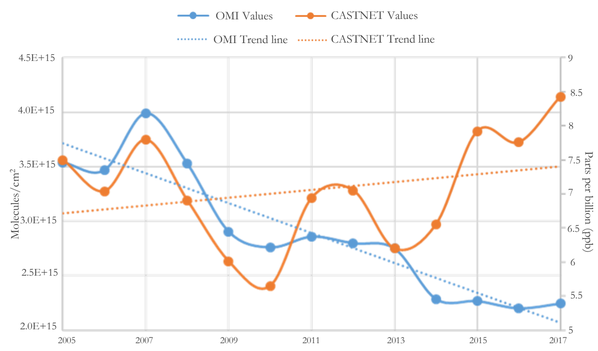


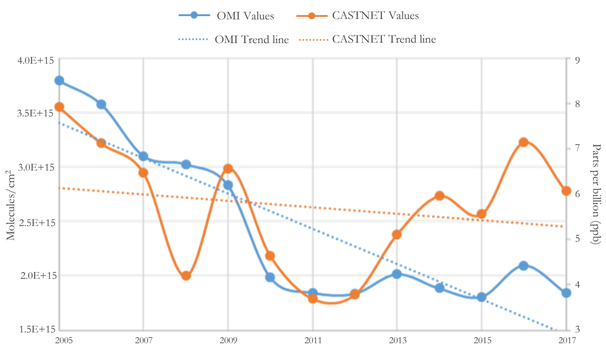


Winter
December 1 –
February 28 (29)
2005 – 2017









Conclusions

- From 2005 to 2017, NO_2 has decreased between the upper troposphere and lower stratosphere in the Intermountain Region states except for Montana.
- NO_2 concentrations are lowest in the summer and highest in the winter.
- OMI NO_2 data cannot be directly compared to *in situ* ground measurements.

Team Members

Chet Warren
Project Lead

Jared Goldbach Ehmer

Zachary Peloquin

Acknowledgements

Project Partners

Debbie Miller, National Park Service Intermountain Region
Andrea Stacy, National Park Service, Air Resource Division

Science Advisors

Dr. Kenton Ross, NASA Langley Research Center
Dr. Bruce Doddridge, NASA Langley Research Center

This material is based upon work supported by NASA through contract NNL16AA05C and cooperative agreement NNX14AB60A. Any mention of a commercial product, service or activity in this material does not constitute NASA endorsement. Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Aeronautics and Space Administration and partner organizations.