LADCO and Air Quality Planning in the U.S. Great Lakes Region

Zac Adelman
LADCO Executive Director

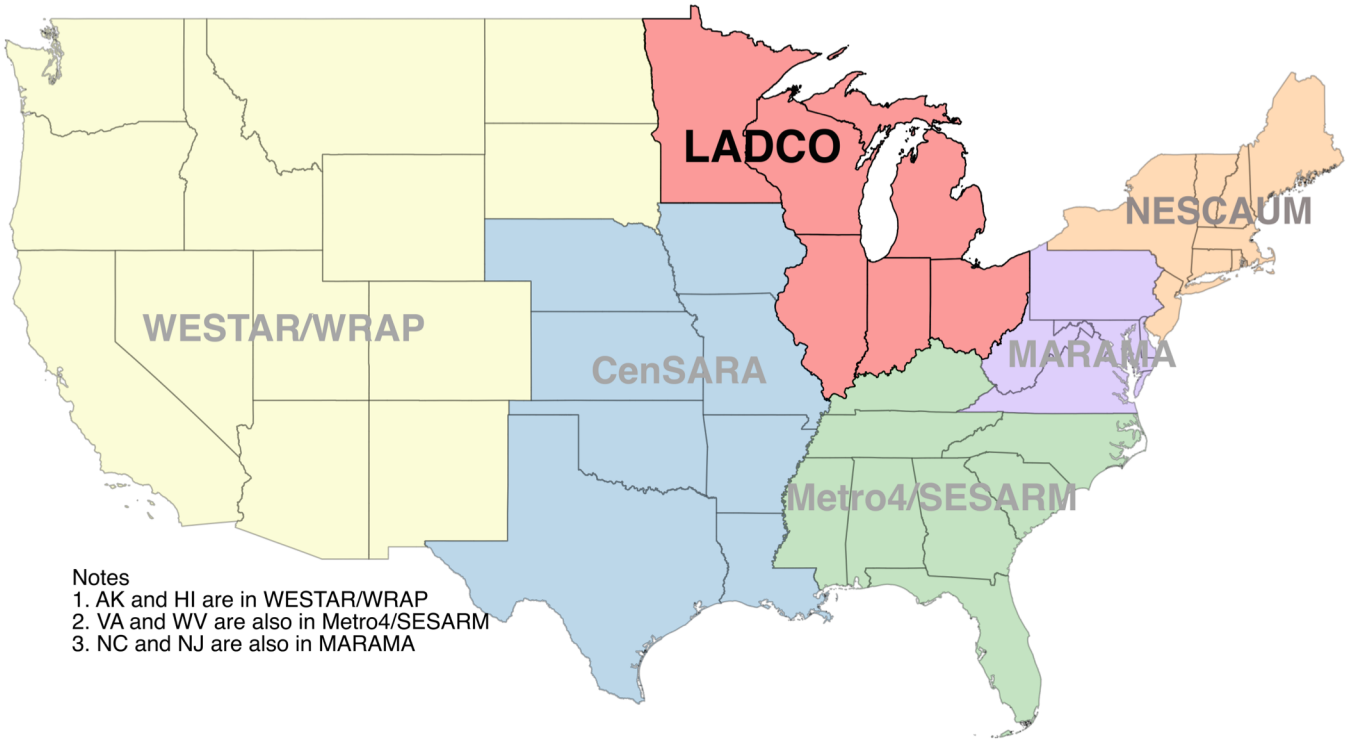
LADCO Regional Air Quality Meeting
April 15, 2019

LADCO | LAKE MICHIGAN AIR DIRECTORS CONSORTIUM


Isle Royale NP, MI
Credit: Ray Dumas


Boundary Waters Wilderness, MN
Credit: Mike Sweet

Multi-Jurisdictional Organizations



LADCO and the MJOs are funded primarily by U.S. EPA grants to the states under Section 105 of the Clean Air Act.

LADCO Background

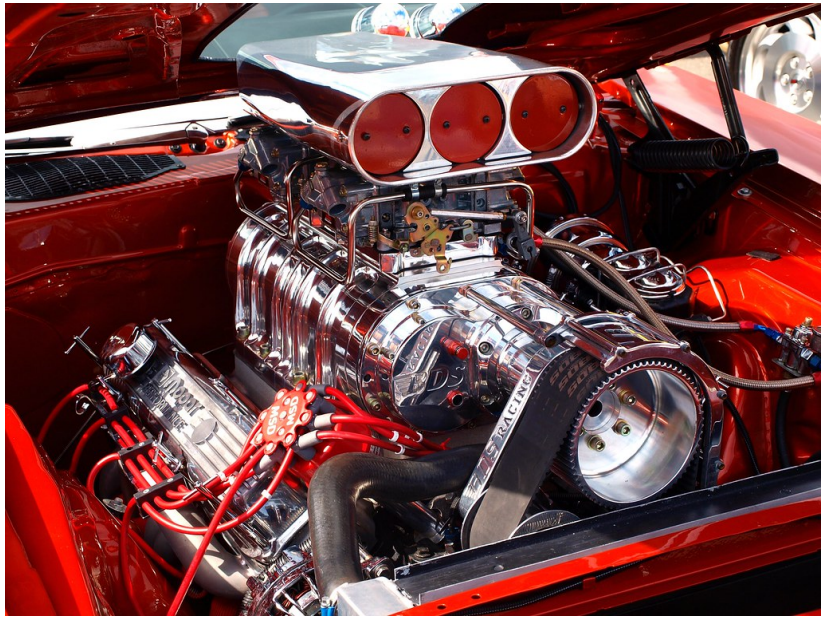
- Formed in 1989 to bring Michigan, Indiana, Illinois, and Wisconsin together to address ozone pollution
  - Ohio joined in 2004; Minnesota joined in 2012
- Technical lead in the region for continental to urban-scale atmospheric modeling: meteorology, emissions, and chemistry-transport
  - LADCO produces decision support information via modeling and monitoring data analyses that our states use for air quality manag
  - ement plans (SIPs)
- LADCO does not provide policy guidance to our membership, only technical guidance and support

LADCO Executive Office Staff

- **Zac Adelman** Executive Director, since 2017
- **Donna Kenski, PhD** Data Scientist, since 2000
- **Mark Janssen** Emissions Director, since 1992
- **Tsengel Nergui, PhD** Atmospheric Modeler, since 2018
- **Catherine Heath** Office Manager, since 2017

What Does LADCO Actually Do?

- Air Quality Modeling
- Air Monitoring
- Data Science
- Air Quality Research
- Training Coordination
- Intra-region Communication Platform
- Contract Management
- Outreach and Advocacy

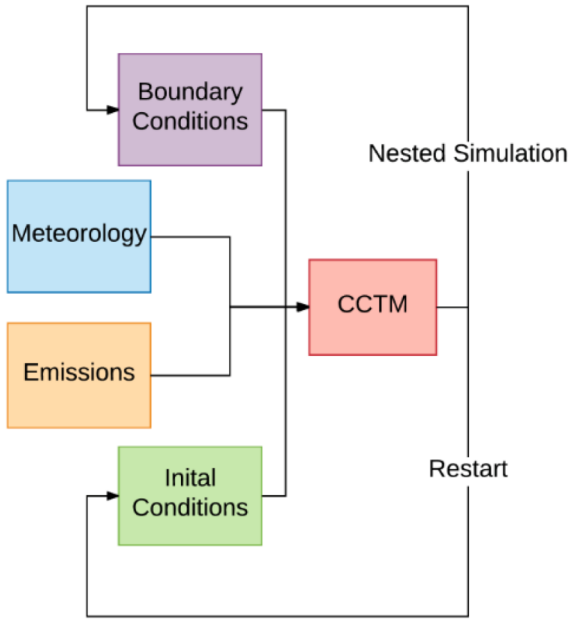


What Does LADCO Produce?

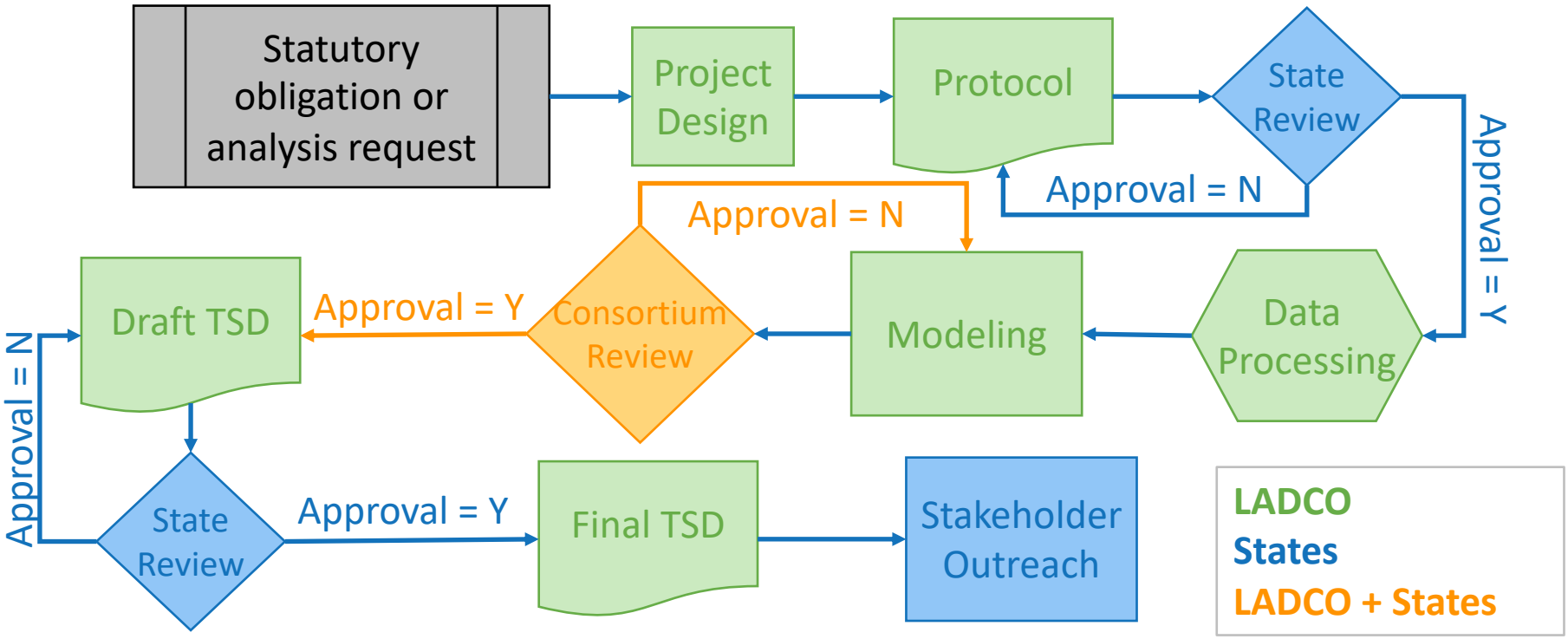
- Decision Support Systems and Data
- Modeling Protocols
- Technical Support Documents (TSDs)
- Knowledge in our Member States

Modeling Platform

Software and data package of all elements that went into a modeling project

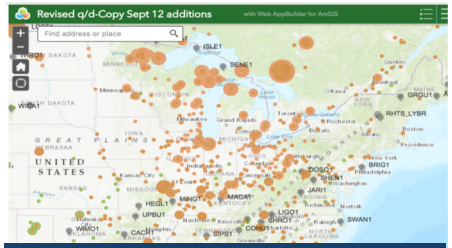


Regulatory Modeling

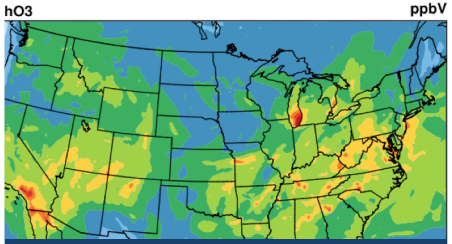


Air Monitoring & Data Science

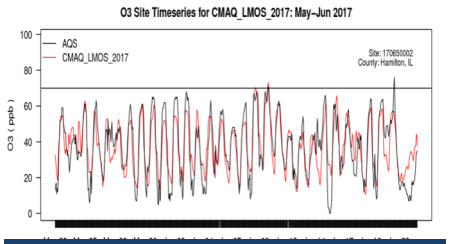
- LADCO staff are experts with ambient monitoring data, and air quality modeling data
- LADCO supports our states through transferring data, analysis products, and modeling capabilities



GIS & Mapping



Data Visualization



Model Evaluation

Statistical Analysis

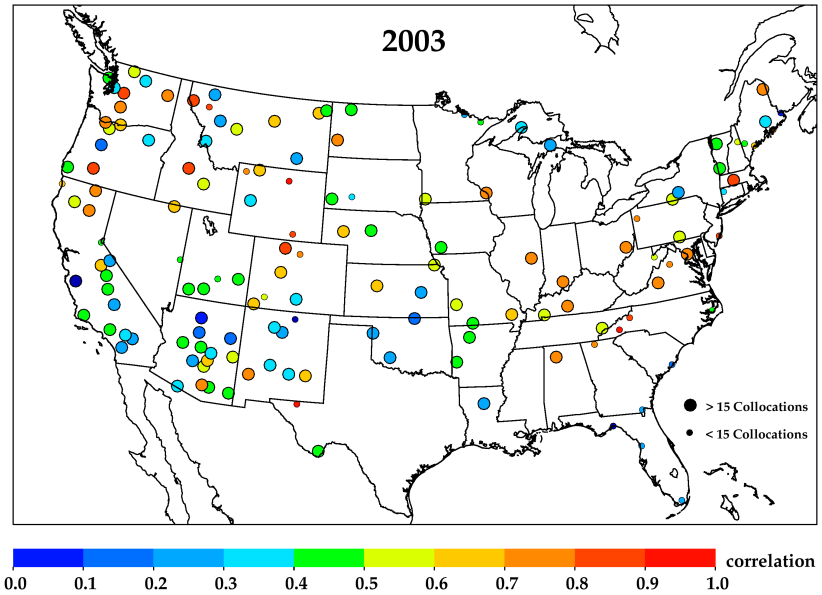
Cloud Computing

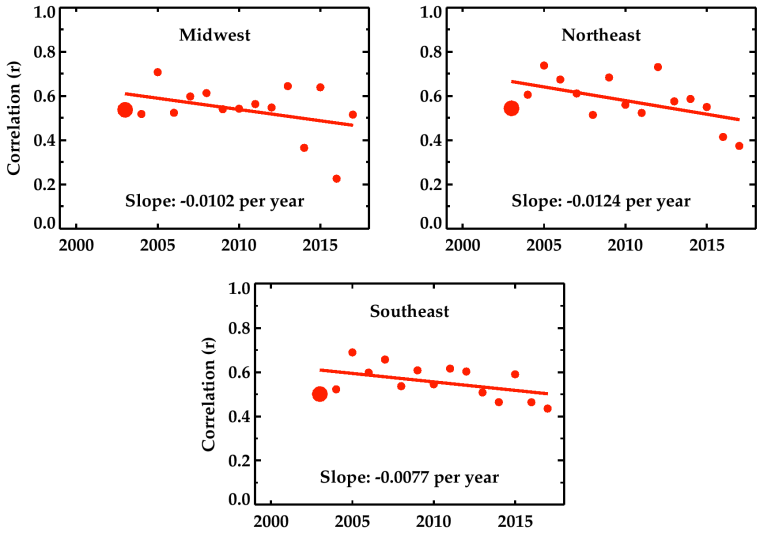
Big Data Delivery

Air Quality Research

- LADCO technical staff serve as collaborators, technical advisors, and/or air planning agency stakeholders

Remote Sensing Aerosol Optical Depth vs. Surface Visibility Correlation Warm Season (Apr – Sept) Trends

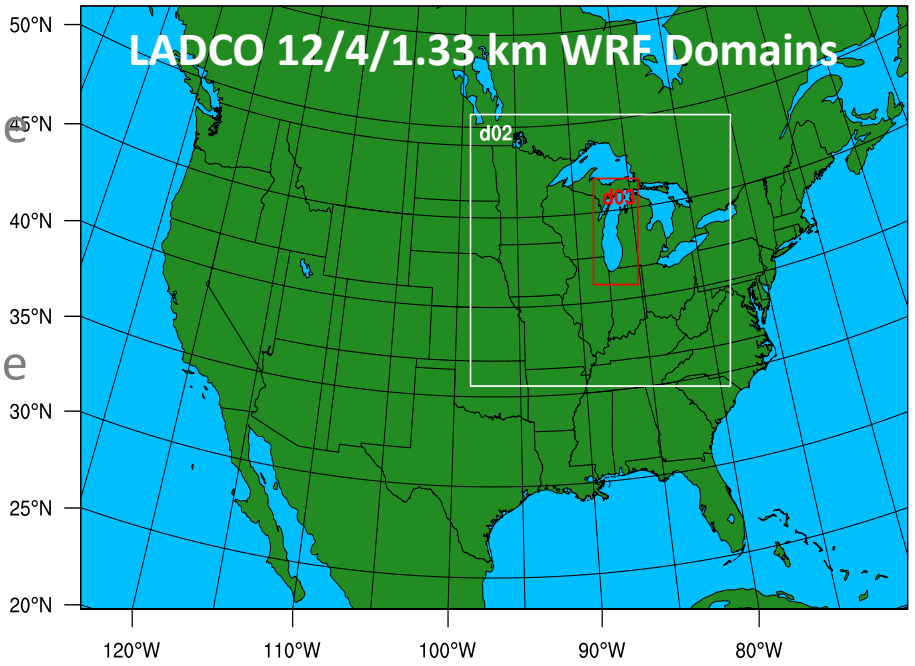




LADCO THE UNIVERSITY OF CHICAGO Argonne NATIONAL LABORATORY

Current Technical Analyses

- Observational Trends
  - Surface network review and enhancement
  - Updating regional & urban O_3 conceptual models
- Regional Photochemical Modeling
  - 2016 WRF/CAMx/CMAQ modeling for O_3 and Regional Haze
- Emissions Modeling
  - Inventory Collaborative
  - Analysis/improvement of mobile sources: onroad, offroad, rail, marine
- Meteorology Modeling
  - WRF optimization for high ozone conditions
- Exceptional Events
  - Studying smoke impacts on air quality in the region

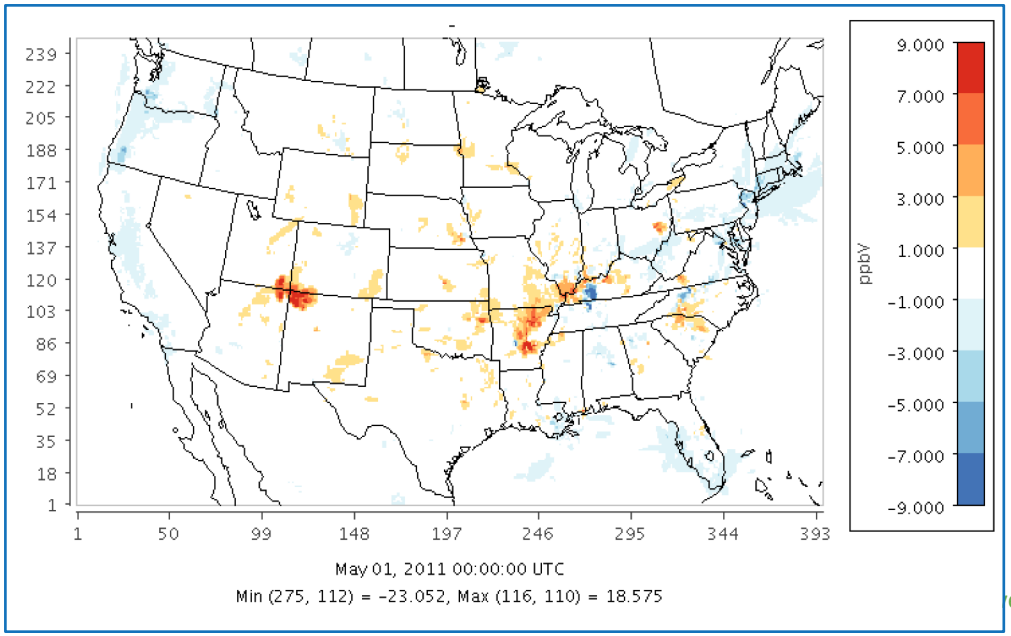


Current Regulatory Focus

- 2015 O_3 NAAQS
  - EPA designations finalized in August 2018
  - Marginal status for all violating LADCO monitors
  - iSIPs (including ”Good Neighbor” SIPs) due October 2018
  - Attainment demonstration (NAA SIP) not required for marginal
  - Marginal attainment date August 3, 2021 ← 2020 O_3 Season
- 2008 O_3 NAAQS
  - Chicago and Sheboygan reclassification from moderate to serious status due to be finalized June 2019
  - NAA SIPs due from IL, IN, WI in Spring 2020
  - Serious attainment date July 21, 2021 ← 2020 O_3 Season
- Regional Haze
  - Round 2 SIPs due July 2021

2015 O_3 NAAQS Transport Modeling

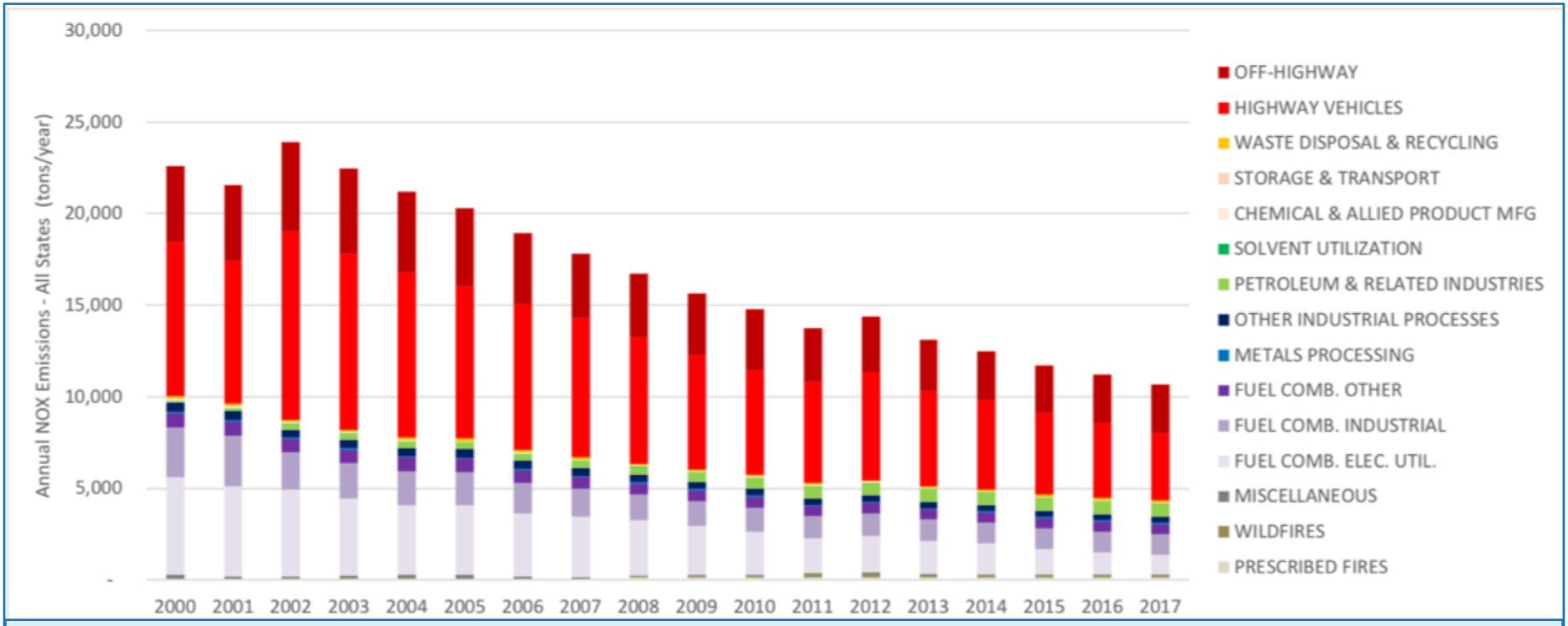
- LADCO reproduced EPA 2011 and 2023 CAMx regional modeling ("EN Platform") as the basis of a transport modeling Technical Support Document (TSD) for our member states
- LADCO replaced the EPA electricity sector 2023 forecasts with ERTAC-EGU model projections; everything else the same with EPA
- CAMx used to tag sector and state contributions to 2023 ozone



EPA – LADCO: differences in 2023 daily maximum MDA8 O3

2015 O_3 NAAQS Transport Modeling

LADCO



~20% Reduction in U.S. EPA National Emissions Inventory NOx Emissions from 2011 → 2017

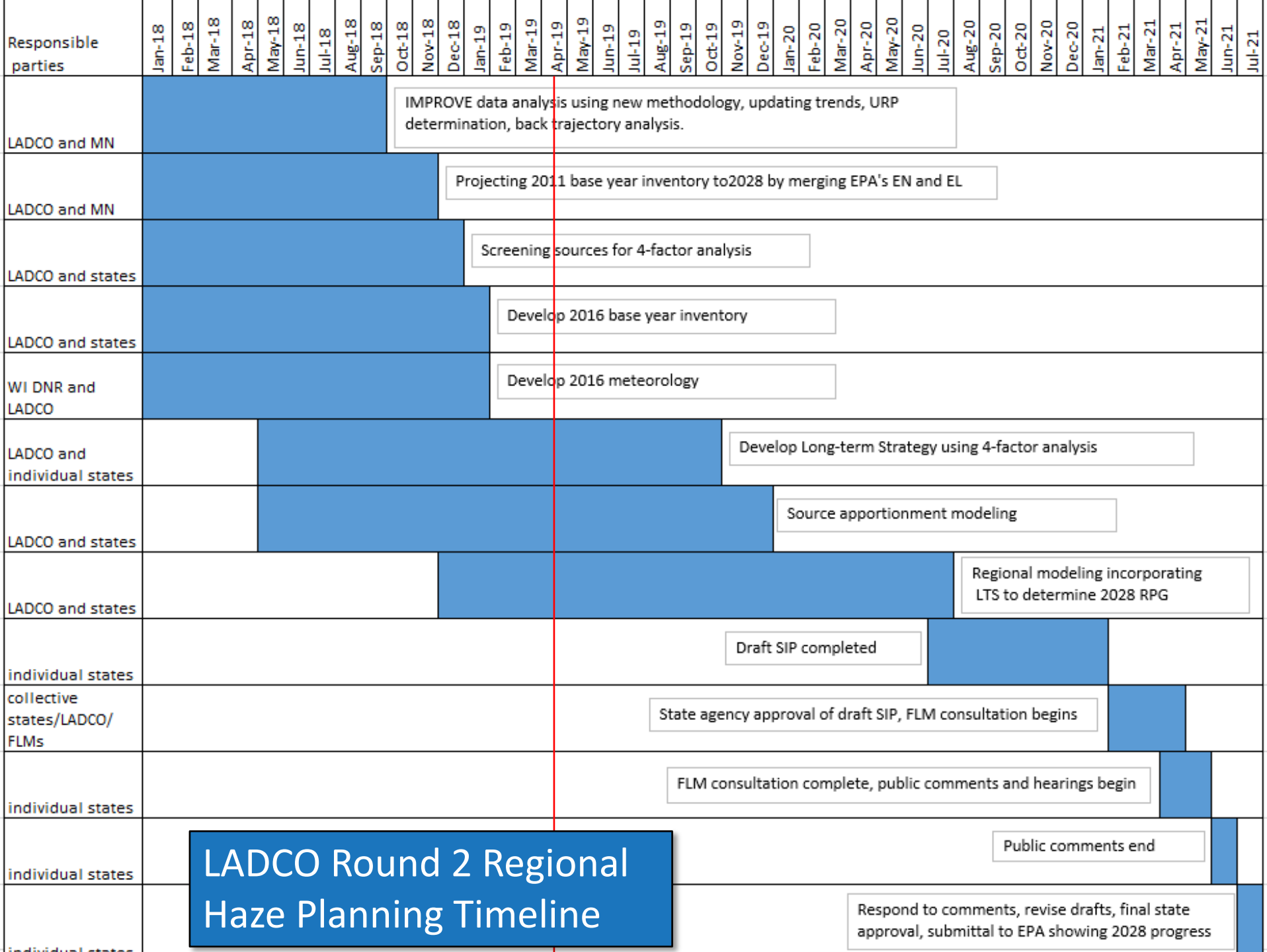
2008 O_3 NAAQS Attainment Modeling

- Chicago and Sheboygan O3 NAAs reclassified to serious
- Attainment modeling will be done by LADCO to demonstrate how to reach attainment by July 21, 2021 (actually by the 2020 O_3 season)
- Modeling approach
  - WRF 2016 simulation, configuration based on LMOS and NASA research projects
  - 2016 emissions projected to 2020 using EPA MOVES (mobile) and ERTAC EGU (power sector) emissions
  - On-the-books emissions controls and source apportionment modeling to identify inventory sector/source regions that contribute to regional ozone
- LADCO TSD to states by Fall 2019

Round II Regional Haze Modeling

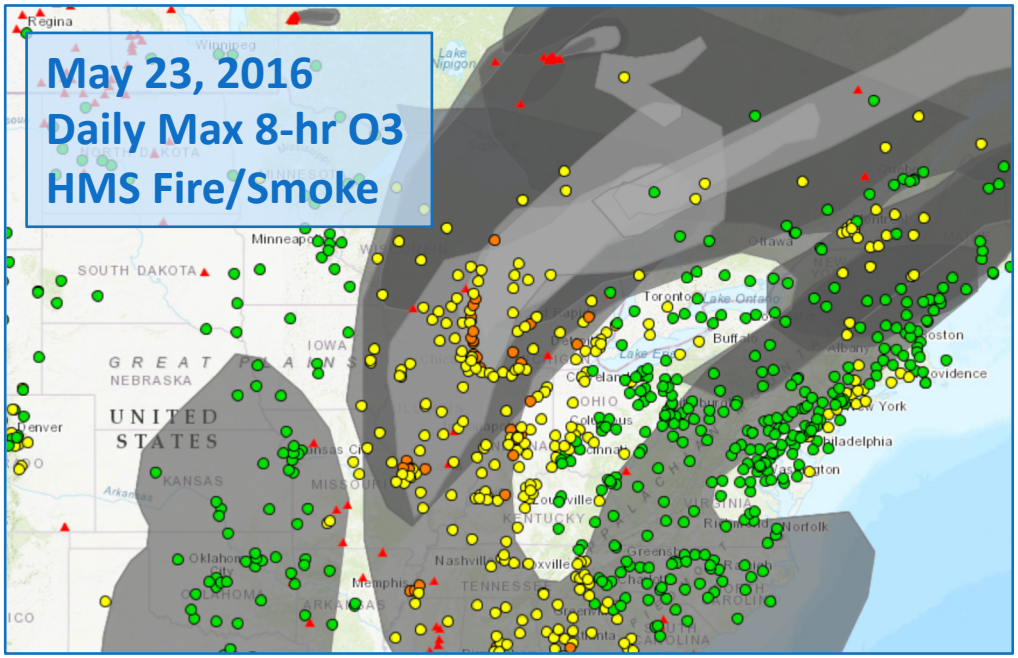
- Regional Haze committee was reconvened in January 2018
- Members from LADCO states, FLMs, R5, EPA-HQ, tribes
- Meet monthly via teleconference
- **Goal:** develop documentation, analyses, modeling, and inventories to assist states in meeting the July 2021 RH SIP submittal target
- Tasks described on timeline (next slide); 3 years remaining to SIP submittal

LADCO Round 2 Regional Haze Planning Timeline



Exceptional Events

- States can get regulatory relief from air pollution caused by unusual or naturally occurring air pollution events
- LADCO works with our states to survey ozone season observations for possible exceptional events (EE)



Credit: Airow Tech

- LADCO EE Workgroup: monthly triage analysis reviews daily surface observations and smoke columns from previous month

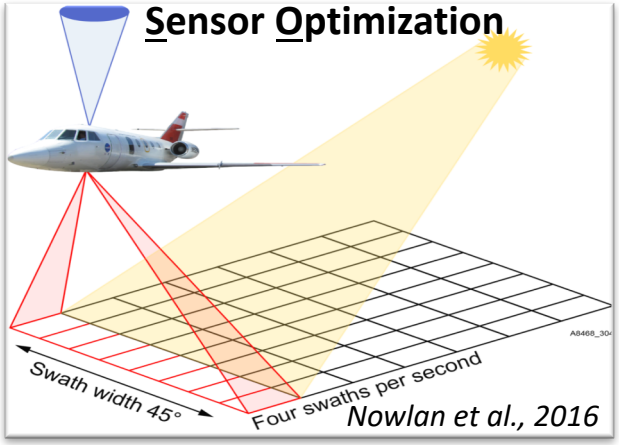
Lake Michigan Ozone Study

May – June 2017
Western Shore of Lake Michigan

Motivations for LMOS

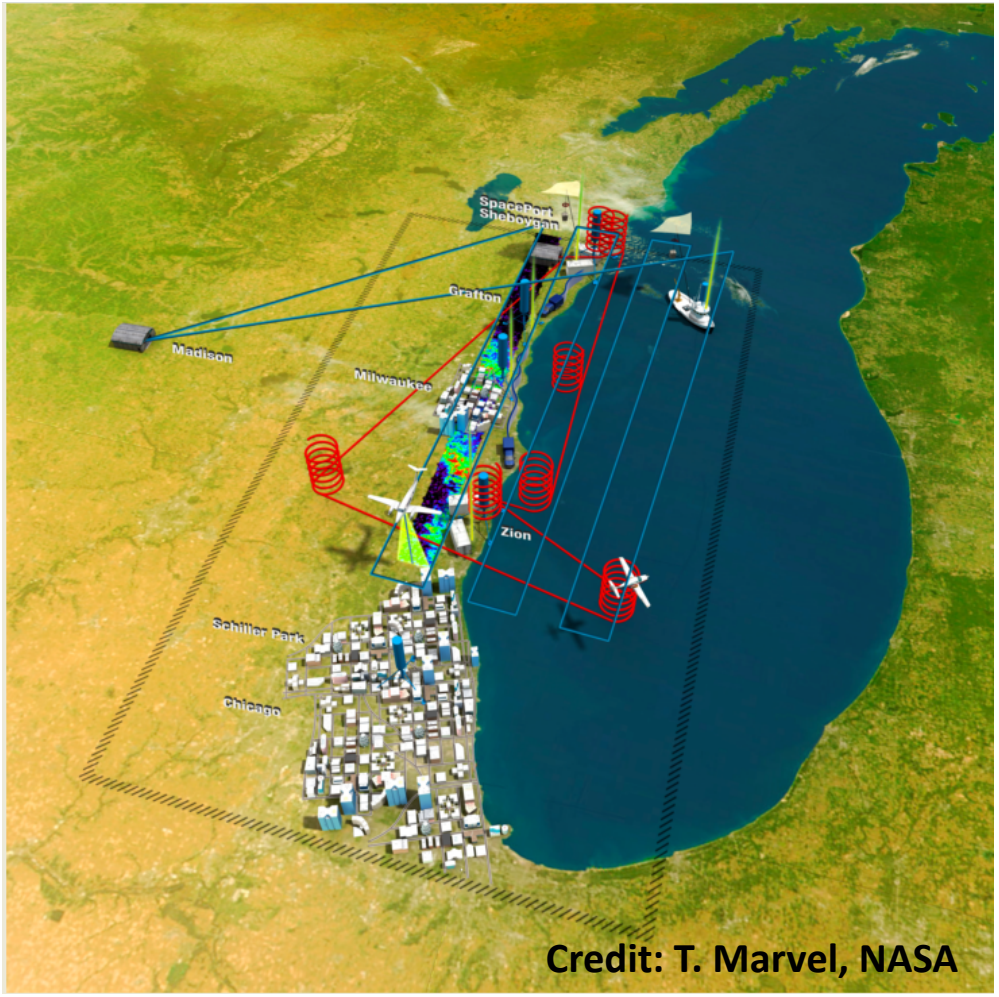
- Persistent high O_3 at some coastal sites
- Planning needs of the LADCO states require further clarity on regional O_3 production
- Last field campaign: summer 1991
- Need for a new study: New instruments/satellites and scarce aloft and over-lake observations

Geostationary Trace gas and Aerosol Sensor Optimization



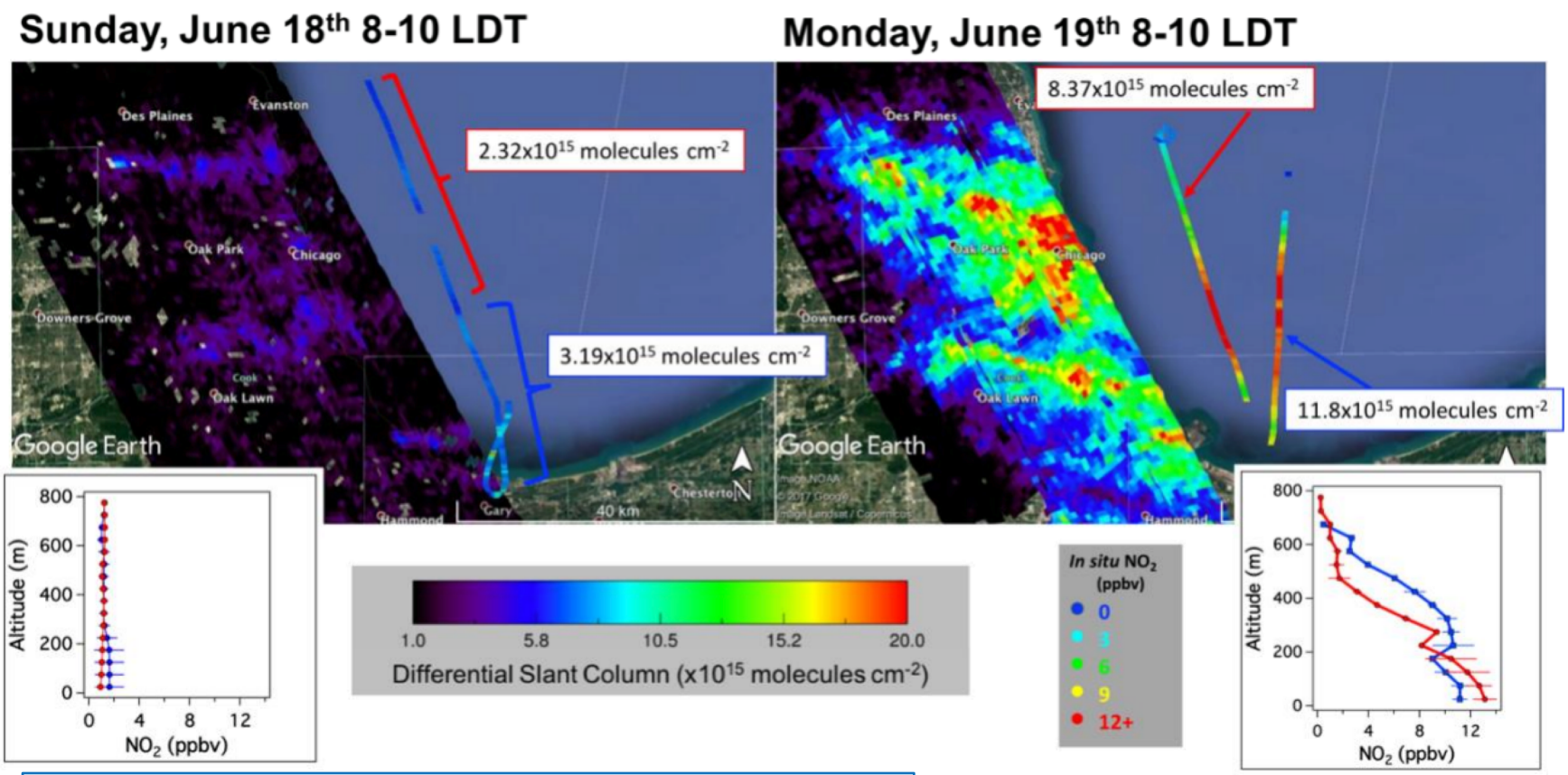
LMOS Study Design

- Observations
  - Aircraft
  - Ship
  - Mobile on-shore
  - Zion, IL Supersite
  - Sheboygan, WI Ground Site
- Forecasts
  - WI DNR
  - NOAA NESDIS
  - U. Iowa
  - NWS



NASA GeoTASO LMOS NO_2 Retrievals

LADCO

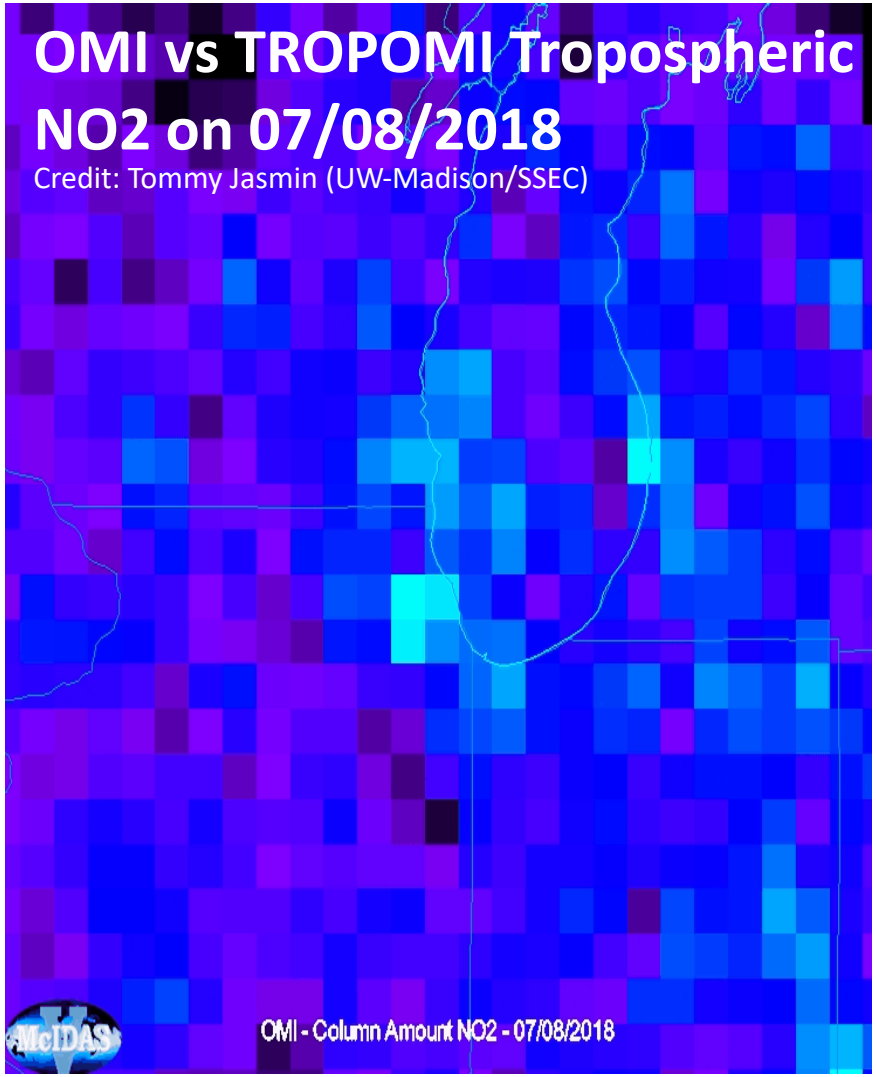


Weekday/weekend NO_2 column differences in Chicago as seen by GeoTASO

Credit: L. Judd, NASA/LaRC

Data Assimilation to Improve Air Quality Model Results

LADCO



TROPOMI

- TROPOspheric Monitoring Instrument
- Launch: October 2017
- Operator: ESA
- Orbit: Sun synchronous
- Horizontal Resolution: 7km x 7km
- Atmospheric Composition: O3, CH4, HCHO, CO, NO2, SO2, aerosol

Aura OMI

- Ozone Monitoring Instrument
- Launch: July 2004
- Operator: NASA
- Orbit: Sun synchronous
- Horizontal Resolution: 13km x 13km
- Atmospheric Composition: O3, NO2, SO2, BrO, OClO, aerosol

Satellite NO_2 Column Data Assimilation

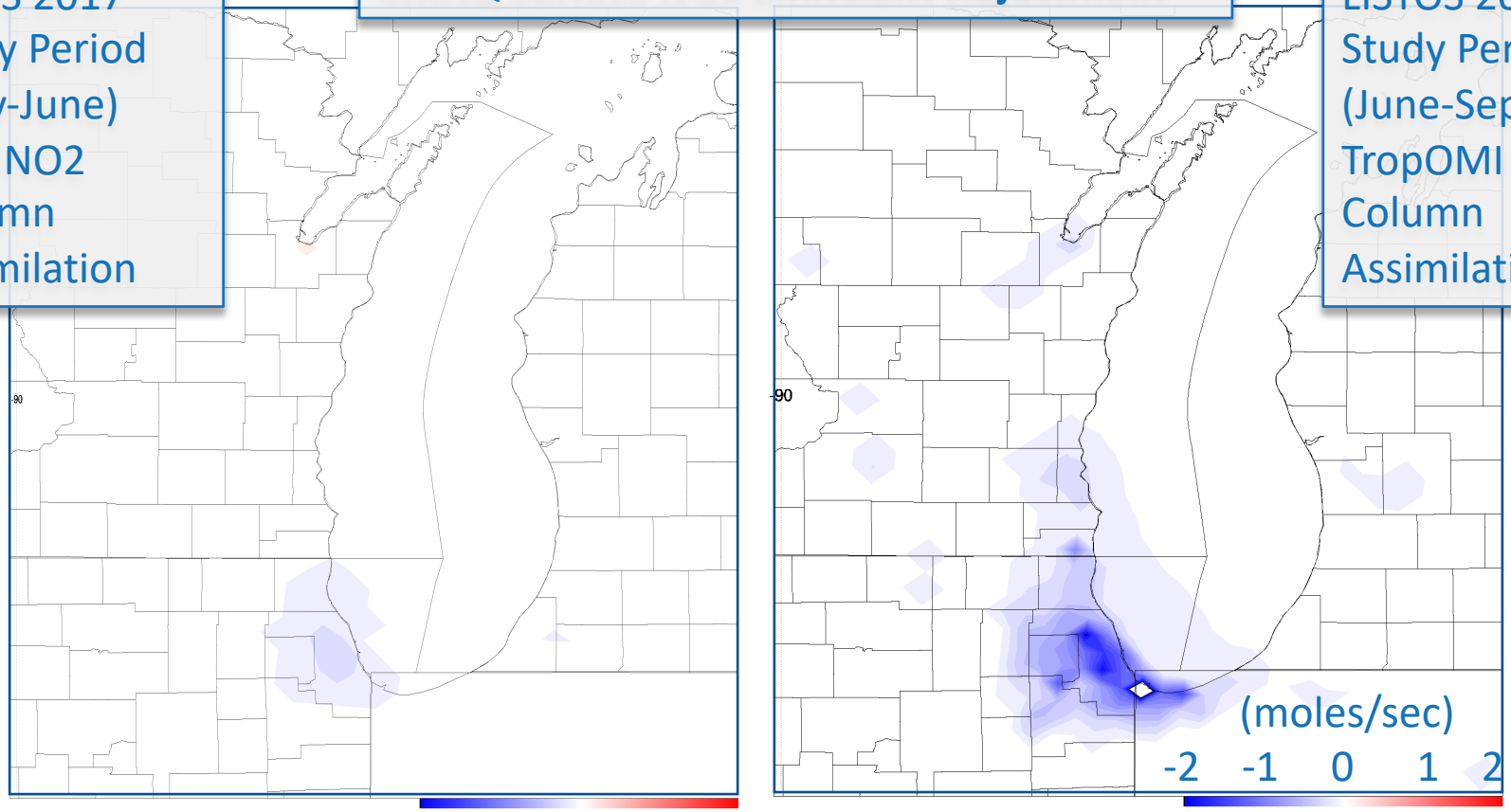
Constrain Air Quality Model Emissions Data w/ Remote Sensing

LADCO

LMOS 2017 Study Period (May-June) OMI NO2 Column Assimilation

CMAQ Surface NOx Emissions Adjustment

LISTOS 2018 Study Period (June-Sept) TropOMI NO2 Column Assimilation



OMI NO_2 results in ~4% reductions in CMAQ NOx emissions in June 2017

TropOMI NO_2 results in ~20% reductions in CMAQ NOx emissions in July-Aug 2018

LADCO's 1-2 Year Plan

- Continue to service our member state air quality planning needs
  - Build collaborations around the region to enhance our capabilities and services
- Modernize our decision support and data systems
  - Cloud-based computing
  - Interactive web-based analysis resources @ www.ladco.org
  - Driving applied research with remote sensing data and cutting-edge modeling technologies
- Enhance the National Air Pollution Training Program
- Continued advocacy for LADCO region on national initiatives

Summary

- LADCO is a hub for our member agencies to receive **training and technical data/guidance** to support their air quality planning goals
- **LADCO does not provide policy guidance** to our membership, only technical guidance and support
- Currently working on **O_3 NAAQS and Regional Haze SIP** support
- Ongoing efforts to modernize and improve **our modeling systems and technology/knowledge transfer approaches** to our members
- Continued **engagement and advocacy** on research and training projects

Questions and Contact

Zac Adelman

Executive Director

adelman@ladco.org