

LADCO's Experience in Applying NASA Data to Air Quality Planning

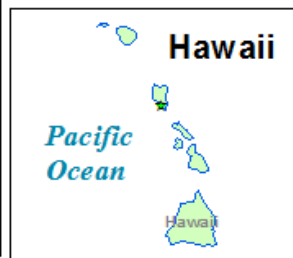
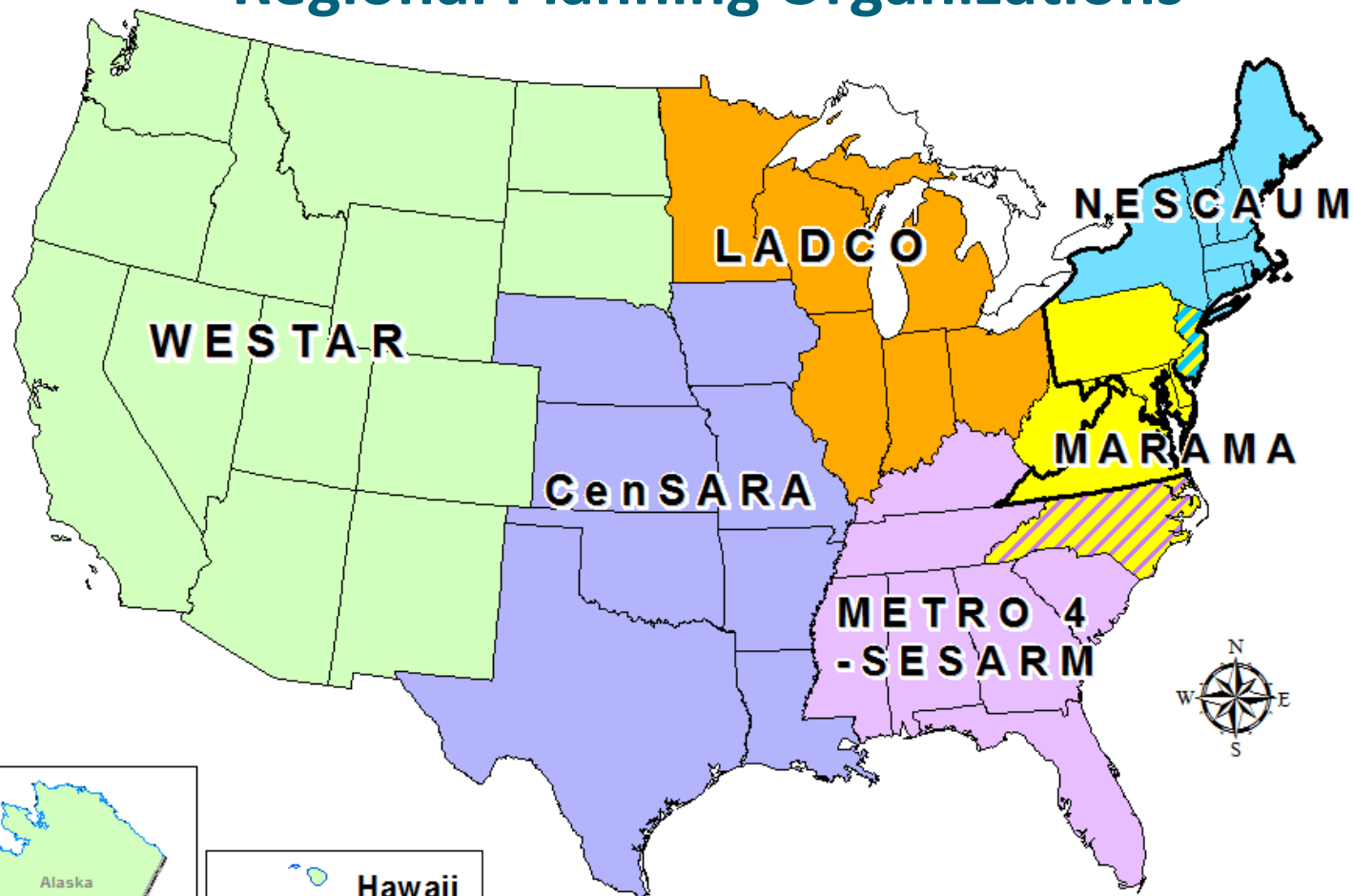
Rob Kaleel

Lake Michigan Air Directors Consortium

November 4, 2016



Regional Planning Organizations



-  MARAMA & METRO 4-SESARM
-  MARAMA & NESCAUM
-  Ozone Transport Commission (OTC)

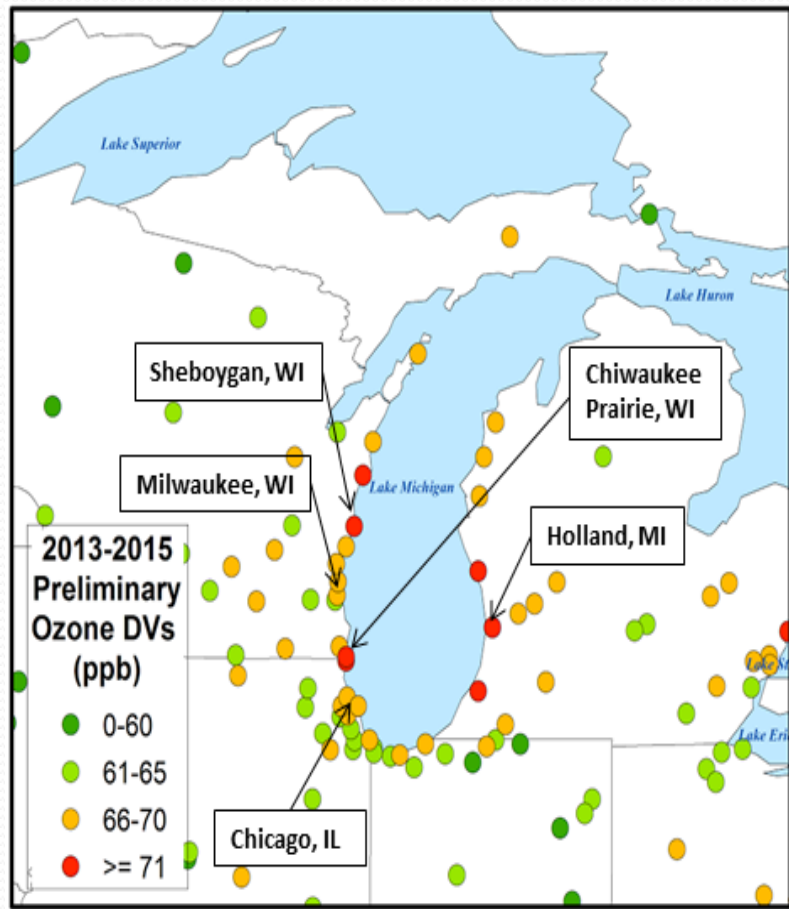
AQAST Collaborators

- **Tracey Holloway**
University of Wisconsin at Madison
- **Monica Harkey**
University of Wisconsin at Madison
- **Brad Pierce**
NOAA/NESDIS
- **Daniel Cohan**
Rice University
- **Daven Henze**
University of Colorado at Boulder

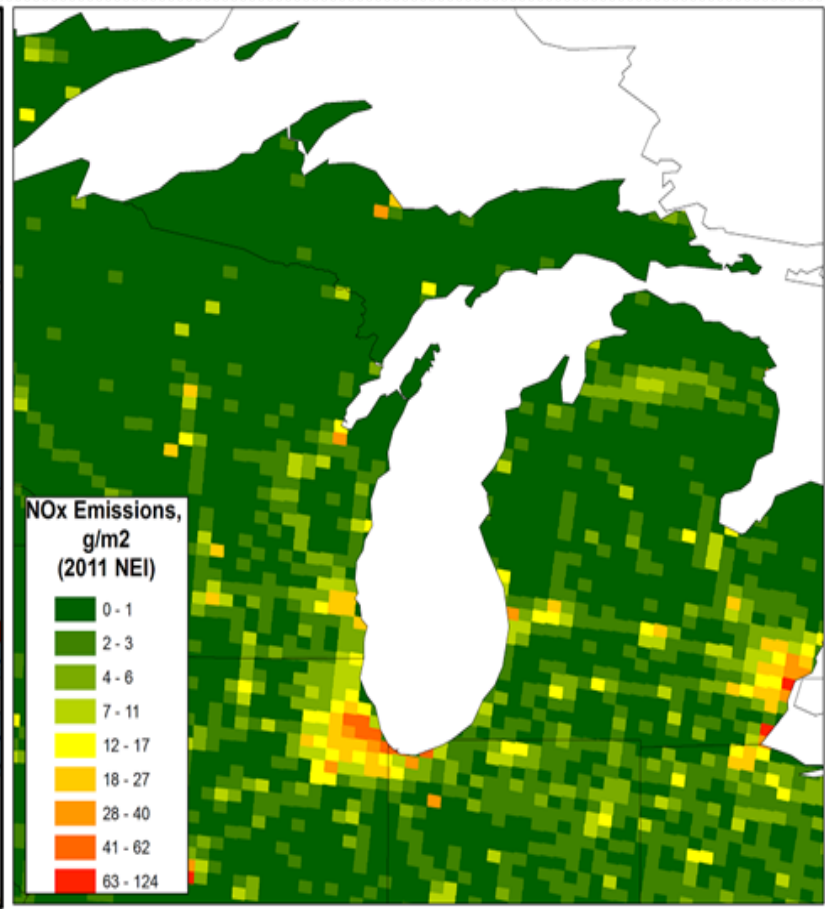
Recent and Future NASA Projects Are Helping to Answer Air Quality Questions in the Midwest

- VOC or NO_x emission controls in urban areas?
- Biogenic emissions: MEGAN or BEIS?
- Importance of boundary conditions
- Planning the 2017 Lake Michigan Ozone Study

Highest Ozone Levels Occur at Shoreline Monitors



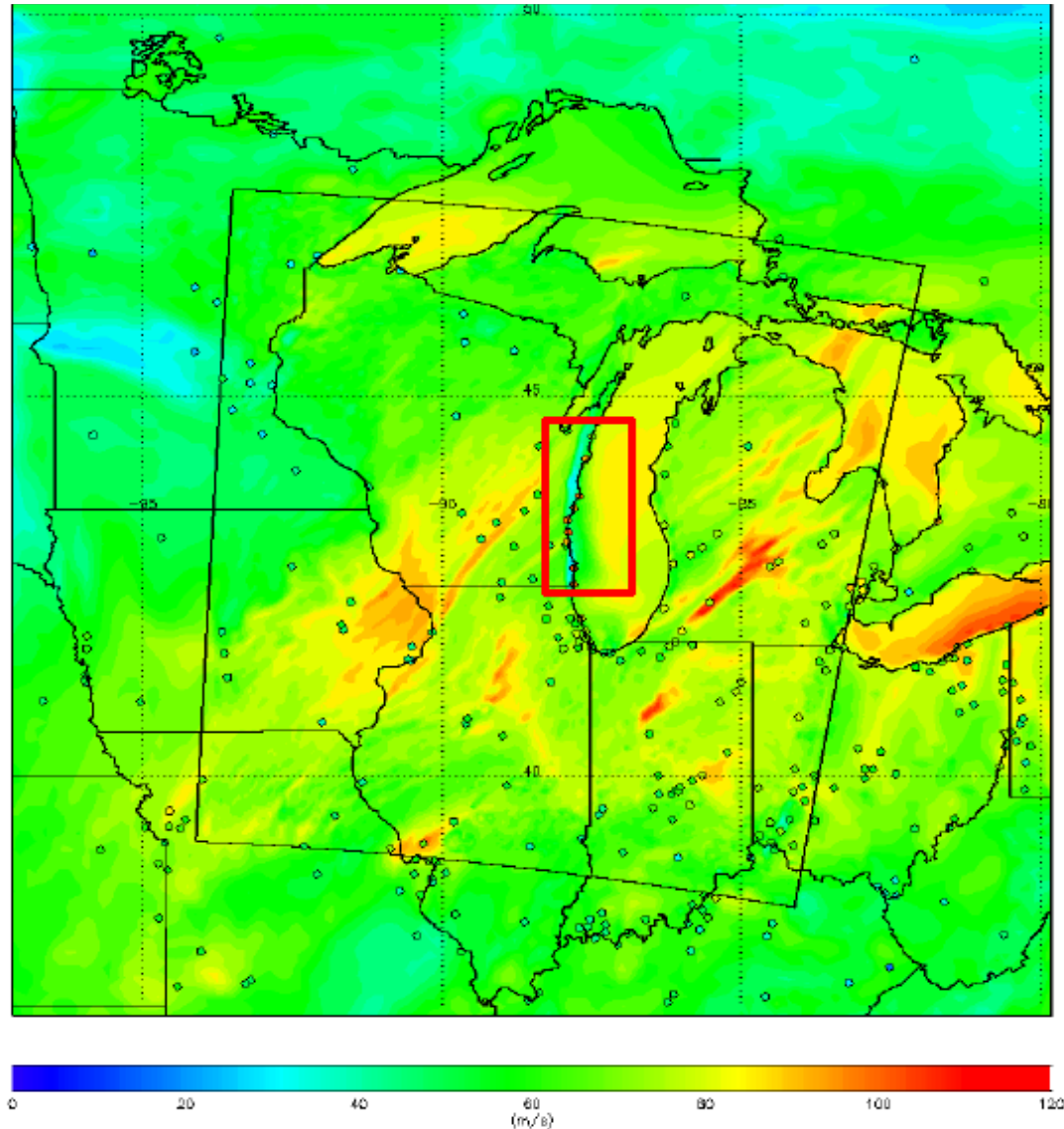
2013-2015 Ozone Design Values



NEI 2011 NO_x area emissions

Current Modeling Does Not Reproduce Ozone Near Lake Michigan Shoreline

4km WRF-CHEM shows significant increase in surface O₃ over Lake Michigan but actually shows lower surface O₃ than 12km along Western Shore of Lake Michigan

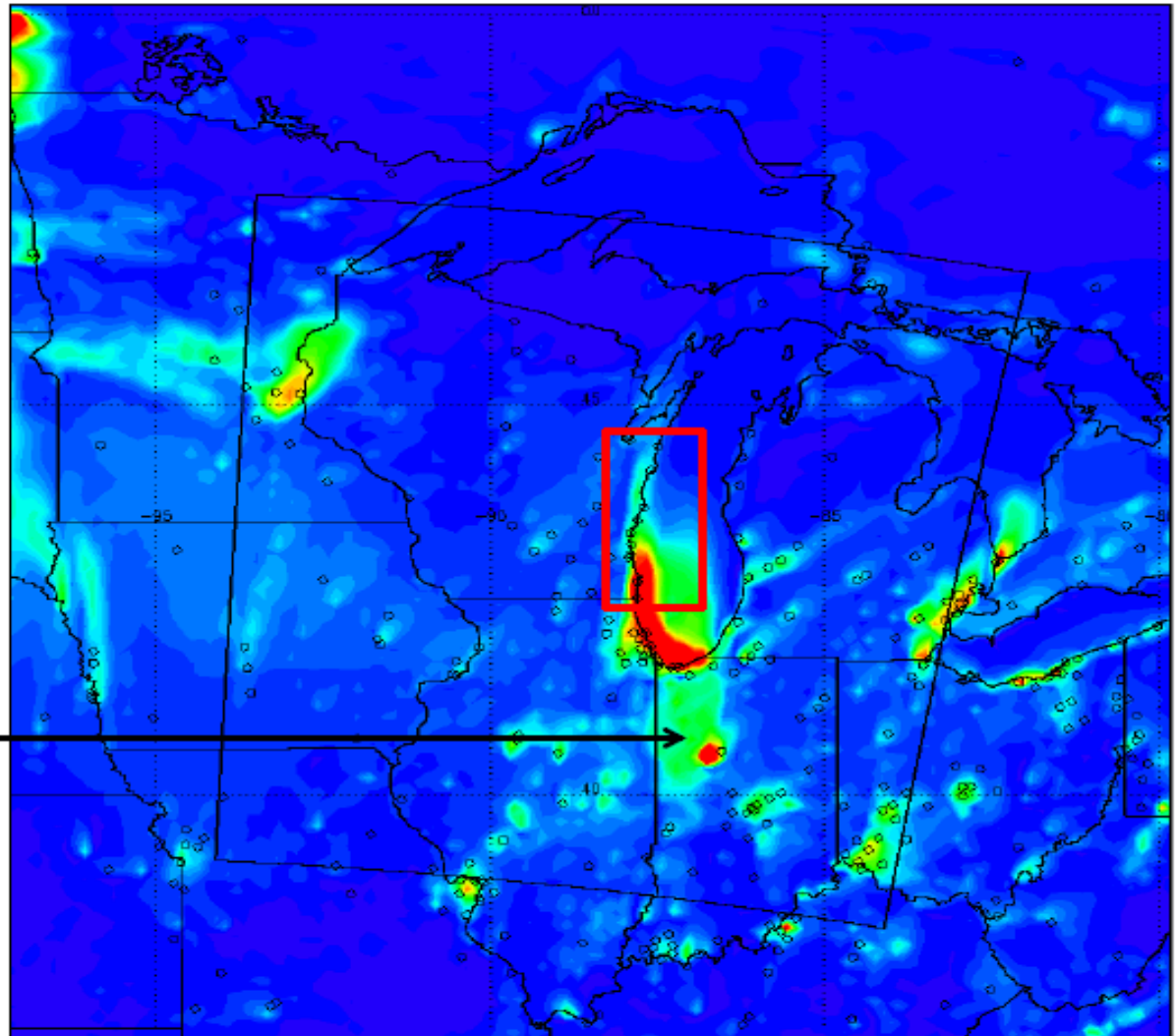


NOx Concentrations over Lake Michigan

WRF-CHEM 12km Surface NOx 22Z (5:00pm Central) July 17, 2011

12km WRF-CHEM shows broad region of higher surface NOx over southern Lake Michigan and NW Indiana

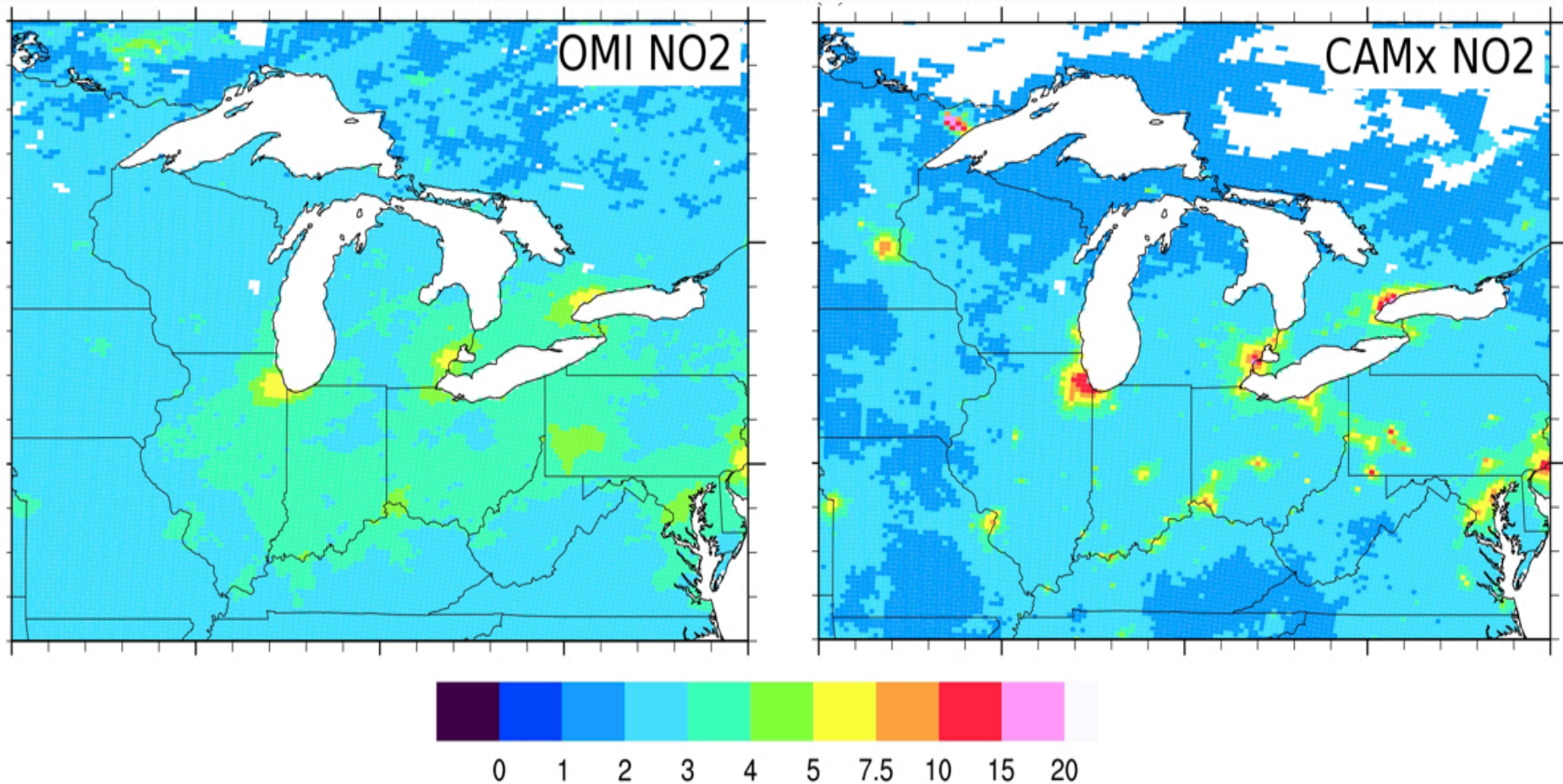
12km NOx high over NW Indiana due to low PBL



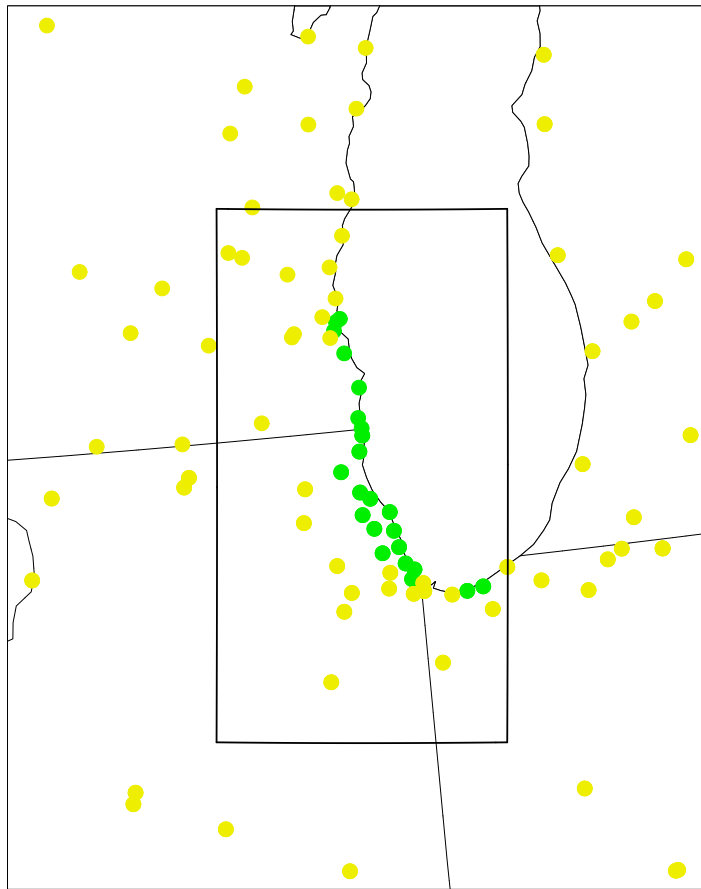
Source: Brad Pierce, NOAA



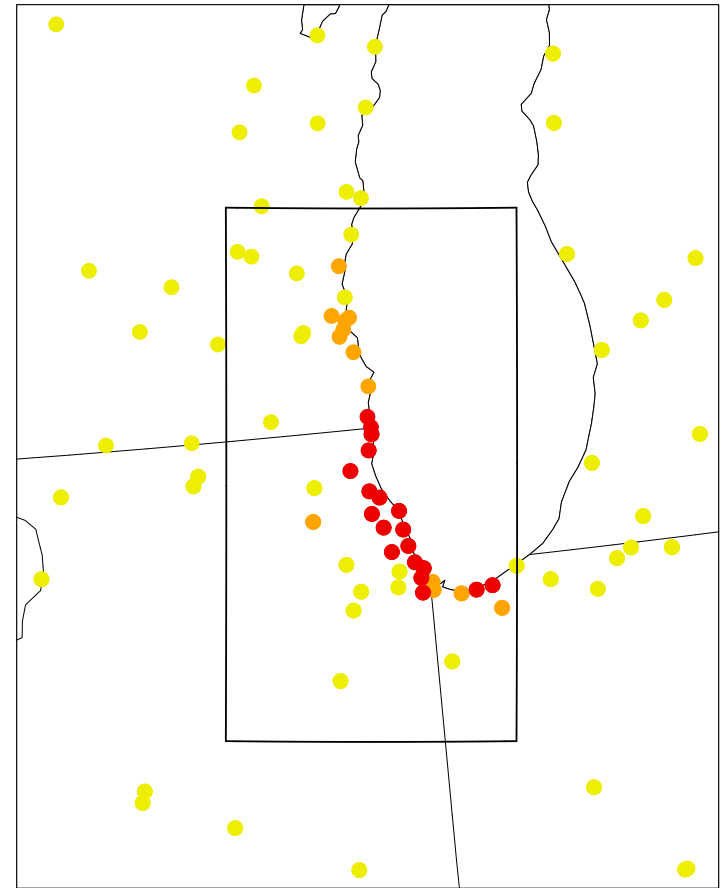
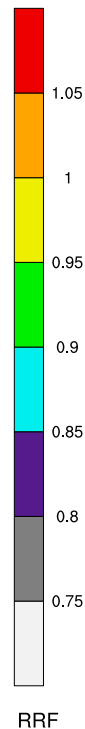
Comparison of 2011 NO₂ Concentrations Measured (NASA-OMI) and Modeled (CAMx)



CAMx Model Sensitivity to VOC and NOx Emissions Reductions



VOC



NOx

Biogenic Emissions

Comparison of BEIS and MEGAN

- **EPA**
 - **BEIS V3.6.1 w/ prognostic PAR from WRF**
- **Daniel Cohan, Rice University**
 - **BEIS V3.14 w/ satellite PAR**
 - **MEGAN V2.10 w/ satellite PAR**
- **Monica Harkey, University of Wisconsin**
 - **OMI – CAMx Comparisons**
 - **BEIS and MEGAN**

BEIS and MEGAN

Contribution of Biogenic Emissions to MDA8 O₃

BEIS

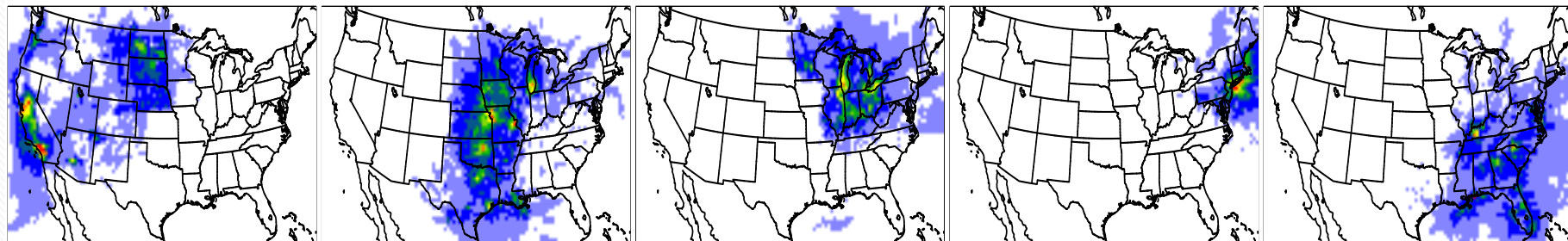
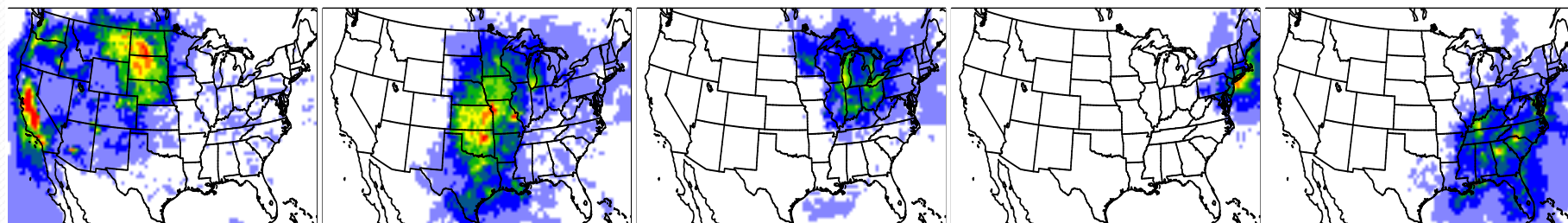
WRAP

CenRAP

LADCO

MANE-VU

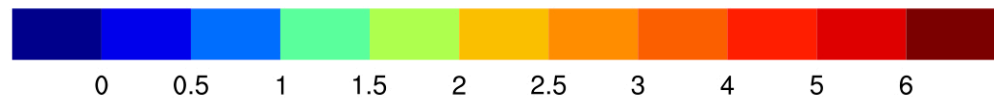
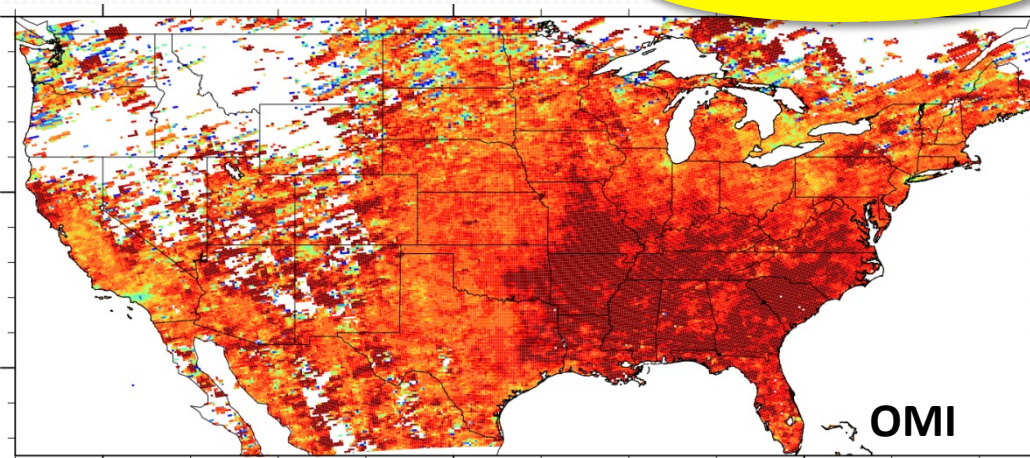
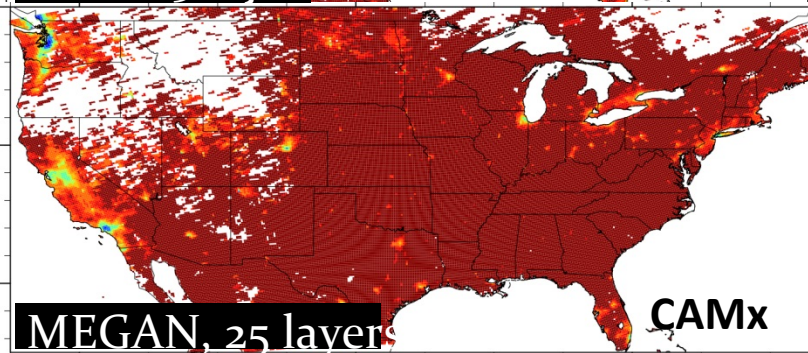
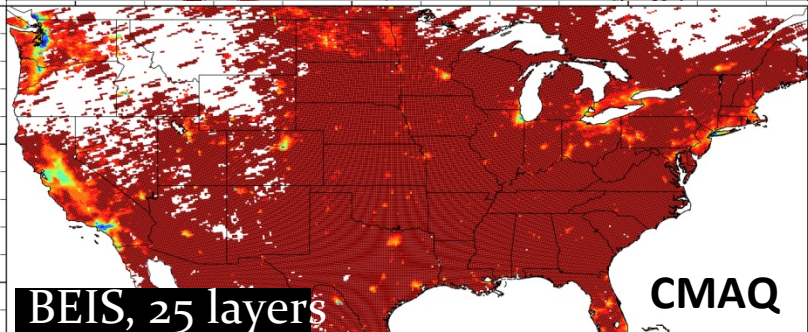
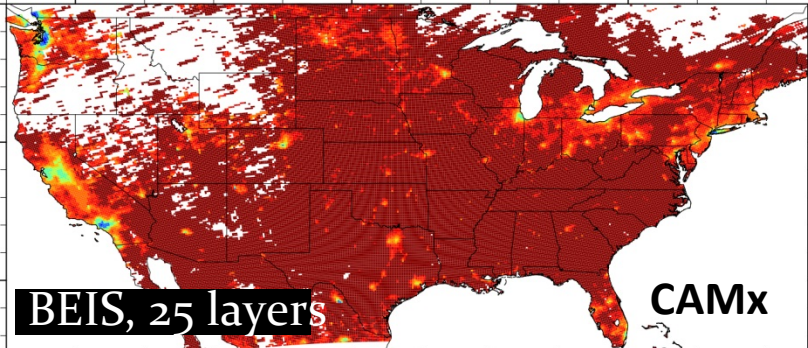
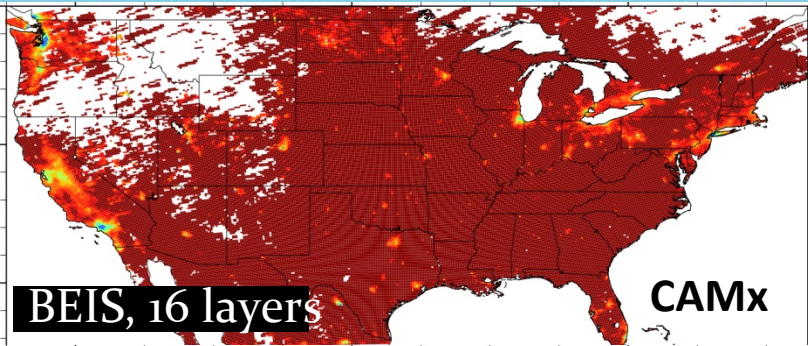
VISTAS



MEGAN

FNR comparison:

July 2011 average



VOC – limited

NO_x - limited

models tend to overestimate FNR where areas are NO_x-limited

Source: Monica Harkey, Univ of Wisconsin

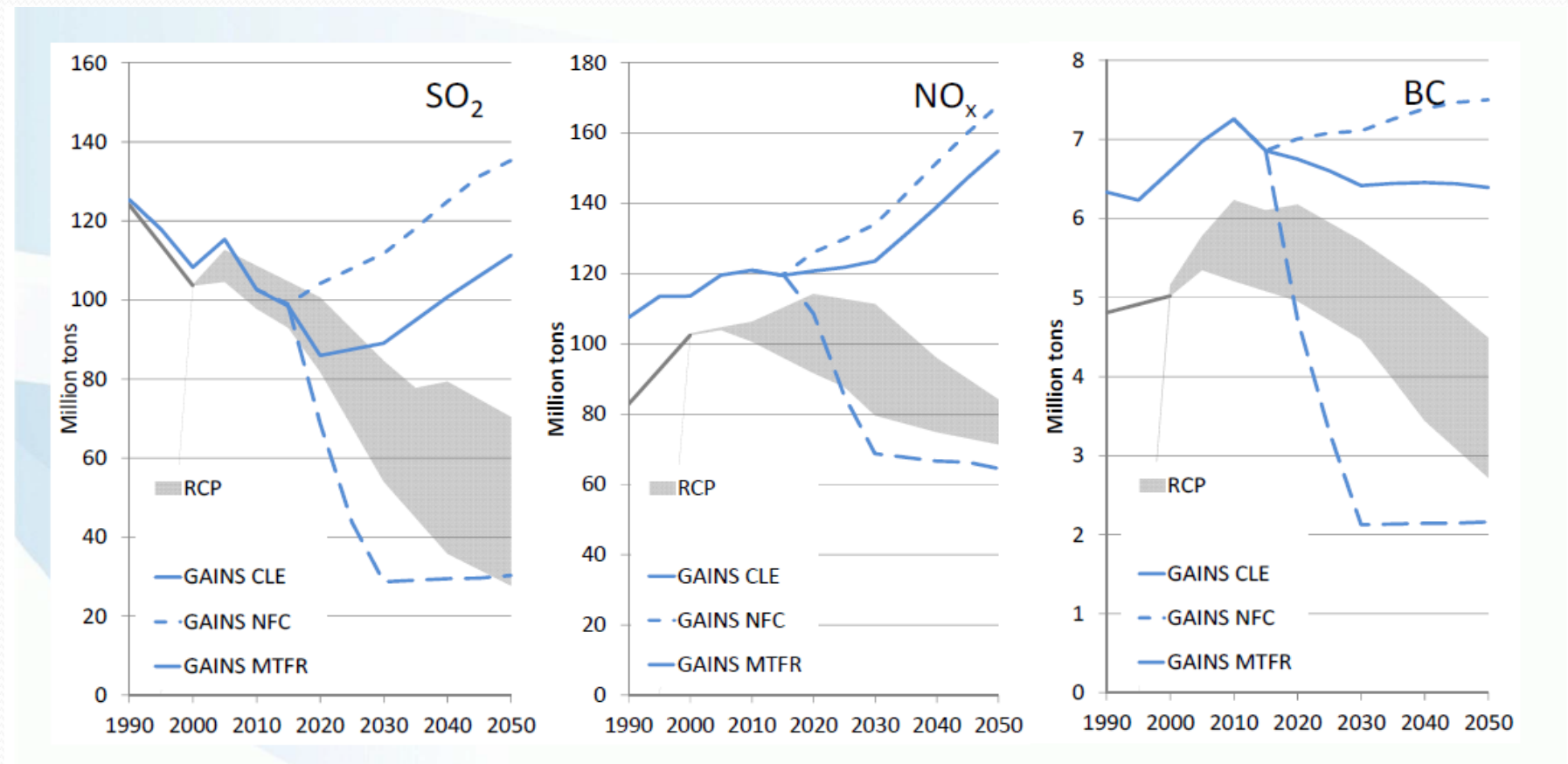
Future Boundary Conditions

- Daven Henze, University of Colorado
 - GEOS-Chem with 2011 meteorology
 - HTAP ECLIPSE “CLE” global inventory for 2010, 2020, 2030, 2050
- LADCO used the GEOS-Chem results to generate boundary conditions (BCs) for CAMx
- LADCO ran CAMx with ECLIPSE 2010, 2020, 2030, and 2050 BCs using EPA’s 2011EH modeling platform

HTAP

- Task Force on Hemispheric Transport of Air Pollution
 - Chaired by Dr. Frank Dentener (European Community) and Dr. Terry Keating (USEPA)
 - International scientific cooperative w/ 30 countries
- Evaluating the Climate and Air Quality Impacts of Short-Lived Pollutants (ECLIPSE) projection scenarios:
 - ***Current legislation (CLE)***
 - Full implementation of national legislations as of 2013
 - **No Further Controls (NFC)**
 - No change in emission factors after 2015
 - **Maximum technically feasible reductions (MTFR)**
 - All currently available control technologies

HTAP ECLIPSE Projections

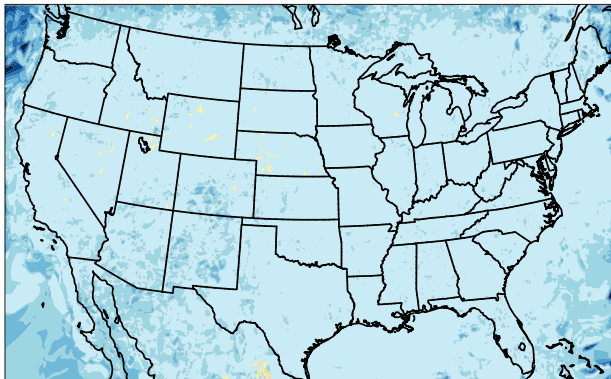


From Keating: "HTAP Workshop on Global Emission Scenarios", February 11-13, 2015

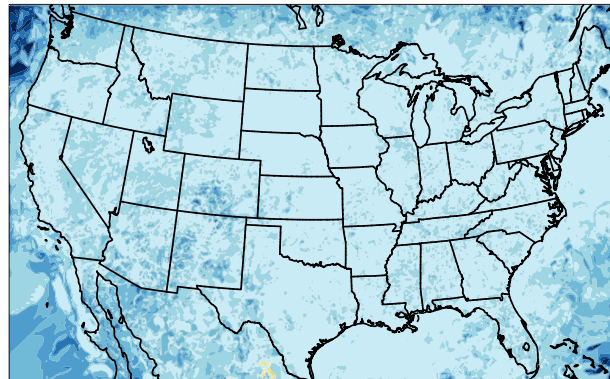
Ozone Impact of BCs

- Change in O₃ MD8 using 2017EH emissions

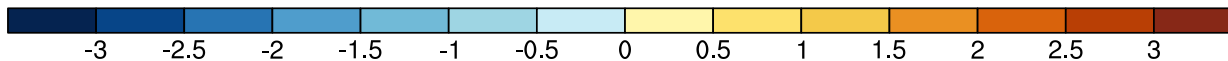
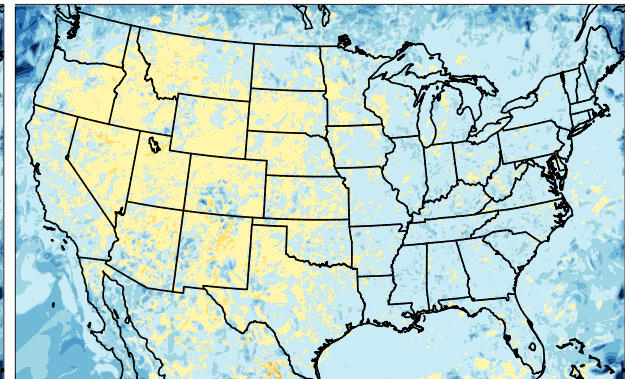
ECLIPSE 2020 - 2010



ECLIPSE 2030 - 2010



ECLIPSE 2050 - 2010



Change in Fourth High 8-Hr O₃ Daily Maximum (ppb)

White Paper: Lake Michigan Ozone Study 2017 (LMOS 2017)

Brad Pierce - NOAA NESDIS Center for Satellite Applications and Research (STAR), Cooperative Institute for Meteorological Satellite Studies, Madison, WI

Rob Kaleel and Donna Kenski - LADCO, Rosemont, IL

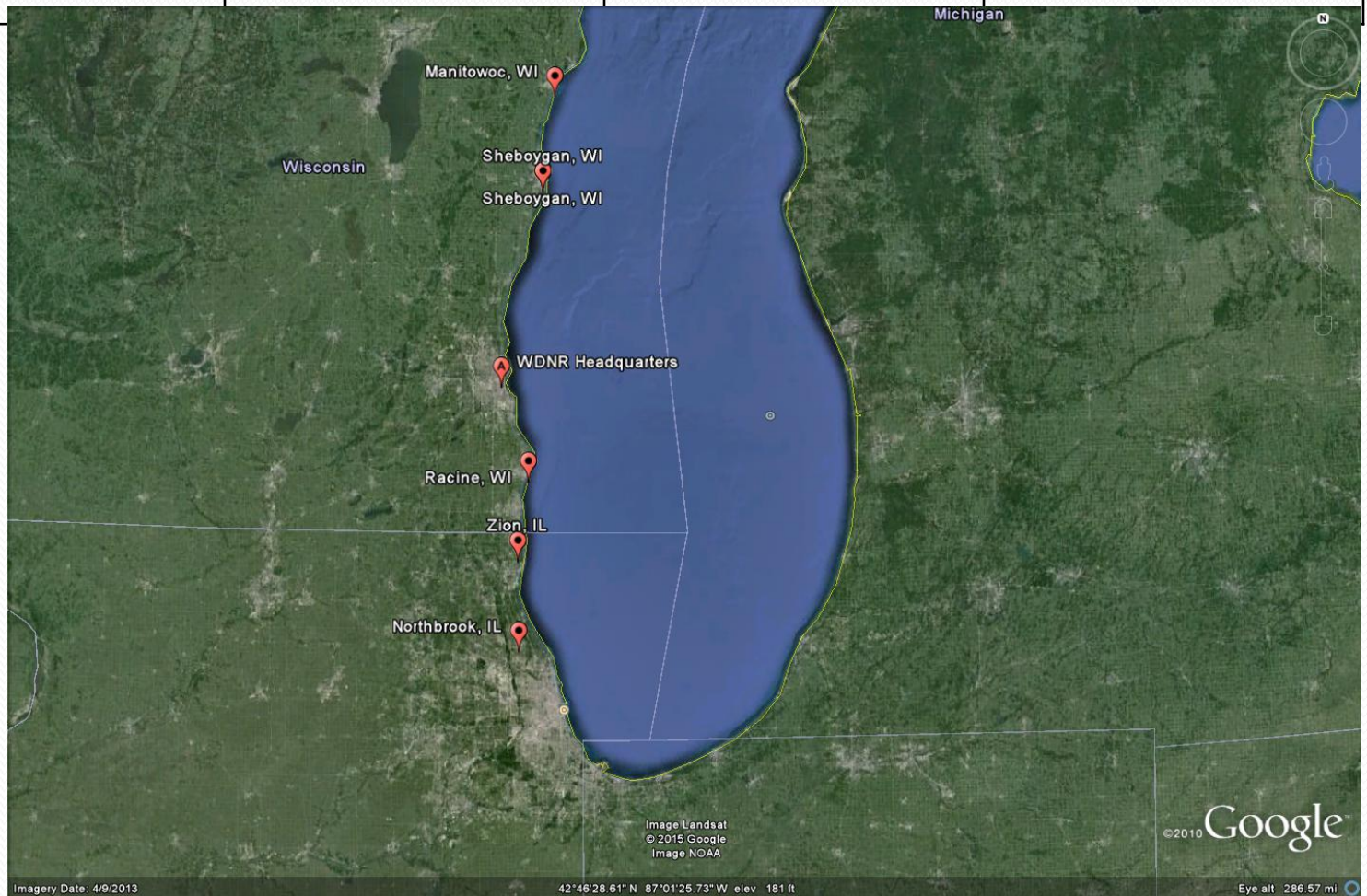
Angela Dickens - Wisconsin Department of Natural Resources, Madison, WI

Tim Bertram - University of Wisconsin-Madison, Department of Chemistry, Madison, WI

Charles Stanier - University of Iowa, Department of Chemical and Biochemical Engineering, Iowa City, IA

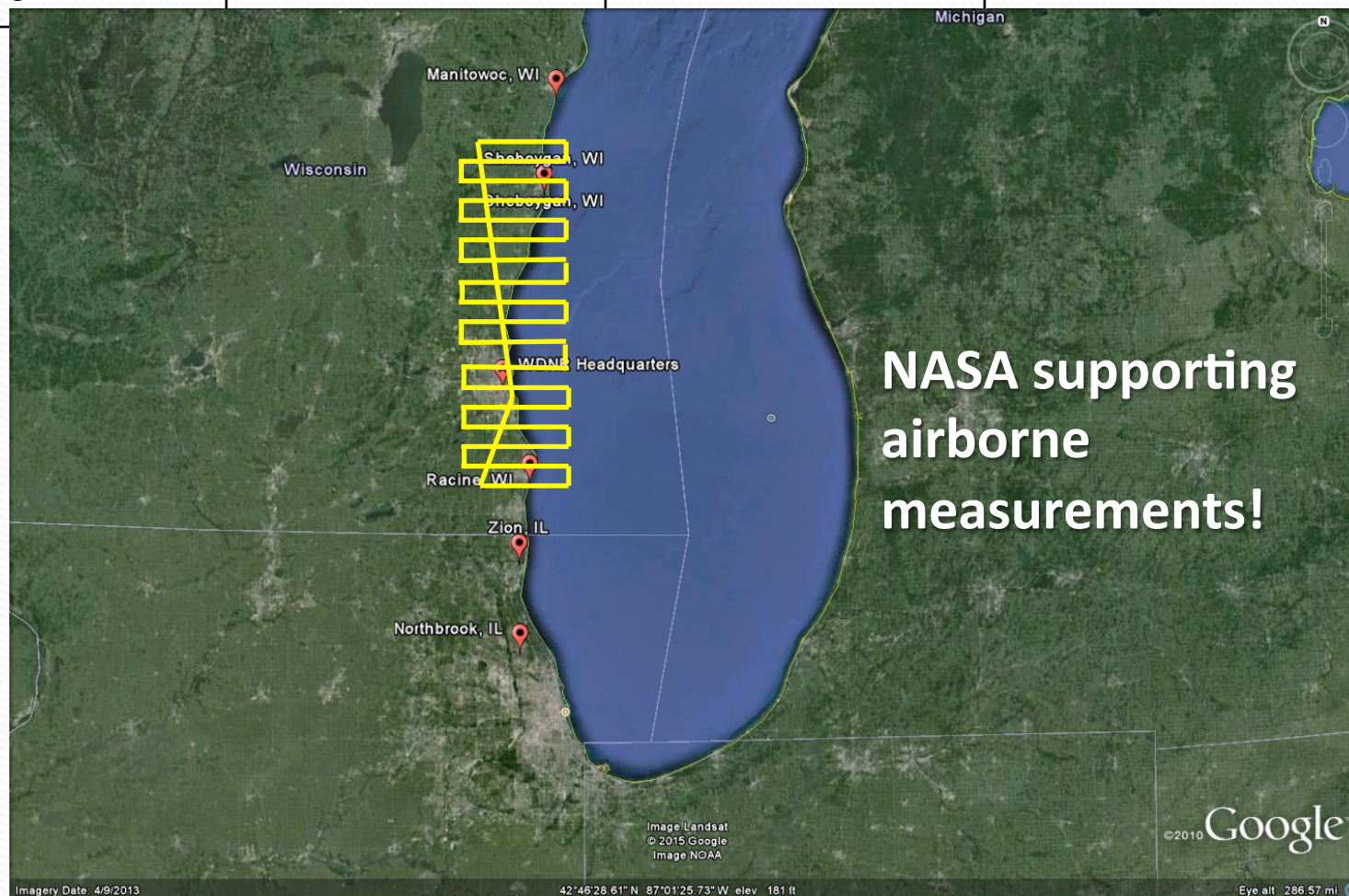
Analytical Approaches:

	Satellites	Airborne platforms	Ground-based
Type of measurement:	Remote sensing only	In situ & remote sensing	In situ & remote sensing
Spatial Coverage:	Excellent	Good	Limited
Temporal Coverage:	Limited	Good	Excellent



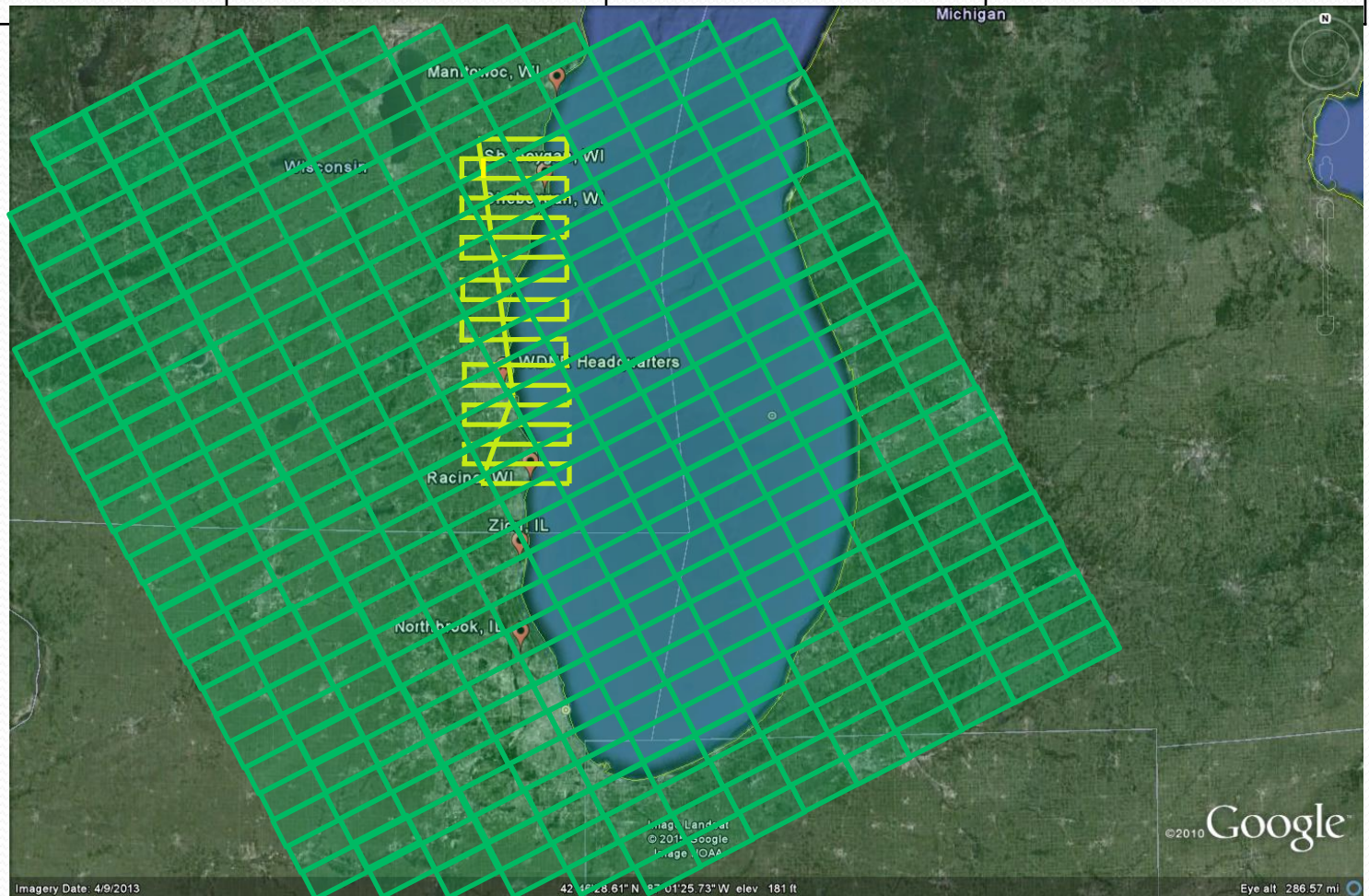
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Questions?

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