The 2016 National Emissions Inventory Collaborative: Modeling with the Beta platform

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July 31, 2019

Topics

- 2016 Inventory Collaborative – Modeling Workgroup
- Beta Emissions Platform - BEIS/MEGAN Comparison
- Future Work

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2016 Collaborative – Modeling Workgroup

- Co-Leads: Zac Adelman (LADCO), Eric Zalewsky (NYSDEC) & Alison Eyth (EPA)

- Workgroup Schedule: Calls 4th Tuesday of the Month, 3:00 PM Eastern

- Wiki: http://views.cira.colostate.edu/wiki/wiki/9190

- Workgroup Participants: EPA, LADCO, MARAMA, CIRA, US FWS, CARB, TX, GA, LA, VA, CO, ID, VA, MI, MN, NY, NJ, NH…

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Modeling Workgroup Tasks

- Review documentation provided by sector workgroups
- Develop platform package with all necessary components to process emissions and generate AQ model-ready emissions
  - SMOKE runscripts, inventory files, ancillary data
  - Capitalize on EPA's experience
- Process emission inventories through SMOKE
  - Test runscripts, QA/QC outputs, Generate reports
- Examine emissions from each sector and compare to previous platforms
  - Check for inconsistencies/anomalies
- Platform customization
  - Document how to change domains, swap sectors, make updates
- Provide feedback to sector workgroups

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Beta Emissions Platform – BEIS/MEGAN Comparison

- Compare air quality modeling results (CMAQ & CAMx) for 2016 Base Year using two biogenic emission inventory options (BEIS & MEGAN).

- Compare BEIS & MEGAN emissions

- Four modeling runs
  - CMAQ w BEIS
 - CMAQ w MEGAN
  - CAMx w BEIS
  - CAMx w MEGAN

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Modeling Setup

- **Emissions**: 2016 Beta emissions inventory
- **Meteorology**: Provided by EPA (WRF v3.8, MCIP v4.3)
- **Boundary conditions**: Extracted from NOAA's 2016 national air quality forecast modeling.
- **Domain**: EPA CONUS 12US2 Emissions & extracted for OTC12 for AQ modeling
- **Modeling period**: May to August, 2016
- **Model Layers**: 35
- **AQ Models**: CMAQ v5.2.1 (cb6r3/AERO6)

  CAMx v6.50 (cb6r4) (Sea salt processed using latest CAMx tool package)
- **Modeling Cases**: CMAQ with BEIS v3.61, CMAQ with MEGAN v3.0

  CAMx with BEIS v3.61, CAMx with MEGAN v3.0

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Mean Bias (ppb) Daily Max 8hr Ozone with 60 ppb threshold
Jun – Aug, 2016

CMAQ_BEIS
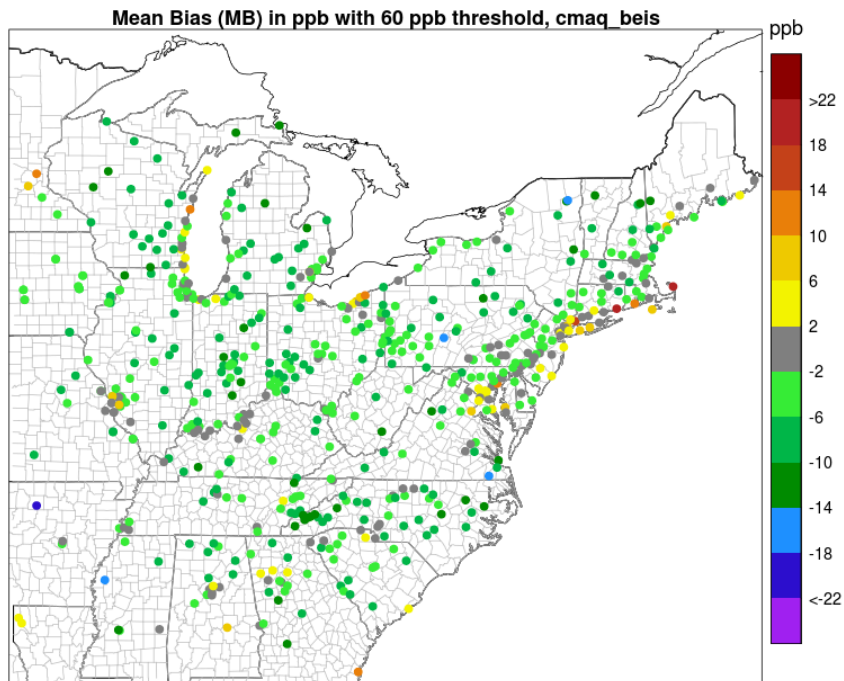
CMAQ_MEGAN

Mean Bias (MB) in ppb with 60 ppb threshold, cmaq_beis

CMAQ v5.2.1, 2016 beta emissions, jun-aug, 2016

Mean Bias (MB) in ppb with 60 ppb threshold, cmaq_megan
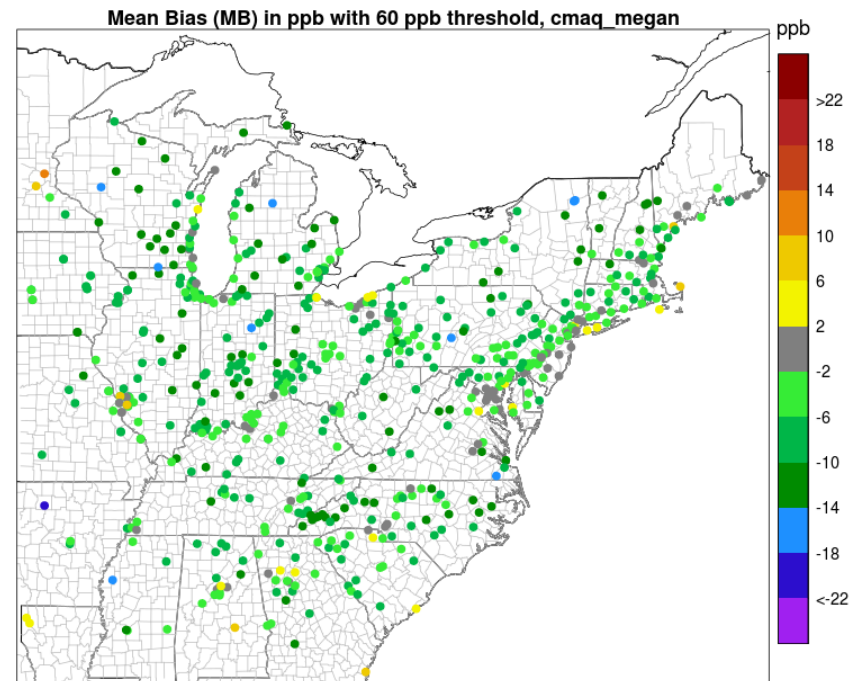
CMAQ v5.2.1, 2016 beta emissions, jun-aug, 2016

Mean Bias (ppb) Daily Max 8hr Ozone with 60 ppb threshold
Jun – Aug, 2016

CAMx_BEIS

CAMx_MEGAN

Mean Bias (MB) in ppb with 60 ppb threshold, camx_beis

CAMx v6.50, 2016 beta emissions, jun-aug, 2016

Mean Bias (MB) in ppb with 60 ppb threshold, camx_megan

CAMx v6.50, 2016 beta emissions, jun-aug, 2016
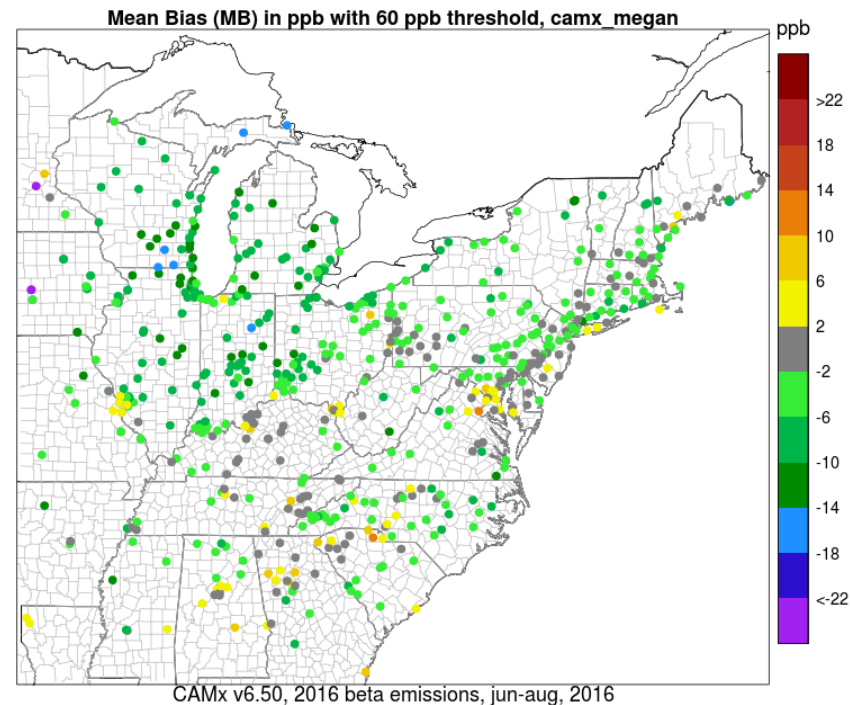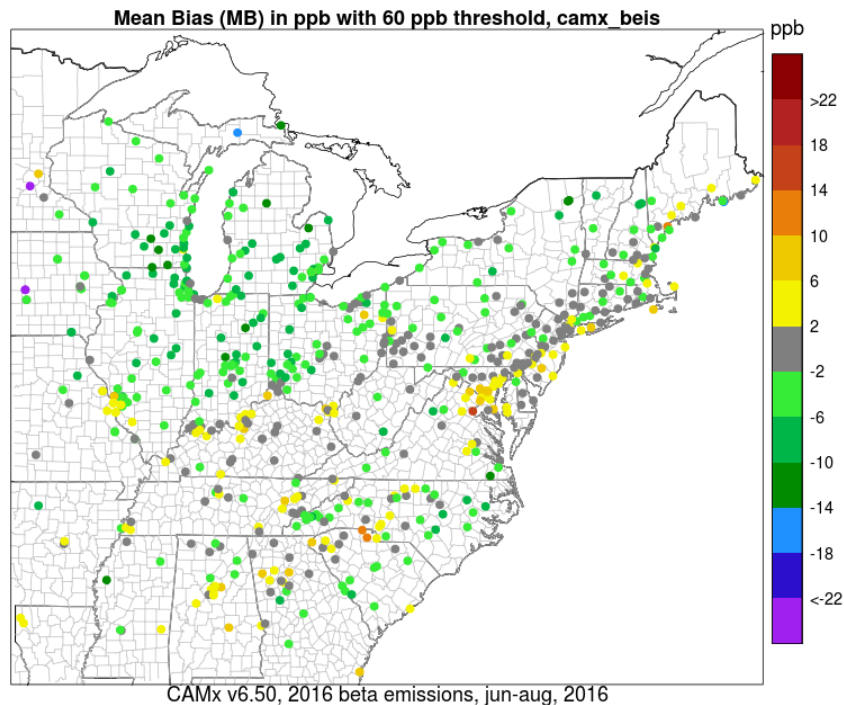
Daily Max 8hr Ozone (ppb) NY-NJ-CT NAA

All Values

60 ppb threshold
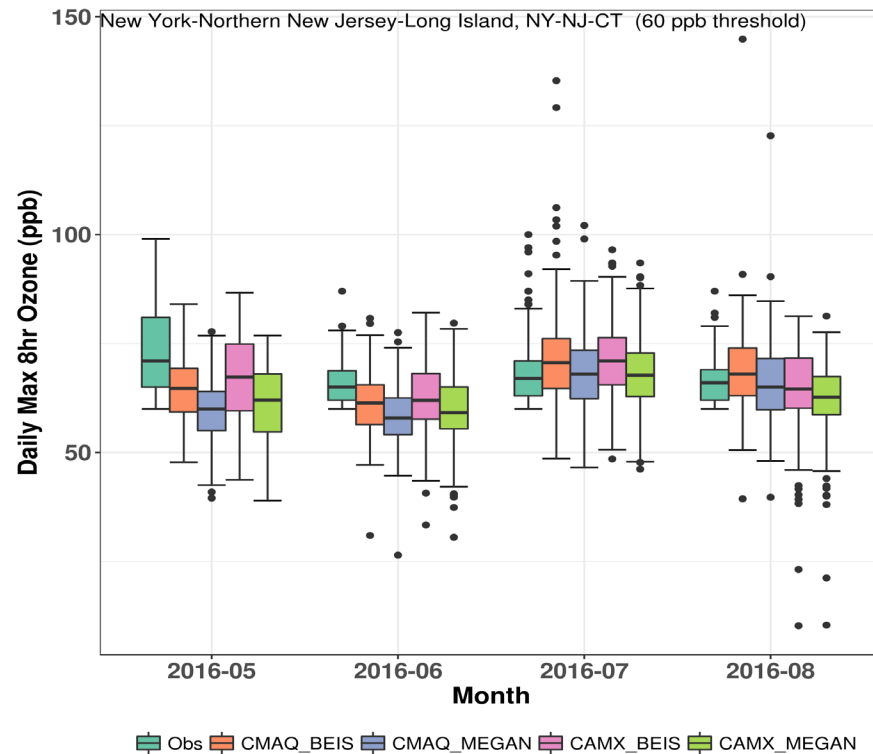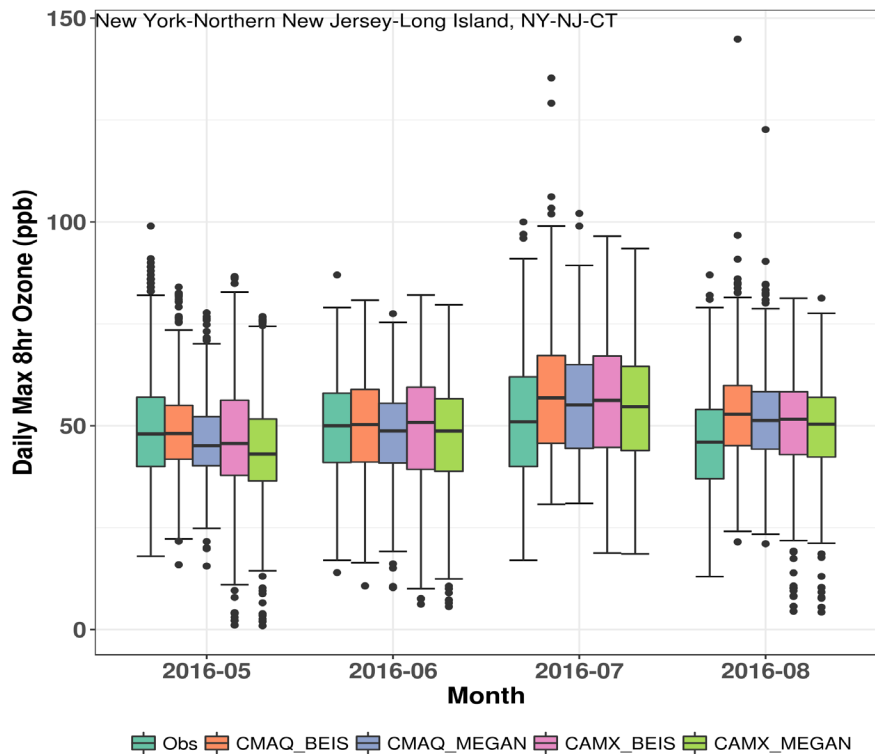
Daily Max 8hr Ozone (ppb) Baltimore NAA
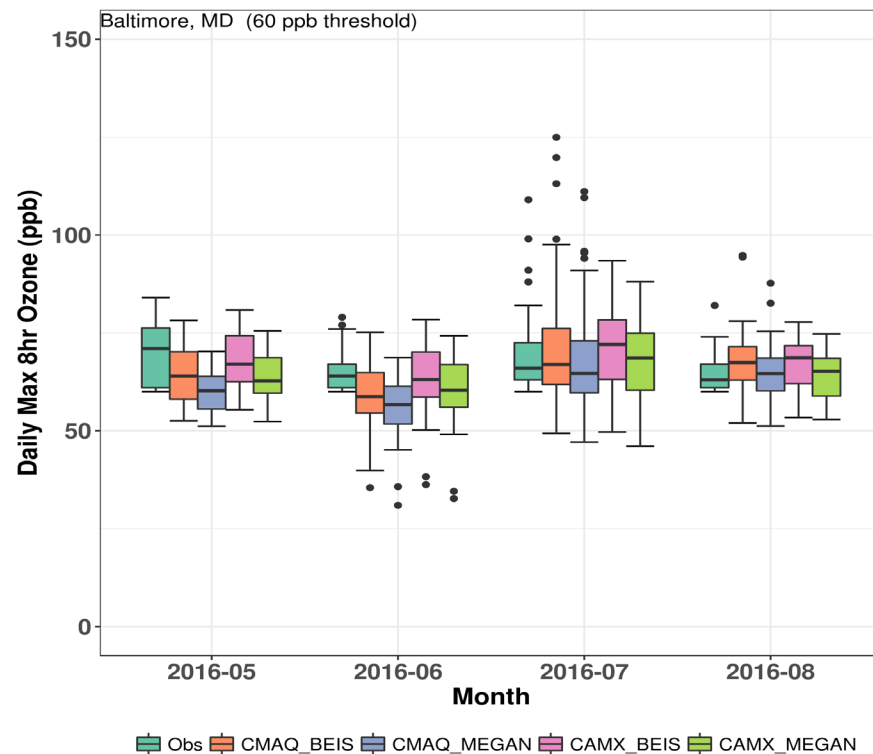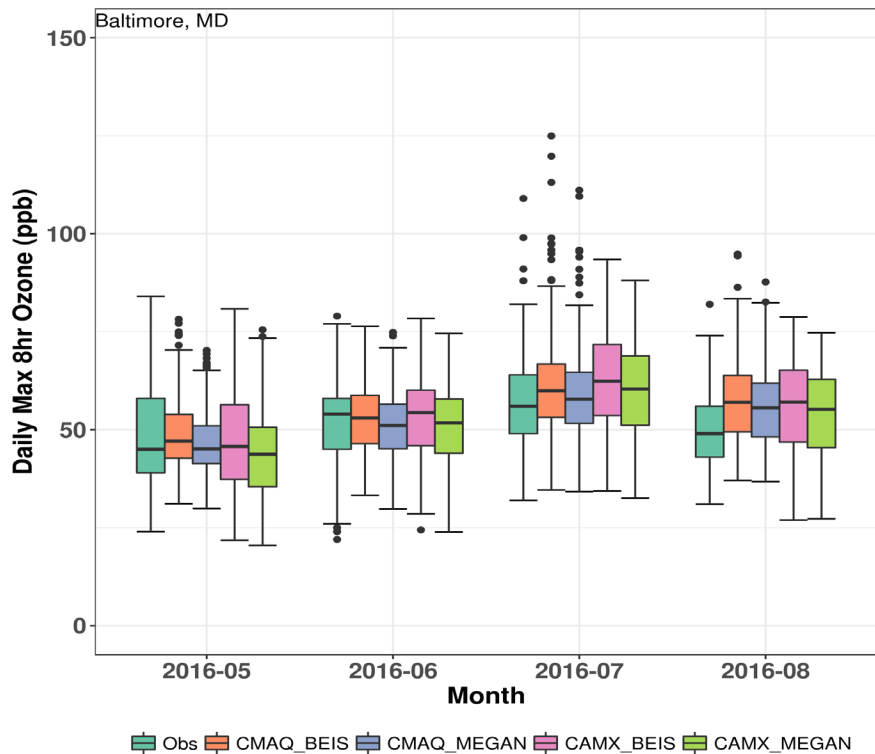
Daily Max 8hr Ozone (ppb) Atlanta NAA

All Values

60 ppb threshold
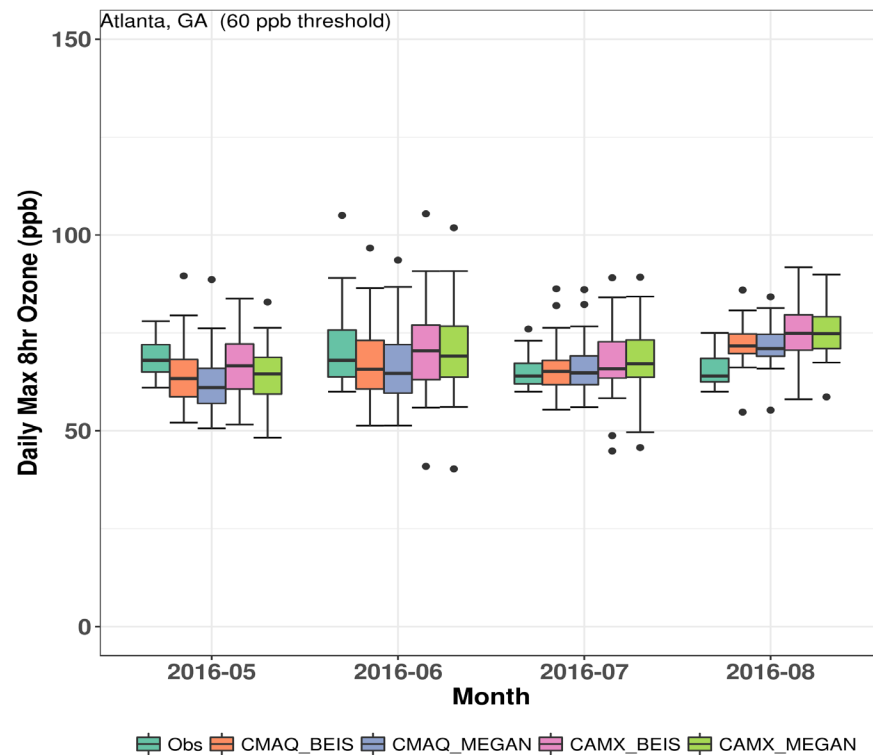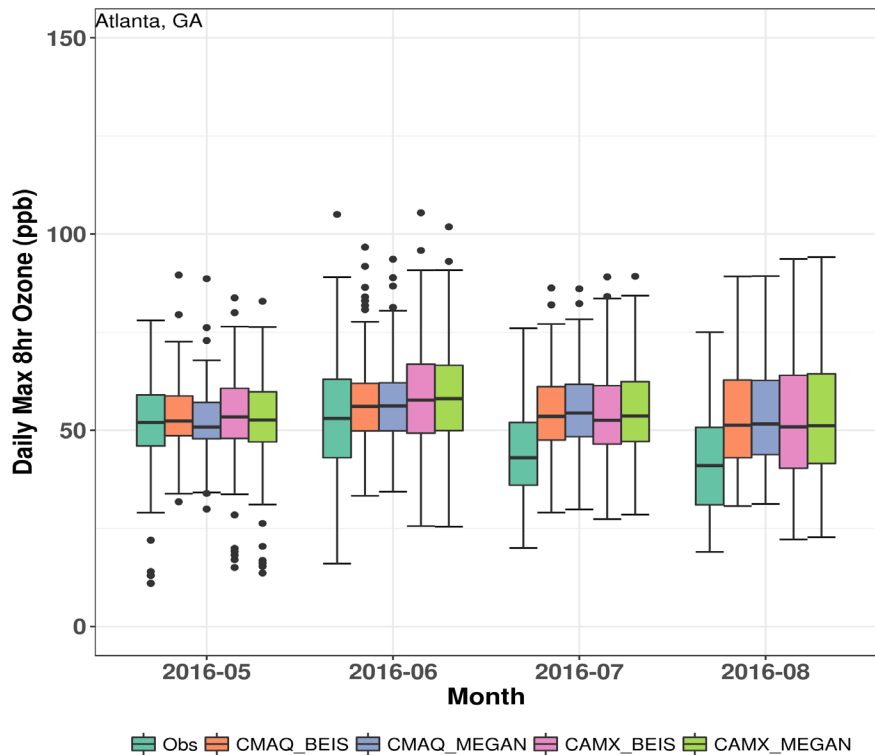
Daily Max 8hr Ozone (ppb) Chicago NAA

All Values

60 ppb threshold
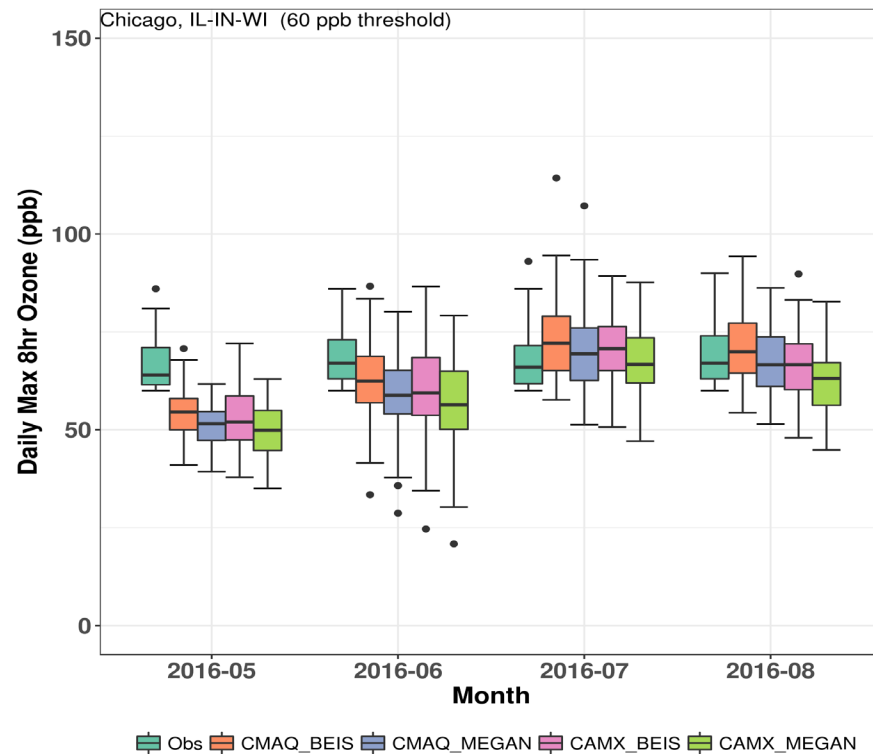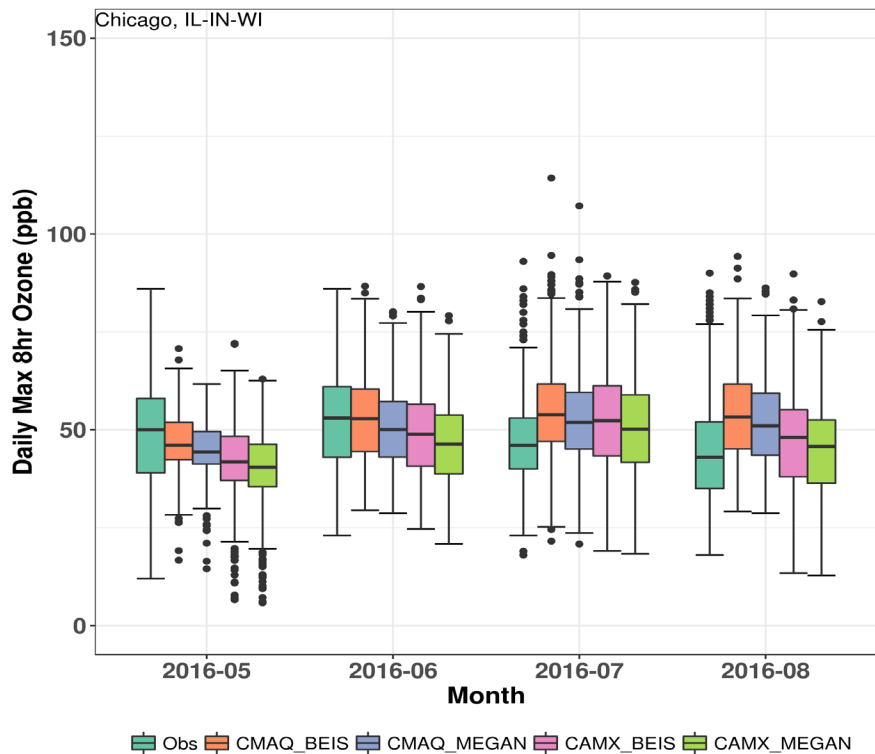
Location of selected analysis sites
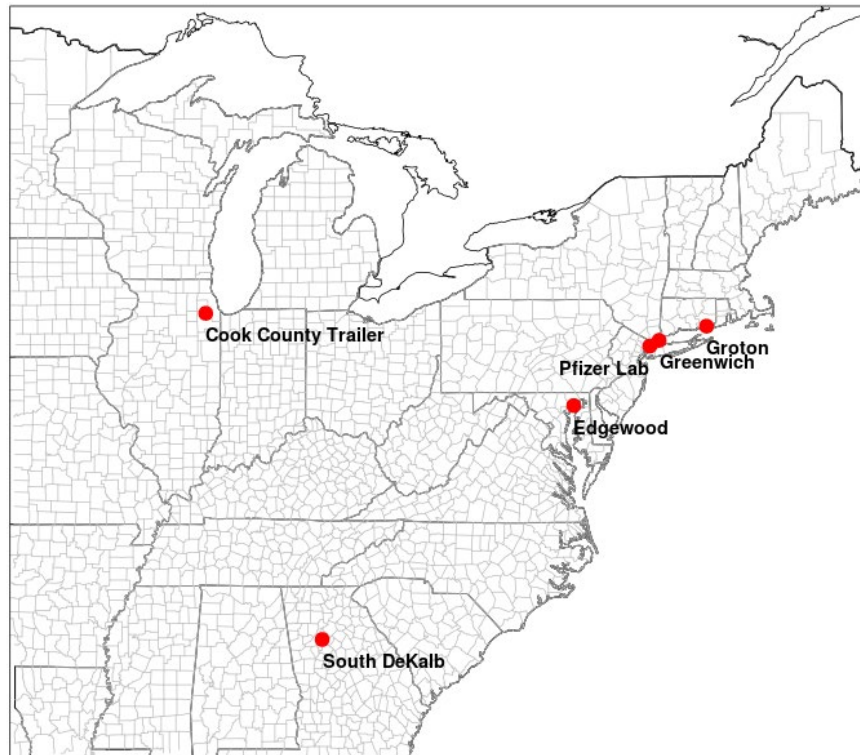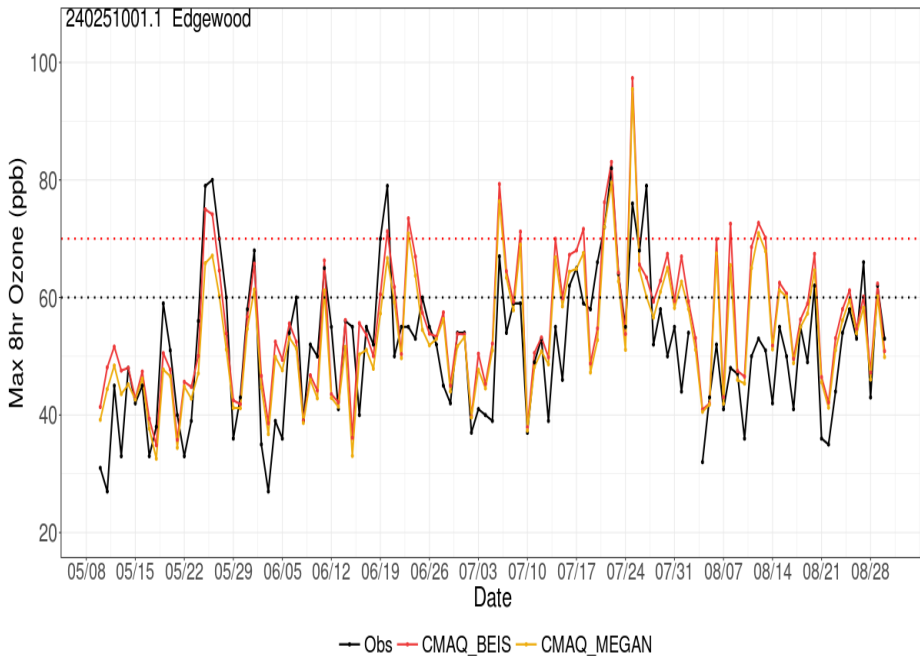
Daily Maximum 8hr Ozone – Groton, CT

CMAQ_BEIS/MEGAN
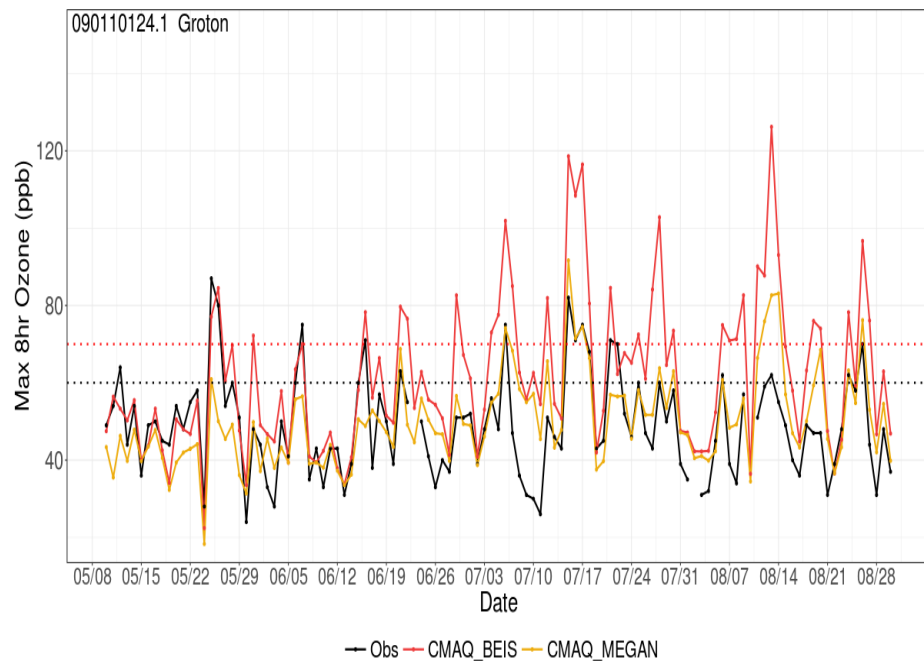
CAMx_BEIS/MEGAN
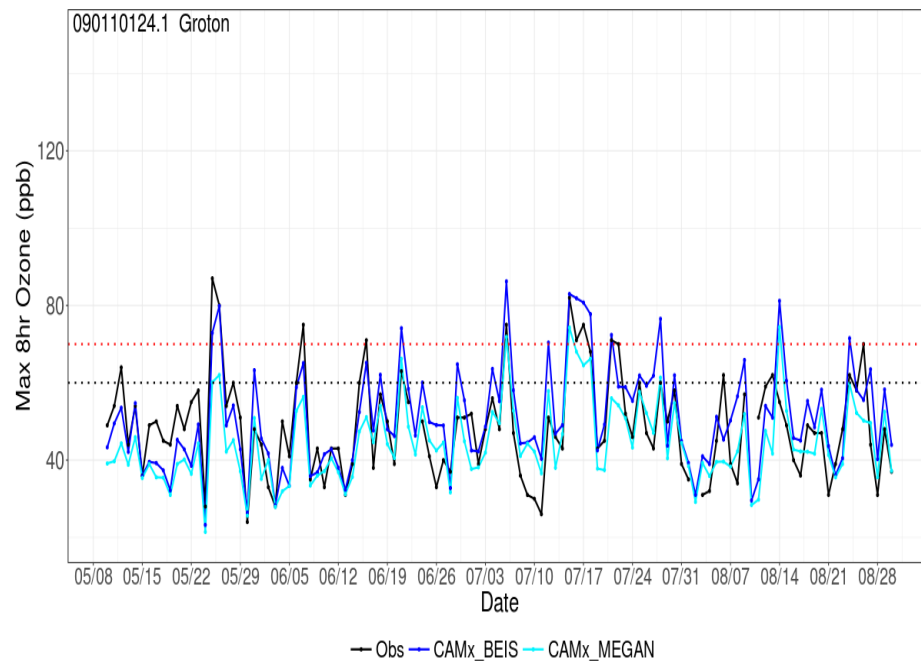
Daily Maximum 8hr Ozone – Edgewood, MD
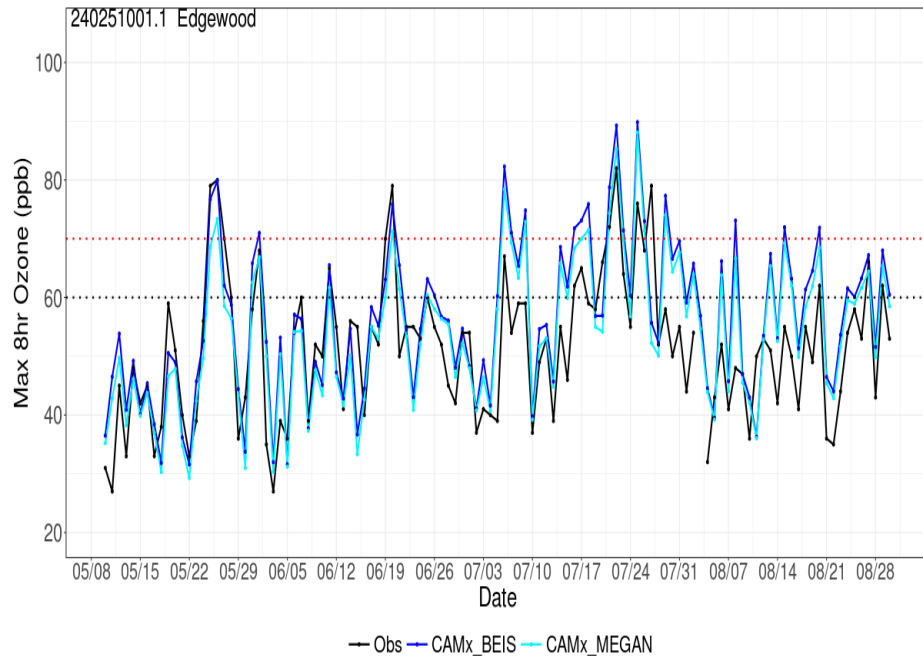
Daily Maximum 8hr Ozone – Cook Co., IL

CMAQ_BEIS/MEGAN
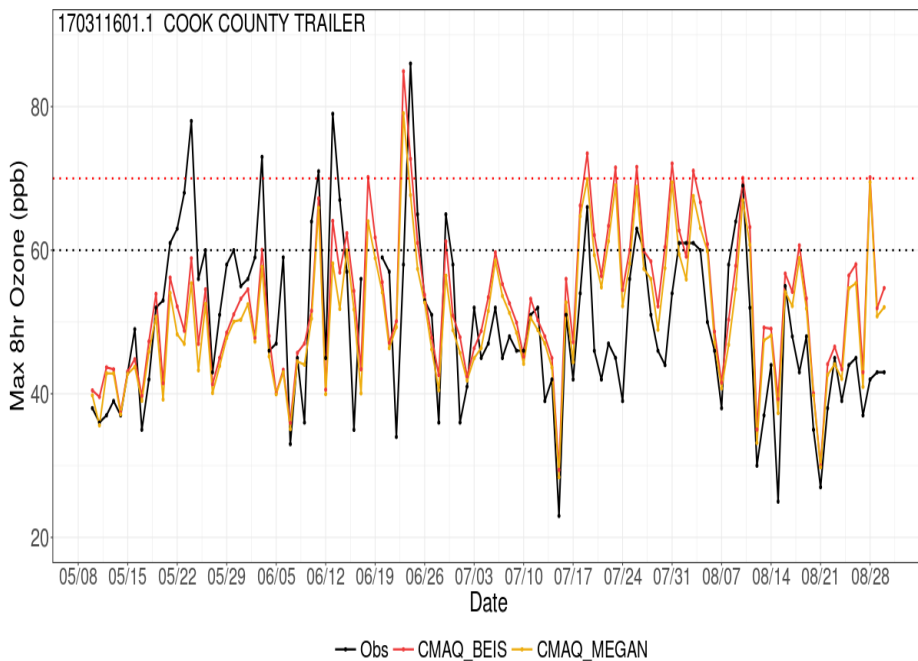
CAMx_BEIS/MEGAN
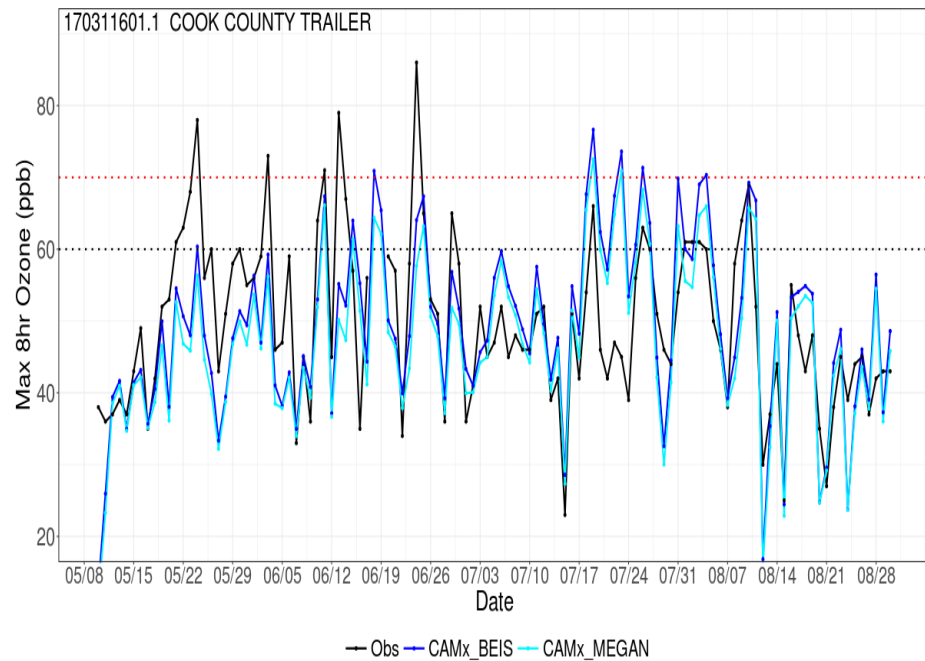
Daily Maximum 8hr Ozone Bias (60ppb Threshold)
May 26, 2016
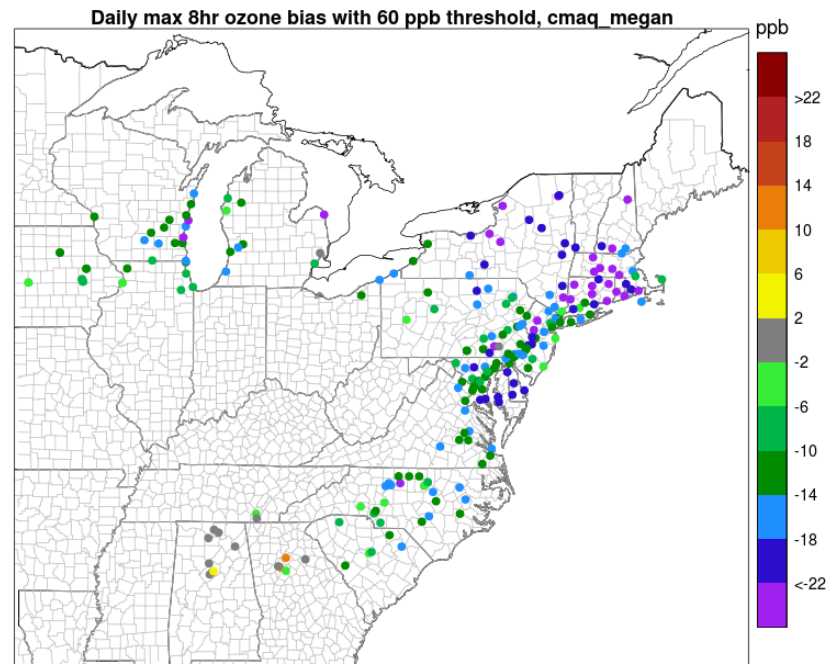
CMAQ_BEIS - OBS
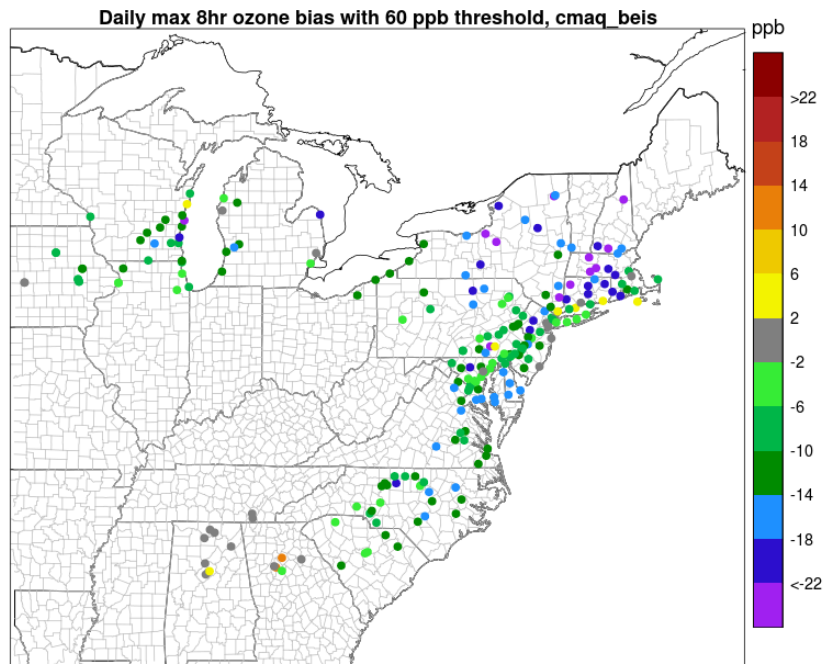
CMAQ_MEGAN - OBS

Daily Maximum 8hr Ozone Bias (60ppb Threshold)
May 26, 2016

CAMx_BEIS - OBS
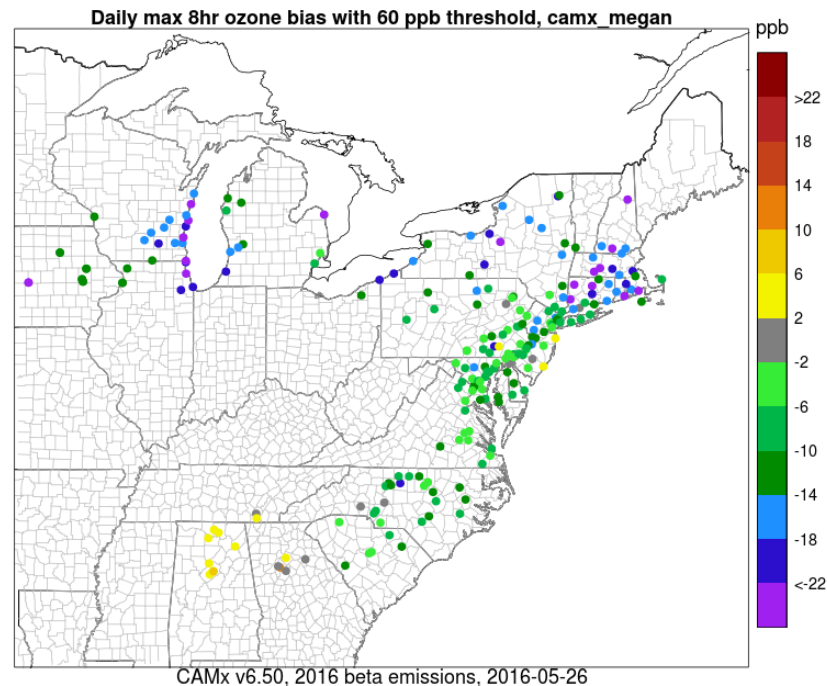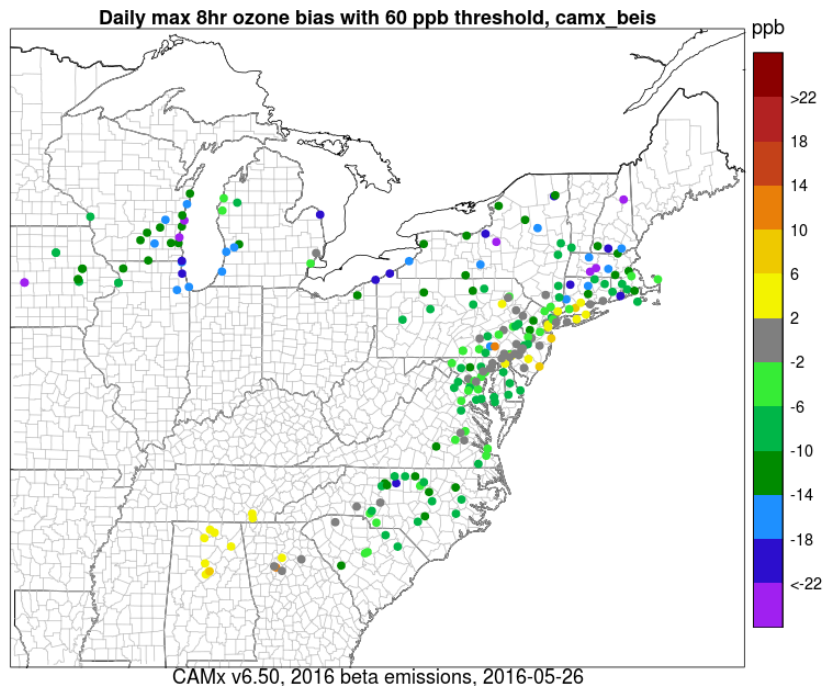
CAMx_MEGAN - OBS

Daily Maximum 8hr Ozone Bias (60ppb Threshold)
July 22, 2016

CMAQ_BEIS - OBS

CMAQ_MEGAN - OBS

Daily max 8hr ozone bias with 60 ppb threshold, cmaq_beis

CMAQ v5.2.1, 2016 beta emissions, 2016-07-22

Daily max 8hr ozone bias with 60 ppb threshold, cmaq_megan

CMAQ v5.2.1, 2016 beta emissions, 2016-07-22

Daily Maximum 8hr Ozone Bias (60ppb Threshold)
July 22, 2016

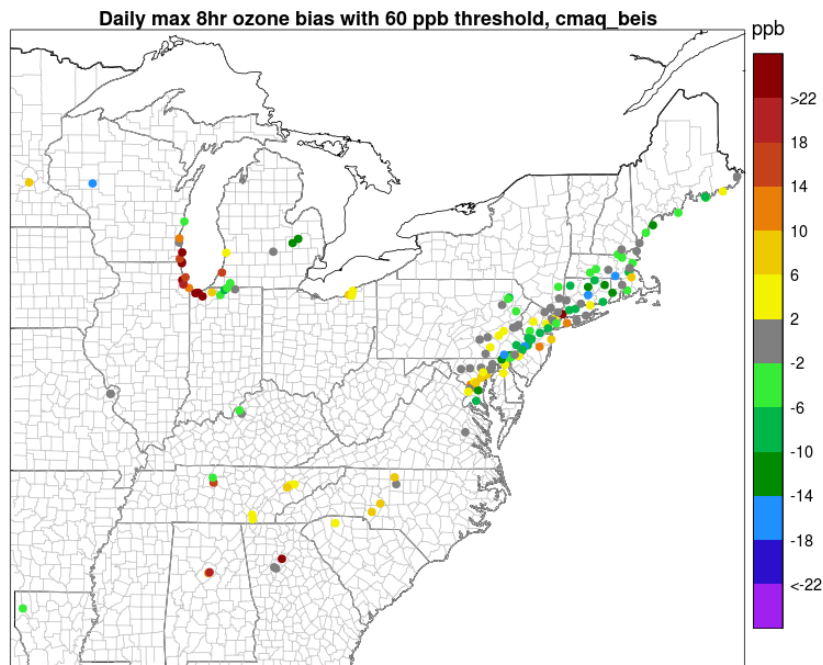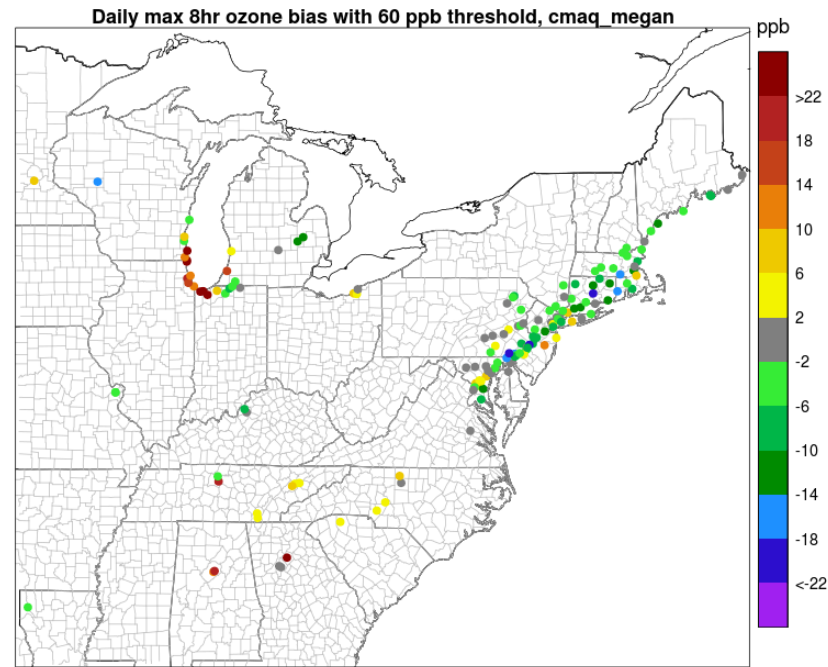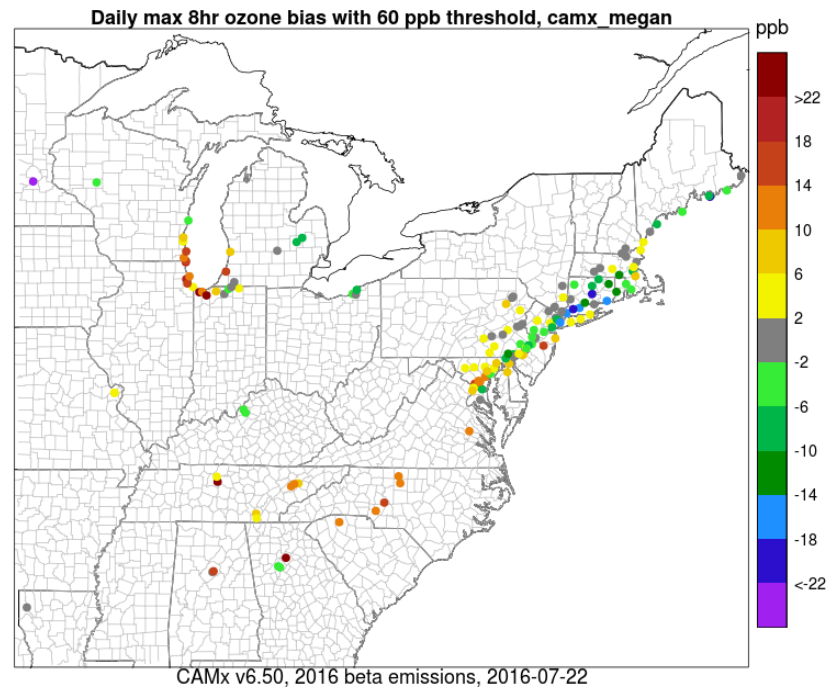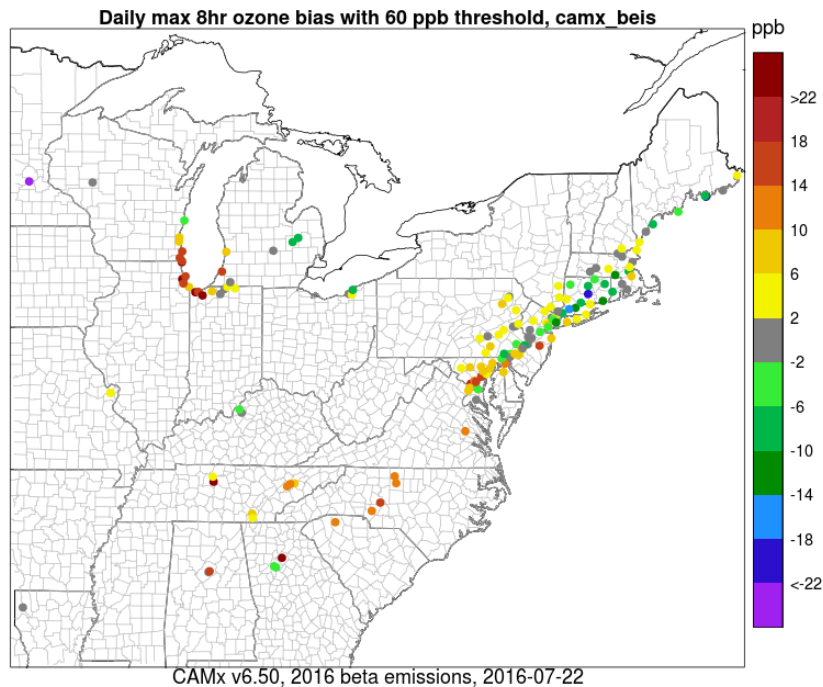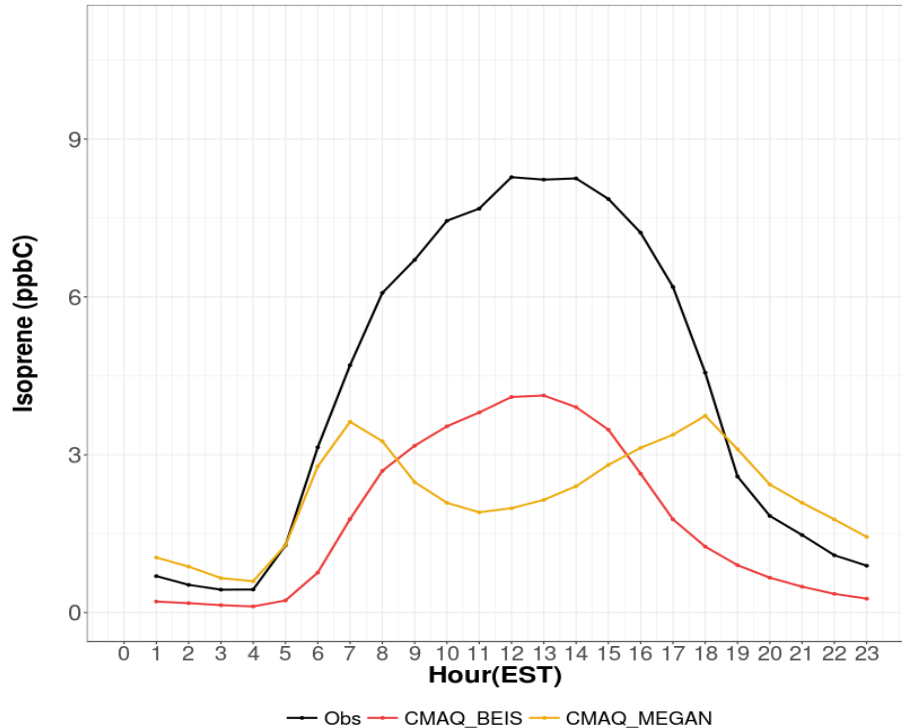### CAMx_BEIS - OBS

CAMx_MEGAN - OBS

Daily max 8hr ozone bias with 60 ppb threshold, camx_beis

CAMx v6.50, 2016 beta emissions, 2016-07-22

Daily max 8hr ozone bias with 60 ppb threshold, camx_megan

CAMx v6.50, 2016 beta emissions, 2016-07-22

Average Diurnal Isoprene Concentration (ppbC)

Jun - August, 2016 (Pfizer Labs, NY)
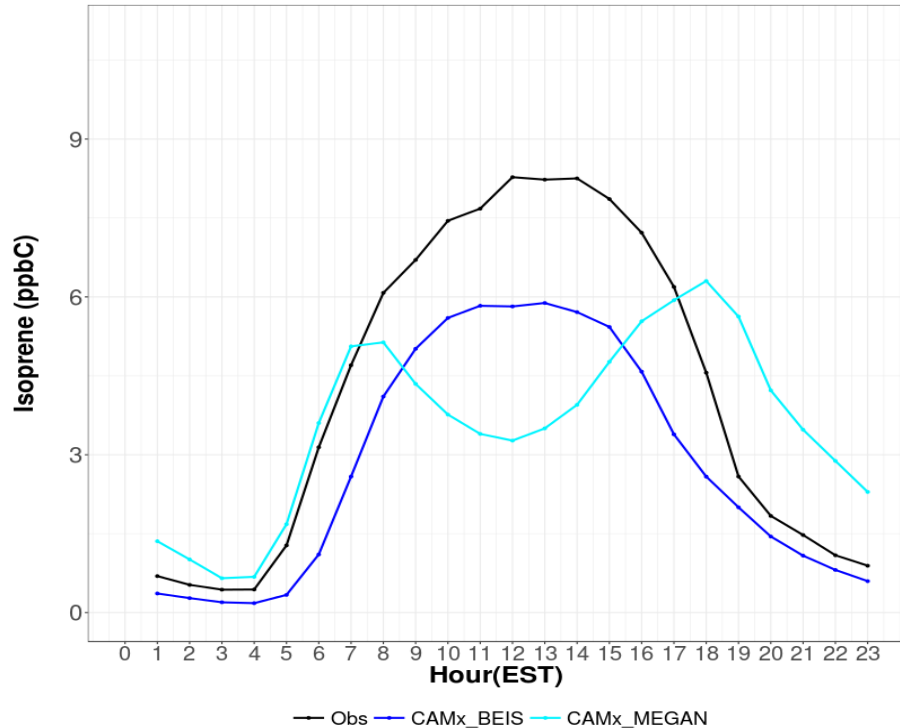
Average Diurnal Isoprene Concentration (ppbC)

Jun - August, 2016 (South DeKalb, GA)

CMAQ_BEIS/MEGAN
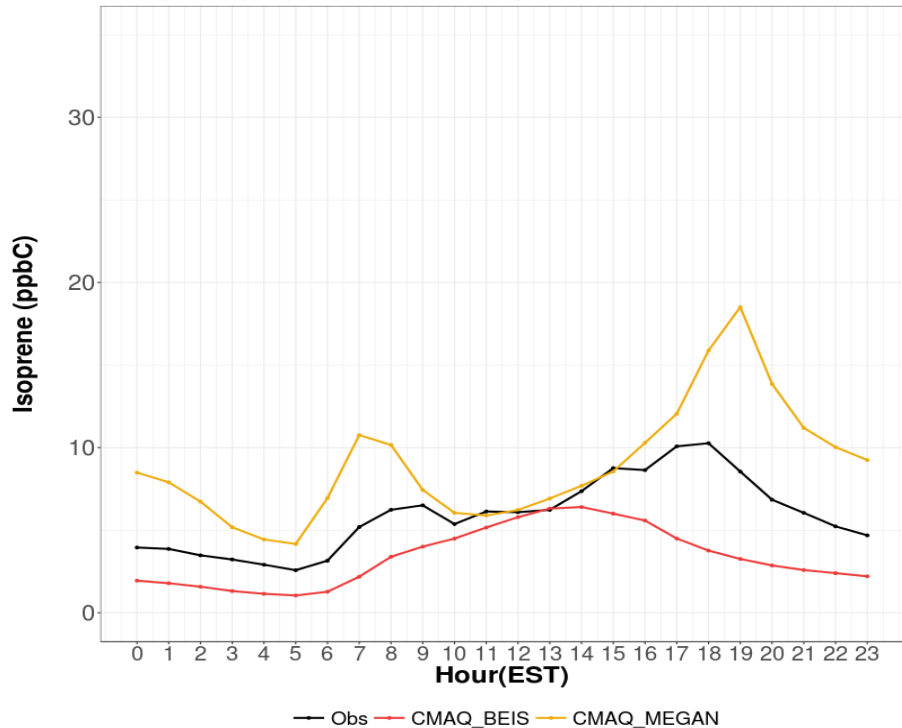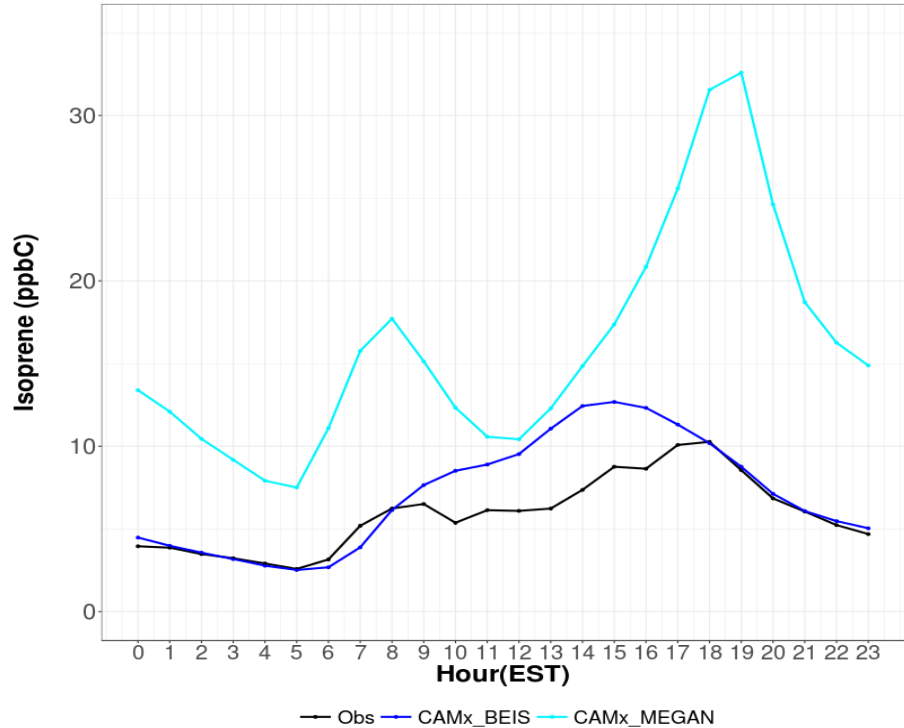
CAMx_BEIS/MEGAN

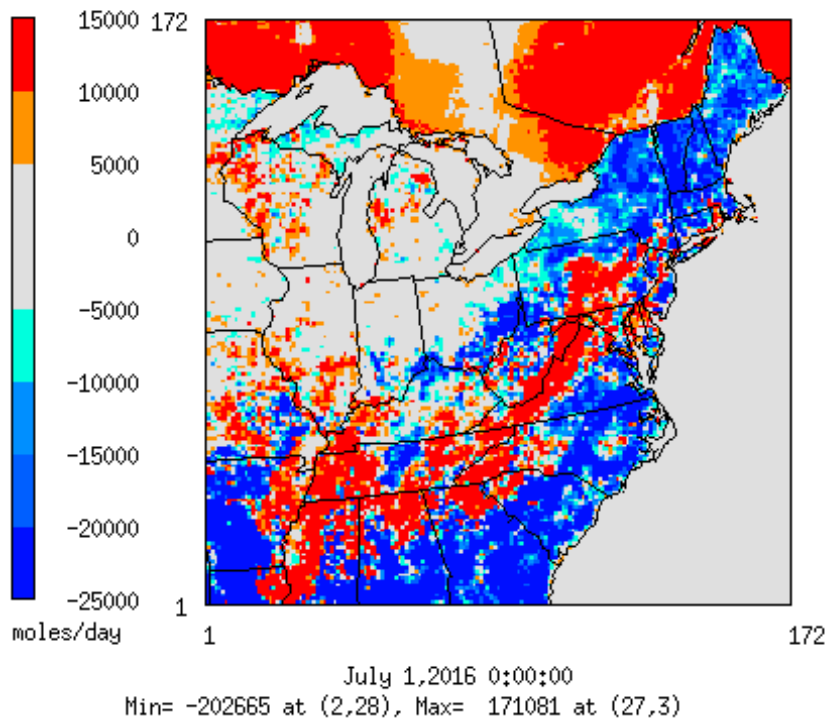# Difference in Daily Biogenic Isoprene Emissions

BEIS v3.61 – MEGAN v3.0 (July 2016)

BEIS > MEGAN warm colors

BEIS < MEGAN cool colors

July 1,2016 0:00:00
Min= -202665 at (2,28), Max= 171081 at (27,3)

BEIS & MEGAN Isoprene Emissions & Daily Maximum 8hr Ozone Concentration at Pfizer Lab NY (May – Aug 2016)

BEIS/MEGAN Isoprene Emissions
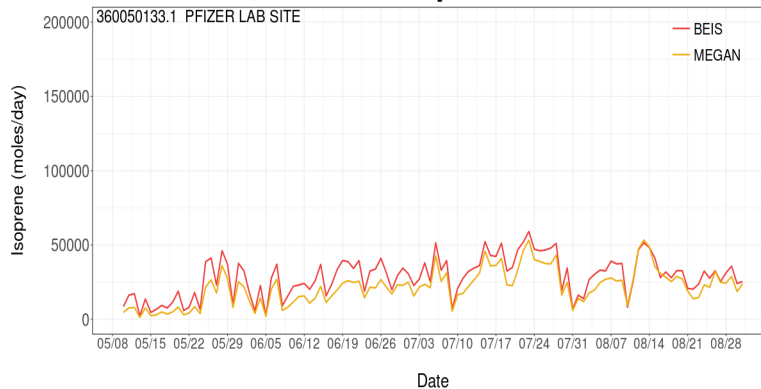
MDA8 Ozone with CMAQ_BEIS/MEGAN

MDA8 Ozone with CAMx_BEIS/MEGAN
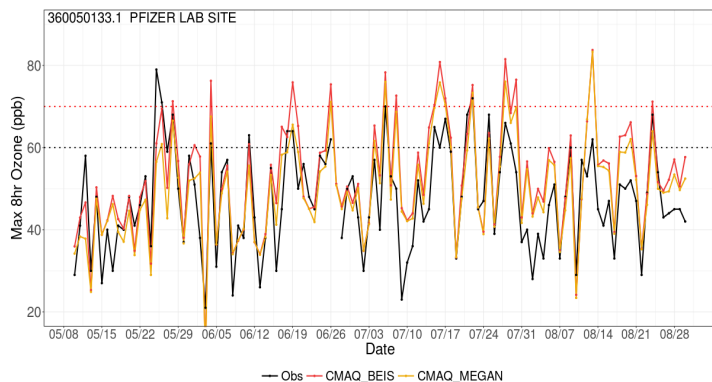
BEIS & MEGAN Isoprene Emissions & Daily Maximum 8hr Ozone Concentration at South DeKalb GA (May – Aug 2016)
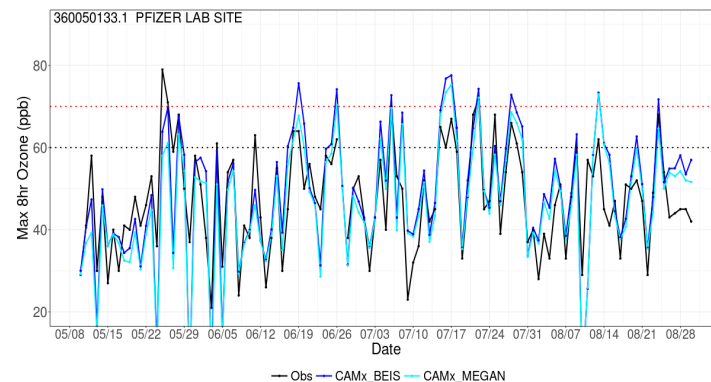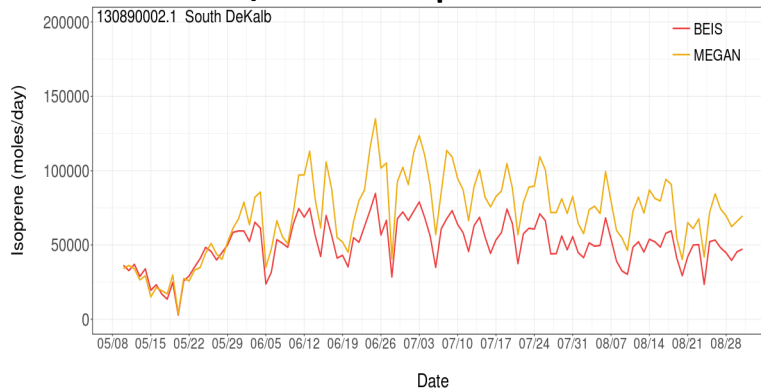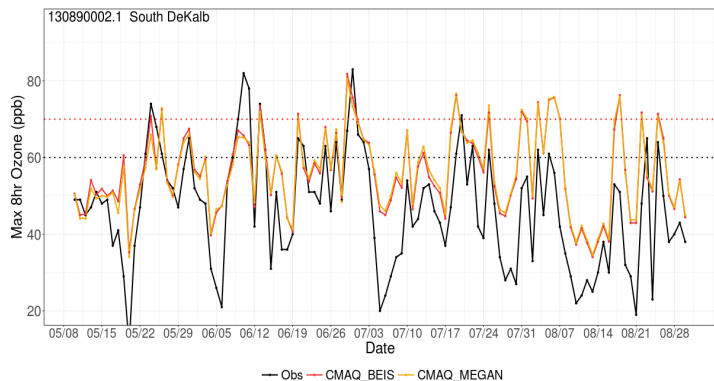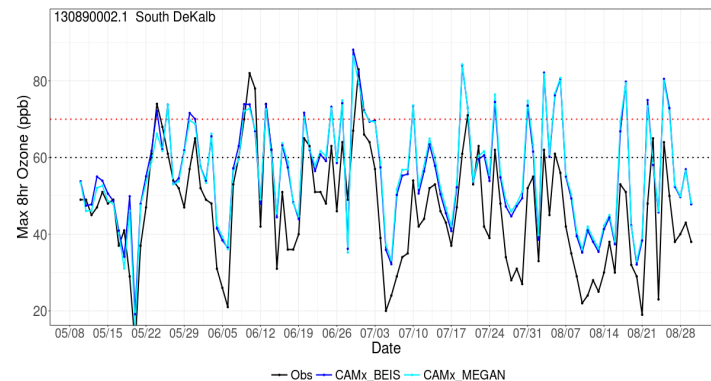

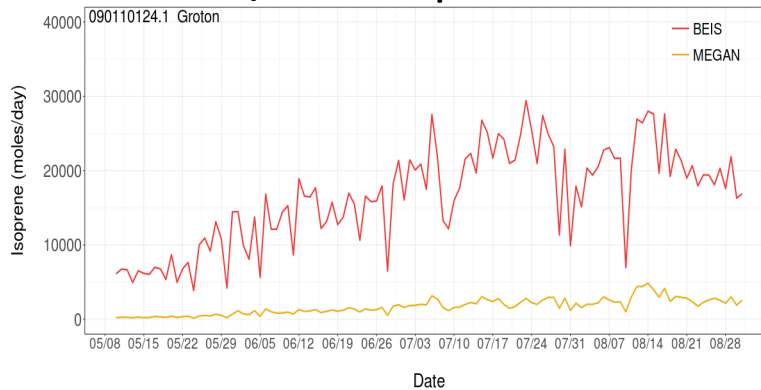BEIS/MEGAN Isoprene Emissions

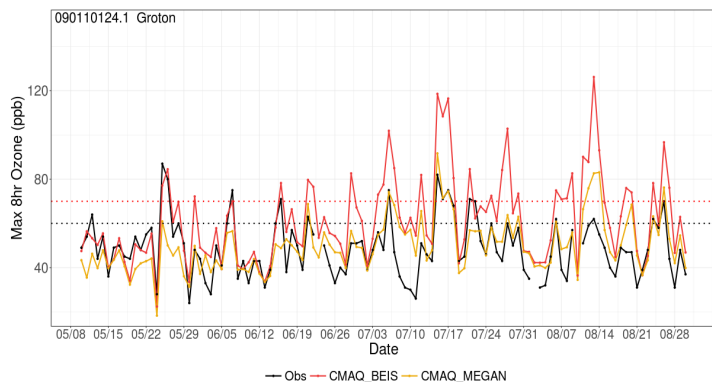MDA8 Ozone with CMAQ_BEIS/MEGAN

MDA8 Ozone with CAMx_BEIS/MEGAN

BEIS & MEGAN Isoprene Emissions & Daily Maximum 8hr Ozone Concentration at Groton CT (May – Aug 2016)
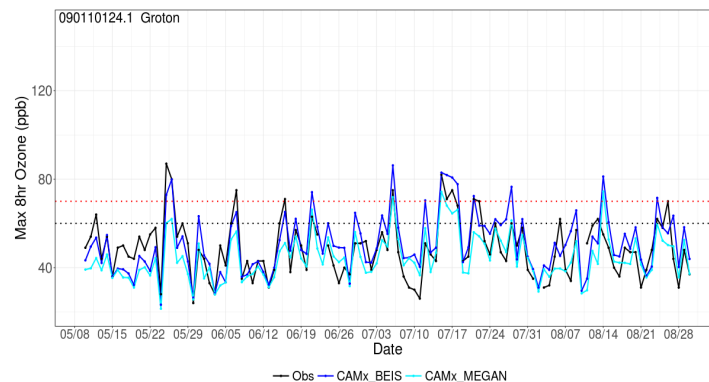
Conclusions

- In general, both AQ models using both biogenic inventories underpredict ozone in May & June and overpredict in July & August.

- On average, for the NAA areas examined, ozone predictions using BEIS are higher than when using MEGAN and this is even more so on high ozone days (with 60 ppb threshold). However, site to site and day to day results can be highly variable.

- For some areas, the difference in BEIS/MEGAN emissions does not impact predicted ozone significantly. However, some monitors in coastal locations along the Long Island Sound do show significant differences in predicted ozone.

- BEIS emissions of isoprene are higher than those from MEGAN in Canada and over the Appalachians during the summer months.

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Future Work

- Continue examining differences in AQ model results with biogenic inventories.

- Conduct a similar analysis with EGU inventories EPA/ERTAC.

- Continue modeling workgroup activities with Version 1 platform, BY and FY modeling, RRF calculations, source apportionment, etc. etc.

Additional Information

- More plots and maps from this analysis:

    https://www.ladco.org/technical/modeling-results/2016-inventory-collaborative/#2016beta

- 2016 Beta Emissions and Ancillary Data:

    ▪ Standardized plots available from LADCO -

    https://www.ladco.org/technical/modeling-results/2016-inventory-collaborative/#2016beta

    ▪ Interactive Mapping/Chart Tool from IWDW -
    http://vibe.cira.colostate.edu/iwdwx/Emissions/2016EMP

Thank You

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