



A TEXAS BIOGENIC MODEL SHOWDOWN

Biogenic emission inventories were developed for May through September 2012 using the Model of Emissions of Gases and Aerosols from Nature (MEGAN) 2.10 and Biogenic Emission Inventory System (BEIS) 3.61 for Texas State Implementation Plan photochemical modeling. Results from both models were evaluated for isoprene and ozone performance. June 2012 results are shown here as a representative month.

MODEL CONFIGURATIONS

MEGAN 2.10 and BEIS 3.61 were run for May through September 2012 using the same WRF 3.7.1 configuration. The Comprehensive Air Quality Model with extensions (CAMx) was run with each biogenic emission inventory.

MEGAN was configured with the latest emission factors and plant functional type (PFT) data, developed in 2015 (AQRP, 2015). The 2015 aircraft-based isoprene emission factor is approximately 50% of the default 2011 factor. Leaf Area Index data was created from the MCD15A2 MODIS product with urban corrections (Ying et al, 2015).

BEIS was configured with EPA's Modeling Platform 2011v6_v3, which used the BELD4 land-use, CB05 speciation, and default emission factors.

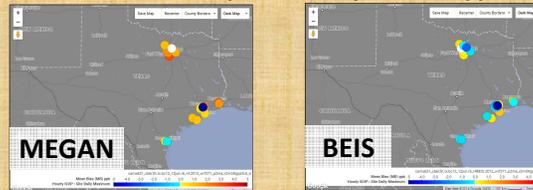
EMISSIONS

MEGAN consistently produced more isoprene emissions than BEIS in Texas during 2012. MEGAN generated emissions earlier and later in the day than BEIS, when low planetary boundary layer heights (PBL) appeared to exacerbate the difference in emission rates and concentrations.

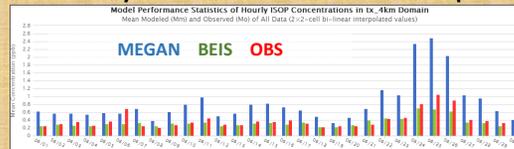
ISOPRENE PERFORMANCE

23 automatic Gas Chromatographs (auto-GCs) operated in 2012 that measured hourly isoprene and other volatile organic compounds. All auto-GCs were located in urban areas and/or near anthropogenic emission sources; a direct comparison to observed biogenic isoprene wasn't possible.

June 2012 Mean Isoprene Bias by Monitor (ppb)

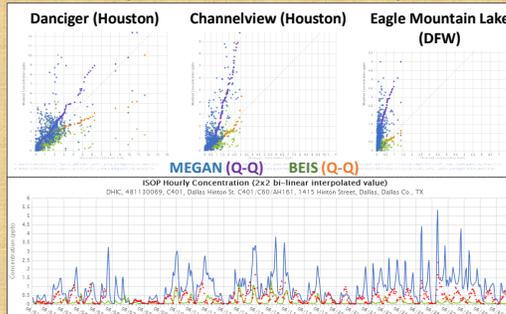


June 2012 Daily Mean Modeled vs Observed Isoprene (ppb)



MEGAN results typically over-predicted isoprene concentrations at Texas auto-GCs while BEIS results showed better agreement (maps and bar chart above).

June 2012 Hourly Modeled vs Observed Isoprene Scatter (ppb)

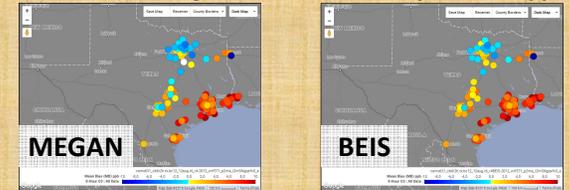


Results at individual monitors varied but BEIS generally performed better. MEGAN performed the best at monitors with the highest observed isoprene.

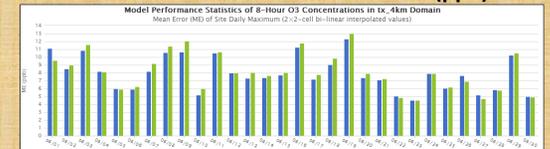
OZONE PERFORMANCE

Over 100 Texas ozone monitors operating in 2012 were used to evaluate CAMx photochemical model output. While there was a large mean difference in isoprene concentrations between MEGAN and BEIS, mean ozone concentrations were similar as shown in the bias maps below.

June 2012 Mean Eight-Hour Ozone Bias by Monitor (ppb)



June 2012 MDA8 Ozone Mean Error (ppb)



CAMx with MEGAN performed better than BEIS according to maximum daily eight-hour ozone (MDA8) results by monitor for all days.

June 2012 MDA8 Ozone ≥ 60 ppb Mean Error (ppb)



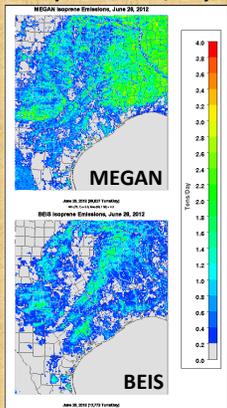
CAMx results with BEIS performed better than MEGAN on high ozone days when observed MDA8 was ≥ 60 ppb.

CONCLUSIONS

MEGAN consistently over-predicted isoprene concentrations throughout Texas in 2012, with higher emission rates in the morning and evening. BEIS produced isoprene concentrations similar to observed and CAMx ozone results showed better agreement on the important high ozone days.

June 26, 2012

Isoprene Tons/Day



June 26, 2012

Diurnal Emissions vs Concentrations

