Isoprene and monoterpene emissions are among the most significant biogenic volatile organic compounds (BVOCs) emitted globally each year.1

Annual biogenic emissions in Texas rank first within the continental U.S. in the 2011 National Emissions Inventory.

Texas has a highly diverse land use/land cover profiles over its ten climate regions.

Land cover characterization is an essential driving variable that determines the phenological emission potential of a region in biogenic emission models.

**Research Objectives**

- This work investigated the influences of land cover characterization on estimates of isoprene and monoterpene emissions using the MODIS global land cover product (MCD12Q1) and a regional product developed by Popescu et al.1 for the Texas Commission on Environmental Quality (TCEQ).
- Simulations with the Model of Emissions of Gases and Aerosols from Nature (MEGAN) were conducted for eastern Texas (Fig. 1) and influences on the standard emission potential (SEP) and emission activity factor were explored both separately and simultaneously.

**MODIS and TCEQ Land Cover Products**

- **MODIS Land Cover Product (MCD12Q1)**
  - The MODIS product (MCD12Q1) provides five types of land cover schemes at annual time steps and 500-m spatial resolution since 2001. Type 3 is the LAI/IPAR biome scheme and was used for comparisons with TCEQ data.
  - The plant functional type (PFT) scheme Type 5 was mapped to MEGAN’s default 16 PFT scheme.
- **TCEQ Land Cover Product**
  - The TCEQ regional land cover product was developed by combining three existing databases from the Landscape Fire and Resources Management Planning Tools Project (LANDFIRE), 2001 National Land Cover Dataset (NCLD), and Texas Parks and Wildlife Department Texas Ecological System Classification Project. This product consisted of 36 land cover categories with a spatial resolution of 30 m.

**MEGAN Configuration**

Isoprene/monoterpene emissions were calculated as:

\[ F = \gamma \sum \varepsilon_j \chi_j \]

where \( \varepsilon \) is the basal emission factor for vegetation type \( j \) with fractional coverage \( \chi \) within a model grid; \( \gamma \) is the overall emission activity factor that accounts for variations in environmental conditions. The standard emission potential (SEP) is used in replacement of the summation term. The MEGAN configuration follows the approach of Huang et al.9

Three sets of simulations were conducted for March-October during 2006-2011, with a focus on the Standard Emission Potential, emission activity factor, and both.

**Isoprene/Monoterpene Emissions**

In central Texas, the significantly lower (by as much as 90%) isoprene and monoterpene emissions generated from the MODIS product compared to the TCEQ product were primarily due to differences in the SEPs associated with differences in land cover characterizations. Relative differences in East Texas ranged from -35% to 45%. Even when the products predicted similar area-averaged monthly emissions, substantial differences could exist spatially.

**Conclusions**

Large discrepancies exist in some areas of eastern Texas between the MODIS MCD12Q1 global and regional TCEQ land cover products. Isoprene and monoterpene emissions differ by as much as a factor of ten in central Texas due to different PFT distributions. Influences of land cover characterization on biogenic emissions are dominated by differences in SEPs that are PFT-dependent. Improved validation of land cover products at regional scales or use of prescribed emission factor maps from in-situ measurements could reduce uncertainties in modeled biogenic emissions.

**References**