Influences of Drought on Biogenic VOC Emissions

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Motivation

- Drought in US expected to increase

- BVOC emissions often dictate NOx:VOC

- BVOC still uncertain

- Direct and indirect impact from drought
Drought Impacts on BVOC Emissions

Drought →

- ↑ Temperature ↓ BVOC
- ↓ Photosynthetically Active Radiation ↑ BVOC
- ↓ Soil Moisture ↓ BVOC
- ↓ Leaf Area Index ↑ BVOC
Study Design

• Ensemble of MEGAN Runs
  – Summers 2005 and 2007
  – Meteorology from WRF
    • Pleim-Xiu Surface Physics
    • NCEP Observational Nudging
  – PAR from WRF or Satellite (UMD)
  – LAI for each year or 2001 -2010 average
    • MODIS monthly average LAI at 0.25° (BU)
    • Modeled daily values at 1.0° (Stockli)
Isoprene Emissions

July 2007 Isoprene Emissions
Average Daily Total

MODIS Landcover Categories

Legend:
- Water
- Evergreen Needleleaf Forest
- Evergreen Broadleaf Forest
- Deciduous Needleleaf Forest
- Deciduous Broadleaf Forest
- Mixed Forest
- Closed Shrublands
- Open Shrublands
- Woody Savannas
- Savannas
- Grasslands
- Permanent Wetlands
- Croplands
- Urban and Built-Up
- Cropland/Natural Vegetation Mosaic
- Snow and Ice
- Barren or Sparsely Vegetated
PDSI and T Influence on BVOC

July 2005 PDSI

July 2007 PDSI

WRF2007 – WRF2005


Temperature

Isoprene

Max value = 10.5034  Min value = -10.2917

Max value = 45.3432  Min value = -130.529
LAI Sensitivity to Drought

Leaf Area Index anomalies correlated to PDSI

Blue: Lower LAI in drought
White: No significant correlation to drought
Red: Higher LAI in drought
LAI Influence

BU

WRF2007, LAI2007 - WRF2007, LAIavg

Stockli

WRF2007, LAI2007 - WRF2007, LAIavg

Isoprene

LAI % Anomaly July 2007

BU

Stockli

LAI

LAI % Anomaly July 2007
PAR: Satellite v WRF

Satellite PAR
PPFD July 2007

Model PAR
PPFD July 2007

Satellite and Ground Observations of Insolation

Ground observations from SURFRAD 6

Satellite from UMD satellite PAR dataset

Model PAR from WRF run
Conclusions

BVOC estimates are most influenced by:

• Temperature

• Choice of LAI dataset

• Source of PAR data
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