

## Primary Motivation

Improve Air Quality Forecasts

Data from Intensive Field Campaigns <--> Modeling Community

- 1) Processes/mechanisms (e.g. organic aerosol formation)
- 2) Emissions (e.g. emission inventory validation)

## The approach within CSD

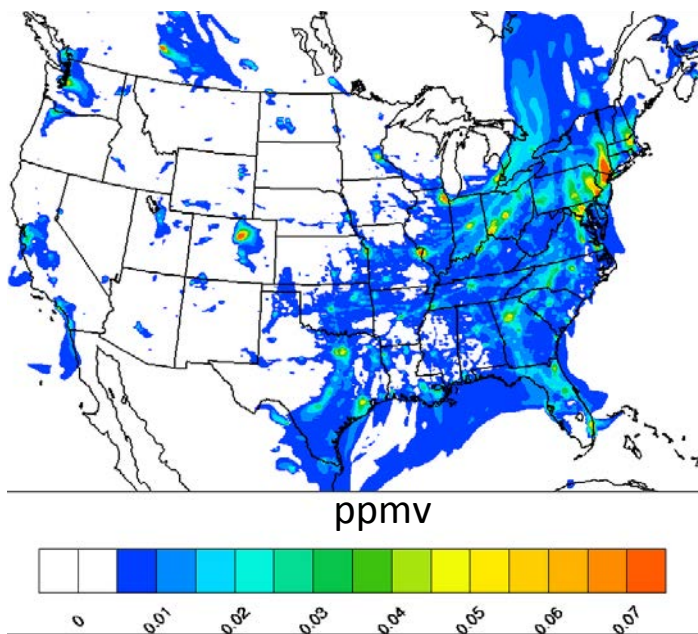
Close collaboration with NOAA Air Quality Forecast Groups

Address AQ forecast model deficiencies

Quantify the impact of CSD observations within models

## Air Quality Forecast Model Support within ESRL

10 meter NO<sub>x</sub>, 17:00 MST, 2/24/15



Real-time ESRL forecasts:

**WRF/Chem** [http://ruc.noaa.gov/wrf/WG11\\_RT/](http://ruc.noaa.gov/wrf/WG11_RT/)  
(WRF – Weather Research Forecast Model)

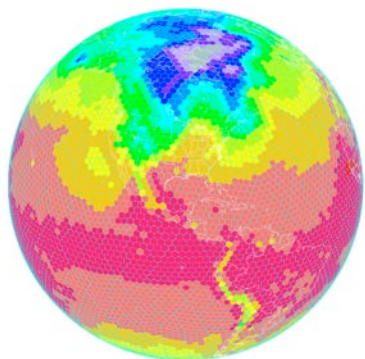
- “Online” or “Inline” coupled model
- ~2000 registered users world-wide
- Developed and maintained at ESRL (Global Systems Division)
- Open source, WRF repository system at NCAR

**WRF/Chem is The Operational Model at the Air Force Weather Research Agency**

- Photochemistry – mechanism development/upgrades
- Aerosol chemistry and physics (Ahmadov et al., 2012)
- CSD provides North American emissions
- Evaluations using data from:
  - NOAA sponsored field campaigns
  - U.S. EPA monitoring networks
  - NASA satellite data

[CSD contributions to WRF/Chem](#)

# Air Quality Forecast Model Support within ESRL



Real-time ESRL forecasts:

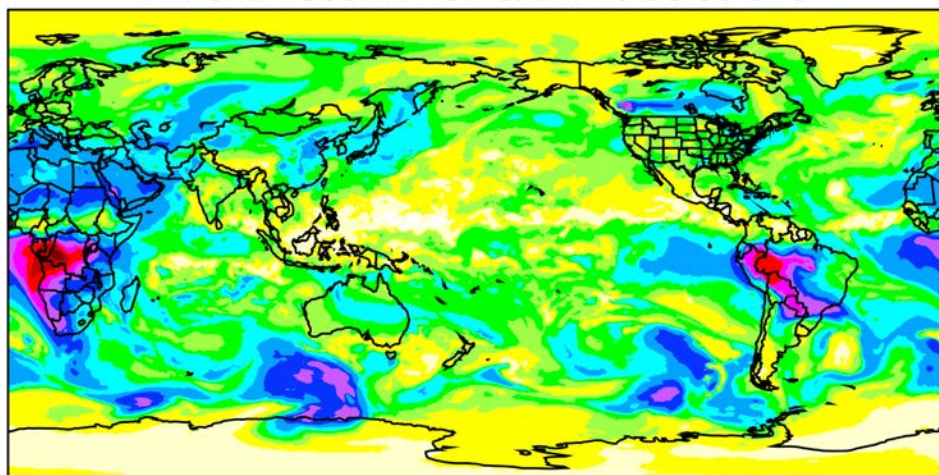
<http://fim.noaa.gov>

## FIM/Chem, NOAA/ESRL/GSD (FIM – Flow-following finite-volume Icosahedral Model)

- Global, 14 day, PM2.5 Aerosol Forecasts
- 6-year Air Force collaboration (WRF/Chem and FIM/Chem)
- Current NCEP sponsored Research-to-Operations initiative support

## CSD contributions to FIM/Chem

FIM-CHEM 550nm AOD 8/21/10 00:00 UTC



- 7.29
  - 5.02
  - 2.85
  - 1.62
  - 0.92
  - 0.52
  - 0.30
  - 0.17
  - 0.10
  - 0.05
  - 0.03
  - 0.02
  - 0.01
- Aerosol optical properties (real-time)
  - Evaluations using AERONET data
  - Evaluations using CSD aircraft data
- ### Current R2O project with GSD
- Photochemistry within FIM/Chem
  - Ahmadov et al. (2012) aerosol
  - Global emissions
  - Evaluations

# North American Emissions used in AQ forecasts

CSD provides North American emissions for photochemical models

<ftp://aftp.fsl.noaa.gov/divisions/taq/>

Currently - NEI-2011 (version 1)

Gridded 4km resolution, hourly, Weekday, Saturday and Sunday

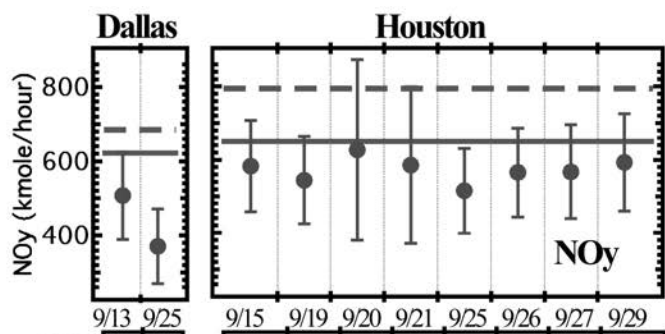
Criteria pollutants, ~50 VOC species, 19 PM2.5 species

Used by WRF/Chem community, universities,....

CSD observations are used to assess emissions inventories

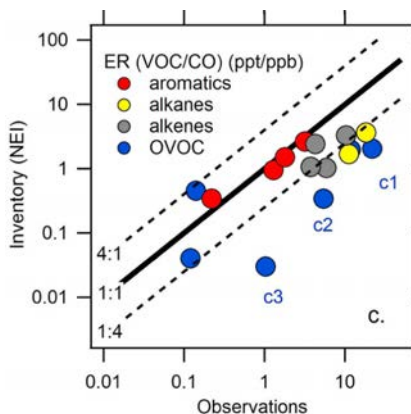
## TEXAQS-2006 (NEI-99)

McKeen et al. (2009)



## CALNEX-2010 (NEI-05)

Borbon et al. (2012)



## UBWOS-2013 (NEI-2011)

Ahmadov et al. (2015)

Inventory source	CH <sub>4</sub> (tons/year)	VOC (tons/year)	NO <sub>x</sub> (tons/year)
EPA NEI-2011	111,000	112,000	18,100
CSD observations	531,000	203,000	4,580

Using CSD based emission information yields improved AQ forecasts

Kim et al. (2011)

Brioude et al. (2013)

Ahmadov et al. (2015)

# Important Stakeholders

## Development and Support for WRF/Chem and FIM/Chem:

WRF and WRF/Chem research communities  
U.S. Air Force

## North American emissions inventory data:

WRF/Chem community  
Universities, Federal Agencies

## Inventory Evaluations:

U.S. EPA  
Individual States (Texas, California, Utah)  
NOAA National Center for Environmental Prediction AQ Forecast Program

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Air Force Weather Research Agency