Temporal Allocation Module Development in EMF

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Why Do We Need TA?

- Inventory time step varies by sector: hourly, daily, month-specific average day, annual

- States need to be able to create State Implementation Plan (SIP) inventories with a consistent time step across inventory sectors: e.g., weekday/weekend, ozone season

- Currently use SMOKE modeling system and/or other post-processing scripts to develop weekday/weekend/ozone season inventories

- Need a tool for states to apply the time step of their choice to any inventory
What is Temporal Allocation?

Base Year Inventories → Temporal Profiles → Daily/Hourly Inventories
How to Convert Emissions?

- Convert a finer resolution to a coarser one
  - Daily totals → monthly totals or episodic average day
  - Sum emissions for appropriate days, divide by number of days for average day value

- Convert a coarser resolution to a finer one
  - Annual totals → monthly totals or daily totals
  - Need to estimate how the emissions will vary through time
What is EMF?

- **Emissions modeling**
  - Emissions inventories → hourly, gridded, chemically speciated emissions estimates
  - Create input for air quality models (CMAQ and CAMx)

- **Software system designed specifically to help with the process of emissions modeling**
  - Manage emissions data files
  - Organize data files and track changes to data
  - Create summaries and comparisons of inventories
  - Share with other users
  - Developed by OAQPS US EPA
How the EMF works

- The EMF client application runs on your local computer.
- The client application communicates with the remote EMF server.
- The remote EMF server stores the emissions data and does the number crunching.
- MARAMA installed the EMF server on Amazon Web Service (AWS).
EMF GUI

EMF Username: admin

EMF Password: ********

Log In  Cancel

Register New User  Reset Password
Temporal Allocation Module

- Designed to help with analysis of inventory emissions
- Convert your inventory data to various temporal resolution periods:
  - Estimate monthly, daily, or episodic totals from annual values
  - Sum up or daily totals for different periods throughout the year
- Same Temporal Allocation Method used in SMOKE modeling system
- Comparable results between EMF TA and SMOKE
- More Flexible Summing/Averaging Methods than SMOKE
### Temporal Allocation Manager

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<th>#</th>
<th>Select</th>
<th>Name</th>
<th>Resolution</th>
<th>Start Day</th>
<th>End Day</th>
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<th>Run Status</th>
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Summary Tab

Name: August 2011 ptegu analysis - cas
Description: Calculate average day VOC emissions for weekends in the first half of August 2011 for the ptegu sector
Project:
Last Modified Date: 12/07/2014 16:32
Creator: Catherine Seppenea

Results
Run Status: Not started
Start Date: Not started
Completion Date: Not started

Save  Run  Refresh  Close
Inventory Tab
Inventory Input Resolution

- Inventory contains emissions data at different temporal resolutions
  - Annual Total (tons/year)
  - Monthly total (tons/month)
  - Monthly Average Day: Monthly total divided by the number of day in the month
  - Daily Totals
  - Hourly Totals (not supported by the Temporal allocation module)

- Supporting FF10 and ORL formats only
Inventory Tab: View Data
### Inventory Tab

A screenshot of the Data Viewer interface shows a table with columns for various data fields, including `COUNTRY_CD`, `REGION_CD`, `TRIBAL_CODE`, `FACILITY_ID`, `UNIT_ID`, `REL_POINT_ID`, `PROCESS_ID`, `AGY_FACILITY_ID`, `AGY_UNIT_ID`, and `AGY_REL_ID`. The table is sorted and filtered, indicating that the current view is showing a subset of the data. The interface also includes options for sorting, filtering, and pagination.
Temporal Resolution
Temporal Output Options

Resolution: Choose an output resolution
- Daily total (tons/day)
- Episodic average (tons/day)
- Episodic total (tons/episode)
- Episodic weekday average (tons/day)
- Episodic weekend average (tons/day)
- Monthly average (tons/day)
- Monthly total (tons/month)
Profile Tab

The image shows a user interface with various tabs and sections, including:

- **Summary**
- **Inventories**
- **Time Period**
- **Profiles**
- **Output**

Each section has options for selecting datasets and viewing properties or data. The current selected dataset for each category is "Not selected."
Temporal Profiles

- Temporal Profiles are estimates of how emissions vary for different time periods.

- Consider a year-to-month temporal profile.
  - 12 factors (between 0 and 1) indicating how much of the annual total to allocate to each month.
  - If each factor is 0.0833 (1/12), then the emissions will be evenly distributed to each month.
  - If July factor = 1.0 and all other = 0.0, then all emissions allocated to July.
Example Monthly Profiles
Types of Temporal Profiles

- Monthly estimates use
  - Year-to-Month profiles: 12 factors per year

- Daily estimates can use either:
  - Month-to-Day profiles: 31 factors per month
  - Week-to-Day profiles: 7 factors per week

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Temporal Profiles Assignments

- Different sources will use different temporal profiles based on the source’s activity or location.

- Temporal profiles assigned to sources via a cross-reference dataset.

- Cross-reference dataset allows:
  - Geographic region (FIPS code)
  - Source type (SCC)
  - Pollutant
  - Point-source characteristics (facility ID, emission unit ID,..)
## X-Reference Data Viewer

![Data Viewer](image)

### Dataset: Gentpro_TREF_HOURLY_BASH_NH3_agNH3_bash_2011ea_11f_newgent_emf_txt_06sep2013_nf_v4_tref.csv

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Execution

![Image of a software interface for temporal allocation with datasets and version selection for Cross Reference Dataset, Year-to-Month Profile Dataset, Week-to-Day Profile Dataset, and Month-to-Day Profile Dataset. The interface includes buttons for Save, Run, Refresh, and Close.]
Types of Outputs

- A run creates up to three output datasets
  - Monthly results, daily results, and episodic results

- EMF Dataset Types
  - Temporal Allocation Monthly Result
    - Total and average day emissions for each source, pollutant, and month
  - Temporal Allocation Daily Result
    - Total emissions for each source, pollutant, and day
  - Temporal Allocation Episodic Result
    - Total and average day emissions for each source and pollutant across the episode
## Output Files

![Image of the Edit Temporal Allocation window with selected output files]

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3 rows: 4 columns: 1 Selected [Filter: None, Sort: None]
Output Files

![Data Viewer](image)

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Resources

EMF Webinar Training

**Advanced SQL for EMF (February 2015)**
- Presentation

**How to Grow and Control Inventories (January 2015)**
- Presentation
- Inventory Projection User's Guide
- Inventory Projection Tutorial

**EMF Temporalization Tool (December 2014)**
- Video of Webinar (YouTube video) *Will be posted at a later date.*
- Presentation
- Tutorial
- Temporalization Tool Users Guide

**SQL for EMF (November 2014)**
- Webinar presentation
- Tutorial
- SQL Reference Guide

**EMF Basics - Part 2 (October 2014)**
- Video of Webinar (YouTube video) *Will be posted at a later date.*
- Presentation
- Tutorial
- Example Queries

**EMF Basics - Part 1 (September 2014)**
- Video of Webinar (YouTube video) *Will be posted at a later date.*
- Presentation
- Tutorial
- Example Queries
Ongoing Project

- Enabling the “Case Manager” module that allows users to run SMOKE modeling system as a main goal of Emission Modeling support

- Setting up the MOVES2014 runs on AWS and executing SMOKE-MOVES2014 Integration tool run through the EMF server on AWS
Acknowledgement

- **MARAMA**
  Julie McDill and Susan McCusker

- **OAQPS, US EPA**
  Alison Eyth and Darin Del Vecchio

- **UNC Institute for the Environment**
  Catherine Seppenen and B.H. Baek
Why Do We Need TA Module?

- An Episode is a user-defined time period
  - Could represent ozone season, summer, winter, etc.
  - You specify the start and end date

- Within an episode, you can consider all days, weekdays, or weekends only
  - Weekend average: calculate average day emissions for each weekend day within the episode

- Currently use SMOKE modeling system or other post-processing scripts to develop daily/hourly inventories based on annual/monthly Inventories
Temporal Output Options

- Temporal Resolution
  - Daily total (tons/day)
  - Episodic average (tons/day)
  - Episodic total (tons/episode)
  - Episodic weekday average (tons/day)
  - Episodic weekend average (tons/day)
  - Monthly average (tons/day)
  - Monthly total (tons/month)

- Period Start and End Date and Time