SMOKE-MOVES2014 Integration Tool Development

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MOVES History

- MOVES2010 released on December 2009

- SMOKE-MOVES2010 released on July 2010

- MOVES2010a released on August 2010

- MOVES2010b released on June 2012

- MOVES2014 released on October 2014

- SMOKE-MOVES2014 released on September 2014 (as a part of SMOKEv3.6)

SMOKE-MOVES Integration Tool

- **RatePerDistance [grams/miles]**

  - Exhaust and most evaporative emissions that happen on real roadtypes

  - Requires Vehicle Mileage Travelled (VMT) activity inventory

- **RatePerVehicle [grams/vehicle/hour]**

  - Exhaust and most evaporative emissions that occur off-network

  - Requires Vehicle population (VPOP) activity inventory

- **RatePerProfile [grams/vehicle/hour]**

  - Vapor venting evaporative emissions that occur off-network

  - Requires Vehicle population (VPOP) activity inventory
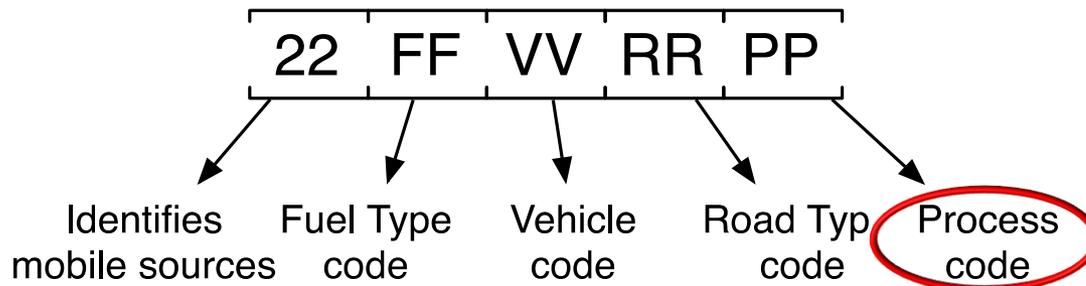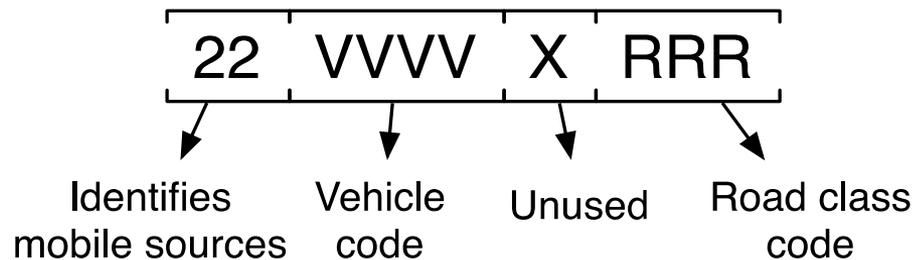
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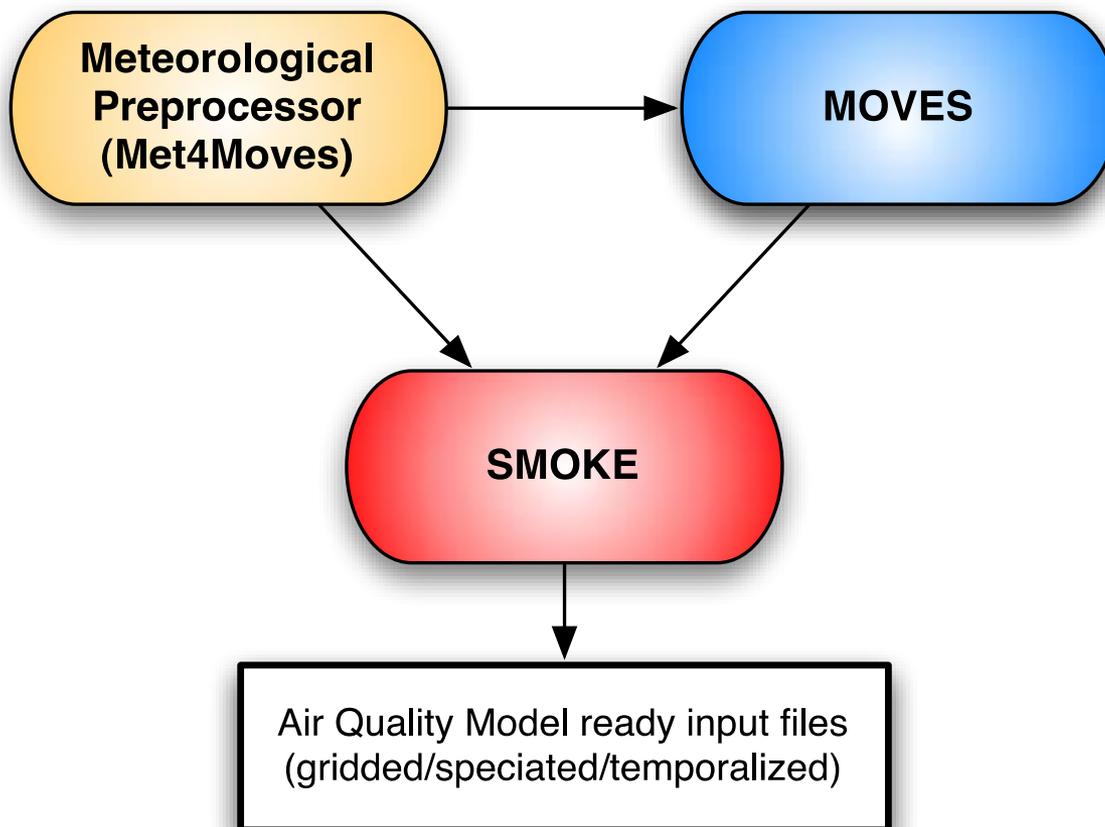
What is New in MOVES2014?

- **New Activity SCCs**
    - MOVES: 6 fuel types, 13 vehicle types, 9 road types, 15 process
    - No more process-specific pollutant name: EXH__CO, EVP__VOC,,,

- **Internal Chemical Speciation**
    - Internally compute air quality model species emissions rates

- **RatePerHour [grams/hour]**
    - Represents the APU operation and extended idling processes originally assigned to RatePerVehicle (RPV)
    - New number of operating hours "HOTELLING" activity data
    - SCC cross-reference input file [SCCXREF]

New MOVES2014 SCC ?

- Combination of fuel type, vehicle type, road type, and process

22	VVVV	X	RRR

Identifies mobile sources   Vehicle code   Unused   Road class code

22	FF	VV	RR	PP

Identifies mobile sources   Fuel Type code   Vehicle code   Road Type code   Process code

MOVES Fuel Type to SCC

MOVES Fuel Type	Description
01	Gasoline
02	Diesel
03	Compressed Natural Gas (CNG)
04	Liquefied Petroleum Gas (LPG)
05	Ethanol (E-85)
09	Electricity

SCC	Aggregated Fuel Type Description	MOVES Fuel Type
X1	All non-diesel fuels	01; 03; 04; 05; 09
X2	All gasoline and ethanol blends	01; 05
X3	All fossil fuels	01; 02; 03; 04; 05
00	All fuels	01; 02; 03; 04; 05; 09

MOVES Vehicle Type to SCC

MOVES Vehicle Type	Description
11	Motorcycle
21	Passenger Car
31	Passenger Truck
32	Light Commercial Truck
41	Intercity Bus
42	Transit Bus
43	School Bus

MOVES Vehicle Type	Description
51	Refuse Truck
52	Single Unit Short-haul Truck
53	Single Unit Long-haul Truck
54	Motor Home
61	Combination Short-haul Truck
62	Combination Long-haul Truck

SCC	Aggregated Vehicle Type Description	MOVES Vehicle Type
30	Light Duty Trucks	31; 32
40	Buses	41; 42; 43
70	All Heavy Duty Trucks and Buses	41; 42; 43; 51; 52; 53; 54; 61; 62
71	All Heavy Duty Trucks	51; 52; 53; 54; 61; 62
72	All Combination Trucks	61; 62
80	All Trucks and Buses	31; 32; 41; 42; 43; 51; 52; 53; 54; 61; 62
81	All Trucks except Buses	31; 32; 51; 52; 53; 54; 61; 62
00	All Vehicles	11; 21; 31; 32; 41; 42; 43; 51; 52; 53; 54; 61; 62

MOVES Road Type to SCC

MOVES Road Type	Description
01	Off-Network
02	Rural Restricted Access
03	Rural Unrestricted Access
04	Urban Restricted Access
05	Urban Unrestricted Access
06	Rural Restricted without Ramps
07	Urban Restricted without Ramps
08	Rural Restricted only Ramps
09	Urban Restricted only Ramps

SCC	Aggregated Road Type Description	MOVES Road Type
70	Freeway	02; 04
71	freeway except ramps	06; 07
72	Ramps	08; 09
80	Non-Freeway	03; 05
90	All On-network	02; 03; 04; 05
00	All on and off-network	01; 02; 03; 04; 05

MOVES Process

MOVES Process	Description
01	Running Exhaust
02	Start Exhaust
09	Brakewear
10	Tirewear
11	Evaporative Permeation
12	Evaporative Fuel Vapor Venting
13	Evaporative Fuel Leaks
15	Crankcase Running Exhaust
16	Crankcase Start Exhaust
17	Crankcase Extended Idle Exhaust
18	Refueling Displacement Vapor Loss
19	Refueling Spillage Loss
90	Extended Idle Exhaust
91	Auxiliary Power Exhaust
99	Well-to-Pum>Well-to-Pumpp

MOVES Process to SCC

SCC	Aggregated Process Type Description	MOVES Process Type
50	All Exhaust	1; 2; 15; 16; 17; 90; 91
51	All Exhaust except Hotelling	1; 2; 15; 16
52	All hotelling exhaust	17; 90; 91
53	All Extended Idle Exhaust	17; 90
60	All Evaporative and Refueling	11; 12; 13; 18; 19
61	All Evaporative except Refueling	11; 12; 13
61	All Evaporative except Refueling	11; 12; 13
62	All Refueling	18; 19
63	All Evaporative except Permeation and Refueling	12; 13
70	All Exhaust and Evaporative and Refueling	1; 2; 11; 12; 13; 15; 16; 17; 18; 19; 90; 91
71	All Exhaust and Evaporative except Refueling	1; 2; 11; 12; 13; 15; 16; 17; 90; 91
72	All Exhaust and Evaporative except Refueling and Hotelling	1; 2; 11; 12; 13; 15; 16
80	All Exhaust and Evaporative and Brake and Tire Wear except Refueling	1; 2; 9; 10; 11; 12; 13; 15; 16; 17; 90; 91
81	All Exhaust and Evaporative and Brake and Tire Wear except Refueling and Hotelling	1; 2; 9; 10; 11; 12; 13; 15; 16; 17
00	All Processes	1; 2; 9; 10; 11; 12; 13; 15; 16; 17; 18; 19; 90; 91

New Activity SCCs

- ◻ NEW Activity SCCs:

  - Non Process-specific SCCs for Activity Inventories

    - Ex: 2200307000, 2200818000

  - Process-specific SCCs for SMOKE-ready MOVES Lookup Tables

    - Ex: 221X307051, 2200818081

  - SMOKE-MOVES2014 needs to map between activity SCCs and full SMOKE SCCs

  - New SCC-mapping file [**SCCXREF**] introduced to convert Activity inventory SCCs to full SMOKE SCCs

MOVES2014 Chemical Speciation

- Pre-computed chemistry-specific model species emission factors outputs

- SMOKE-MOVES2014 integration tool is updated to support pre-computed model species ER from MOVES2014

- Bring back the traditional Chemical Speciation Profiles method in SMOKE modeling system

- SMOKE v3.6.5 will be released in April-May 2015

Emission Process vs Emission Rate

Emission Process	Type of Emission Rate (MOVES2010)	Type of Emission Rate (MOVES2014)
Running Exhaust	Distance	Distance
Start Exhaust	Vehicle	Vehicle **or** Start
Brakewear	Distance	Distance
Tirewear	Distance	Distance
Evaporative Permeation	Distance **and** Vehicle	Distance **and** Vehicle
Evaporative Fuel Vapor Venting	Profile	Profile
Evaporative Fuel Leaks	Distance **and** Vehicle	Distance **and** Vehicle
Crankcase Running Exhaust	Distance	Distance
Crankcase Start Exhaust	Vehicle	Vehicle **or** Start
Crankcase Extended Idle Exhaust	Vehicle	Vehicle
Refueling Displacement Vapor Loss	Distance **and** Vehicle	Distance **and** Vehicle
Refueling Spillage Loss	Distance **and** Vehicle	Distance **and** Vehicle
Extended Idle Exhaust	Vehicle	Vehicle **or** Hour
Auxiliary Power Exhaust	Vehicle	Vehicle **or** Hour

New RatePerHour Process Mode

- New Process Mode: **RatePerHour** (RPH) [grams/hour]

  - Represent extended idle and APU mode separated from RatePerVehicle (RPV) in MOVES2010

- New "**Hotelling**" Activity Inventory Data

  - Represents the hours of APU operation and extended idling

  - Non-mode specific SCCs

  - SCC cross-reference input file [SCCXREF]

- **RatePerStart** (RPS) is not processed separately in SMOKE-MOVES2014

SMOKE-MOVES2014 Optimization

- Increased no of SCCs

- Increased no of Pollutants + Species

- Computational time could be an issue for running a big no of grid cells

- Code Optimization has increased the computational time up to 2.5 times

- Processing Optimization: Perform a long modeling hours for each execution: High memory usage
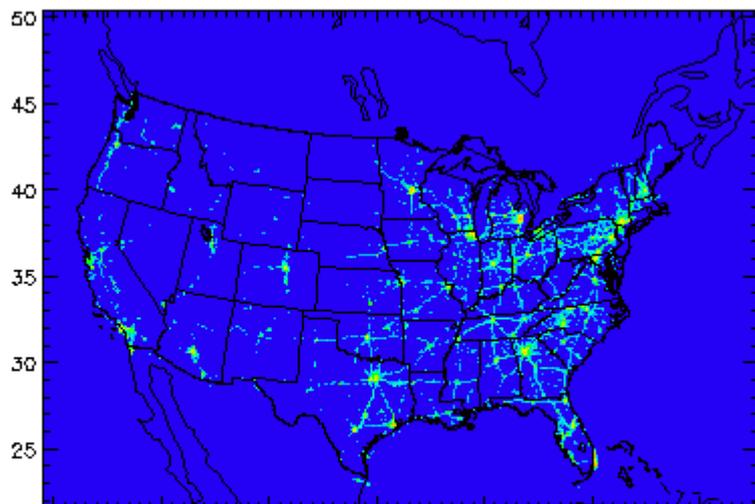
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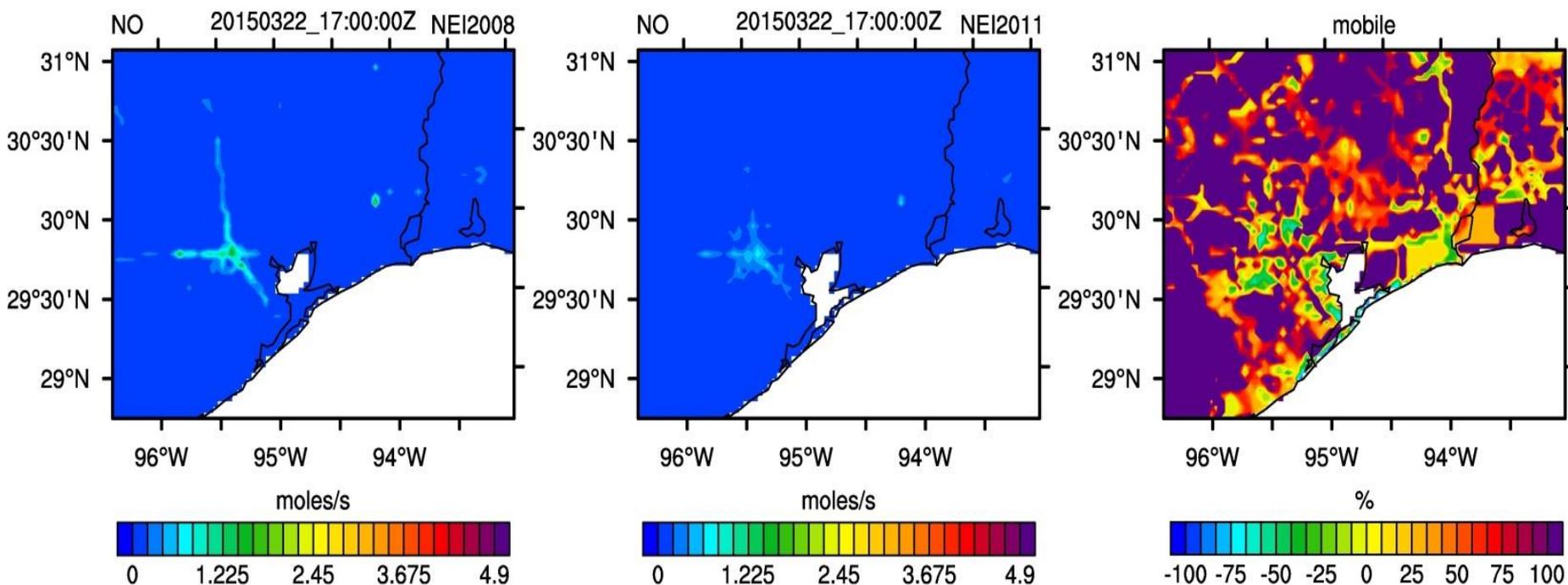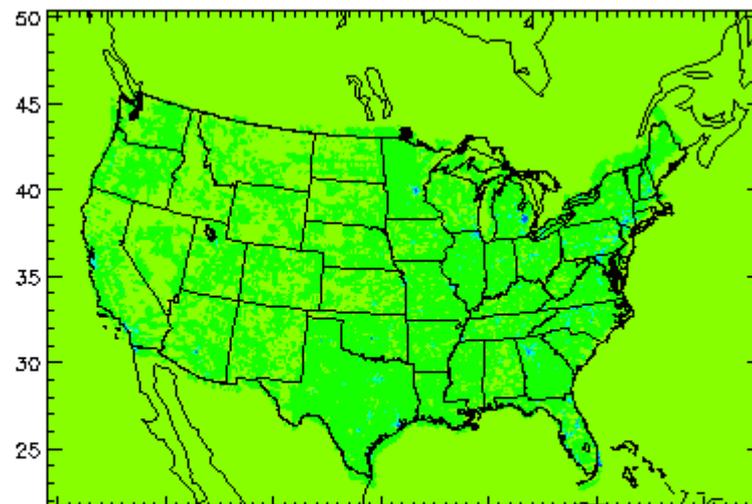

(NEI2008-NEI2011)/NEI2011*100

NEI2008 and NEI2011

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