MATES V Regional Modeling Analysis: Emissions Inventory and Modeling

MATES V Technical Advisory Group Meeting
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South Coast Air Quality Management District

Toxic Air Contaminants (TAC) Inventories for MATES-IV

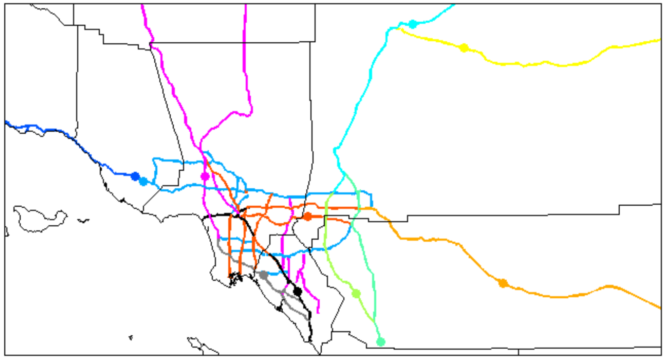
- MATES IV: 2012-2013
- Criteria Pollutant Inventories:
  - Based on 2012 AQMP Inventories
  - Projected from 2008 (base year) to 2012
- TAC Emissions from Speciation of TOG and PM Emissions Using CARB Profiles
- Hourly Emissions in 2x2Km Grids for Regional Modeling

Emissions Inventory for MATES V

- Point & Area sources
  - 2016 AQMP inventory
  - Annual Emissions Report for 2017 or 2018 upon availability
- On-Road
  - Emissions rates from EMFAC 2017
  - VMT and travel activity data for 2018
    - SCAG'S 2016 RTP/SCS Travel Demand Model estimates
- Off-Road
  - 2016 AQMP inventory projected for 2018
  - Port and OGV will be revised using the most recent available data
    - Discrepancy between projection from actual data
  - Incorporating Revisions Available by 2019

On-Road Emissions Inventory for the 2016 AQMP

- Based on real-time sensor data
- Light and Medium duty vehicles
  - California Department of Transportation Performance Measurement System
    (Caltrans PeMS)
  - > 9000 traffic monitoring stations
- Heavy duty vehicles
  - CalTrans PeMS Weight-In-Motion (WIM)

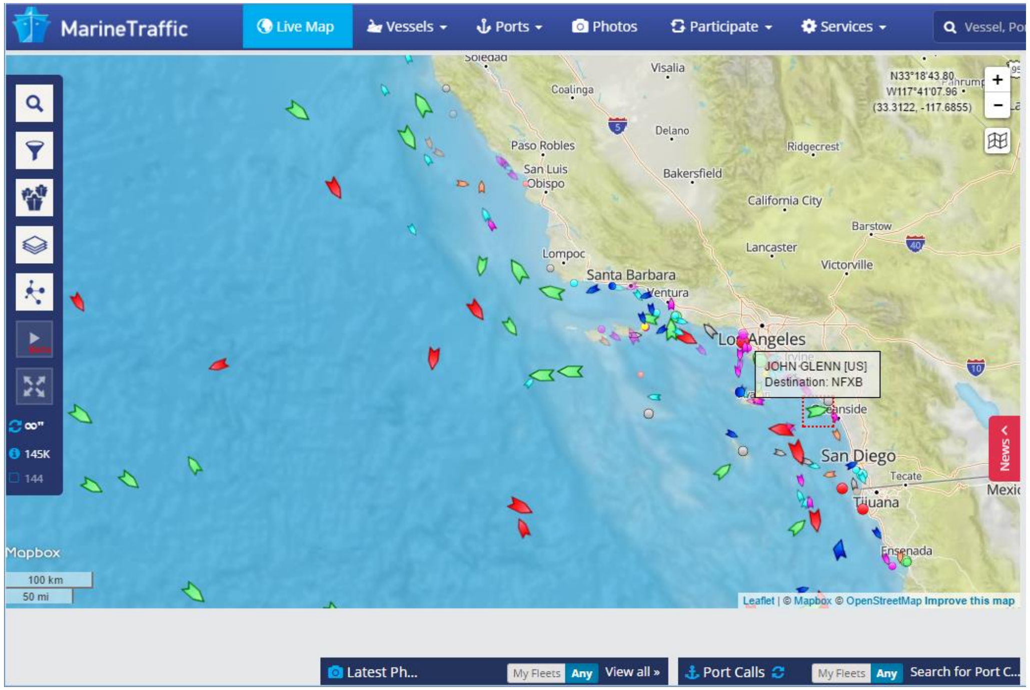


Possible Improvements

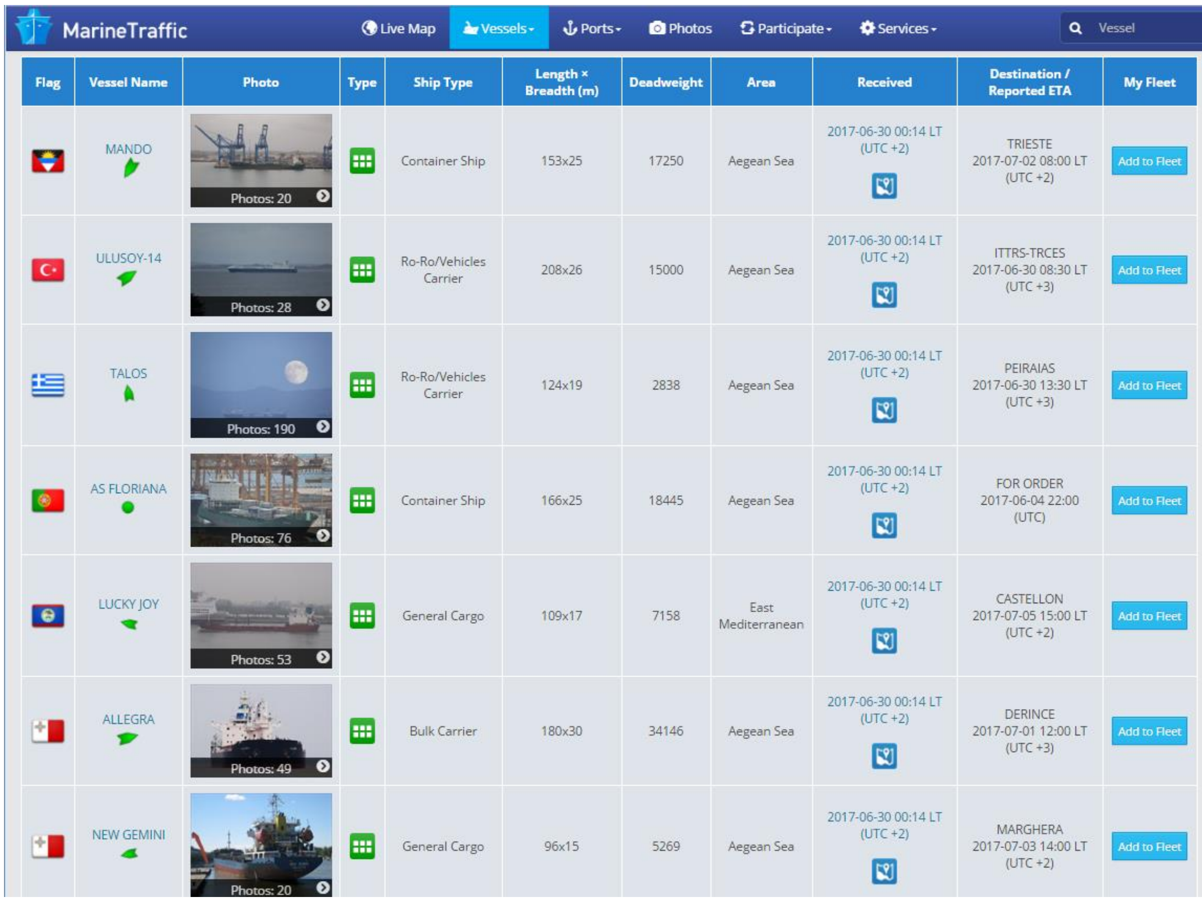
- Latest CARB Speciation Profiles upon availability
- Utilizing Permit Information to Allocate Minor Point Sources to Specific Locations
  - Minor Point sources are currently treated as area source
- Finer Scale spatial representations of
  - On-Road Emissions
  - Railroad Emissions
- Re-evaluating Ocean Going Vessels
  - Projection vs. Actual reported emissions
  - GPS based real-time ship location data, AIS (Automatic identification system)
- Improving aircraft taking-off and landing emissions
  - ACARS (Aircraft Communications Addressing and Reporting System)
  - "Aircraft Situation Display to Industry" (ASDI) data
  - Collaboration with CARB

AIS (Automatic identification system) Marine Traffic Data

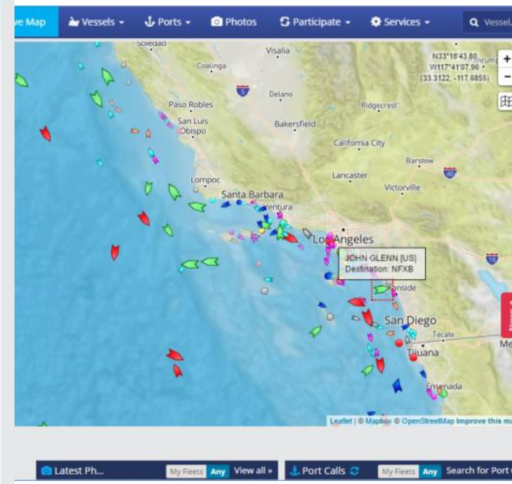
- The automatic identification system (AIS) is an automatic tracking system used for collision avoidance on ships and by vessel traffic services (VTS).
- Provides vessel type, size, position, course, and speed.



Example of AIS ship data near Port of LA



Flag	Vessel Name	Photo	Type	Ship Type	Length × Breadth (m)	Deadweight	Area	Received	Destination / Reported ETA	My Fleet
	MANDO	Photos: 20		Container Ship	153x25	17250	Aegean Sea	2017-06-30 00:14 LT (UTC +2)	TRIESTE 2017-07-02 08:00 LT (UTC +2)	Add to Fleet
	ULUSOY-14	Photos: 28		Ro-Ro/Vehicles Carrier	208x26	15000	Aegean Sea	2017-06-30 00:14 LT (UTC +2)	ITTRS-TRCES 2017-06-30 08:30 LT (UTC +3)	Add to Fleet
	TALOS	Photos: 190		Ro-Ro/Vehicles Carrier	124x19	2838	Aegean Sea	2017-06-30 00:14 LT (UTC +2)	PEIRAIAS 2017-06-30 13:30 LT (UTC +3)	Add to Fleet
	AS FLORIANA	Photos: 76		Container Ship	166x25	18445	Aegean Sea	2017-06-30 00:14 LT (UTC +2)	FOR ORDER 2017-06-04 22:00 (UTC)	Add to Fleet
	LUCKY JOY	Photos: 53		General Cargo	109x17	7158	East Mediterranean	2017-06-30 00:14 LT (UTC +2)	CASTELLON 2017-07-05 15:00 LT (UTC +2)	Add to Fleet
	ALLEGRA	Photos: 49		Bulk Carrier	180x30	34146	Aegean Sea	2017-06-30 00:14 LT (UTC +2)	DERINCE 2017-07-01 12:00 LT (UTC +3)	Add to Fleet
	NEW GEMINI	Photos: 20		General Cargo	96x15	5269	Aegean Sea	2017-06-30 00:14 LT (UTC +2)	MARGHERA 2017-07-03 14:00 LT (UTC +2)	Add to Fleet



South Coast
Air Quality Management District

Aloft Aircraft Emissions

(Source: www.flickr.com)

Chemical Transport Modeling

- Same as MATES IV
- 2 km by 2 km grid resolution
- Domain covers the Basin, major OGV corridors and the Coachella Valley

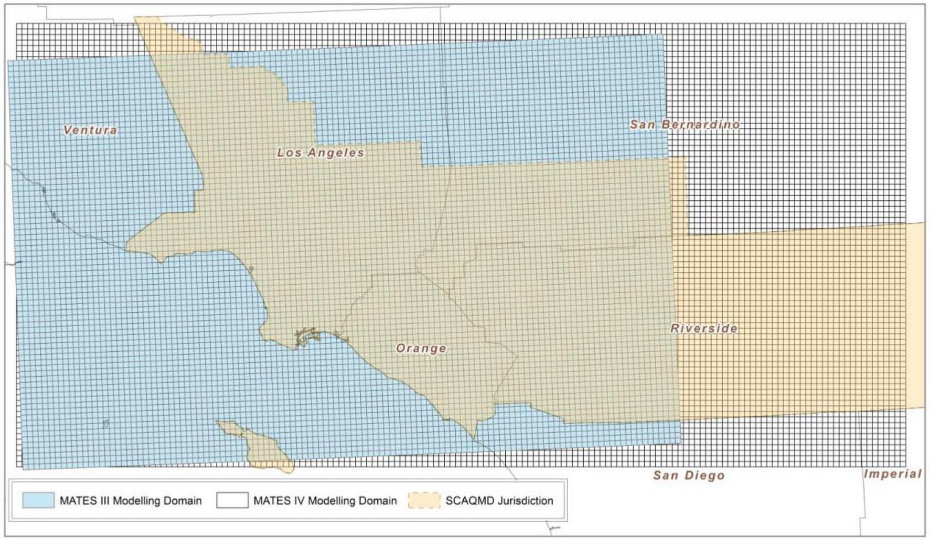


Figure 4-1.
MATES IV Modeling Domain. Shaded area highlights the grid extension to the MATES III modeling domain.

Modeling Platform: Dispersion Platform

- In-House Emissions Model

- Meteorological Model to provide dispersion platform
  - WRF mesoscale model
  - NAM and NARR as initial and boundary values
  - Considering urban parameterizations with high-resolution urban morphology, and high-resolution landuse data from SCAG

Modeling Platform: Chemical Transport Platform

- CAMx/rTRAC
  - Reactive Tracer probing algorithm
  - In MATES IV simulations, 20 toxic species were identified as a major risk contributors
- CMAQ
  - Primary modeling platform for the 2012 and 2016 AQMPs
  - Offers several options to account for chemical reactions and source apportionment probing tool for toxic species
  - Still needs customization to enable tracking of key toxic contaminants and source contributions to them.

Toxics reported in MATES IV

Species	Type	CB6MP_AE6_AQ (CMAQ 5.2)	SAPRC99tx3_ae5_aq (CMAQ 5.0.2)	saprc07tc_ae6_aq (CMAQ 5.2)
1,3 Butadiene	Gas	BUTADIENE13	✓	✓
Acetaldehyde	Gas	ALD2, ALD2_PRIMARY	✓	✓
As (2.5)	Aerosol	AAS (I)		
As (TSP)	Aerosol	AAS(I,J,K)		
Benzene	Gas	BENZENE	✓	✓
Cd (2.5)	Aerosol	ACD (I)	✓	
Cd (TSP)	Aerosol	ACD (I,J,K)	✓	
Cr6 (TSP)	Aerosol	ACR_VI (I,J,K)	✓	
EC_{10}	Aerosol	DE_EC (I,J)		
$EC_{2.5}$	Aerosol	DE_EC (I)		
Formaldehyde	Gas	FORM, FORM_PRIMARY	✓	✓
Methylene Chloride	Non-reactive	CL2_ME	✓	
Naphthalene	Non-reactive	NAPHTHALENE	✓	
Ni (2.5)	Aerosol	ANI (I)	✓	
Ni (TSP)	Aerosol	ANI (I,J,K)	✓	
Pb (2.5)	Aerosol	APB (I)	✓	
Pb (TSP)	Aerosol	APB (I,J,K)	✓	
P-Dichlorobenzene	Non-reactive	DICHLOROBENZENE	✓	
Perchloroethylene	Non-reactive	CL4_ETHE	✓	
Trichloroethylene	Non-reactive	CL3_ETHE	✓	

Summary

- Emissions Inventory will be substantially updated from MATES IV methodology. This includes spatial and temporal allocation of on- and off-road mobile sources and point sources

- Multiple Chemical transport modeling platforms and various chemical mechanisms will be evaluated to ensure the most updated methodology and consistent with AQMP/SIP approaches.