2010 Canadian CAC Emission Inventories for the Air Quality Modelling Platform Supporting Policy Regulations

Presented by J. Zhang[2] on behalf of :

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2015 International Emission Inventory Conference
"Air Quality Challenges: Tackling the Changing Face of Emissions"
San Diego, CA, April 13-16, 2015

Environment Canada - Air Quality Modelling Applications Section (AQMAS)

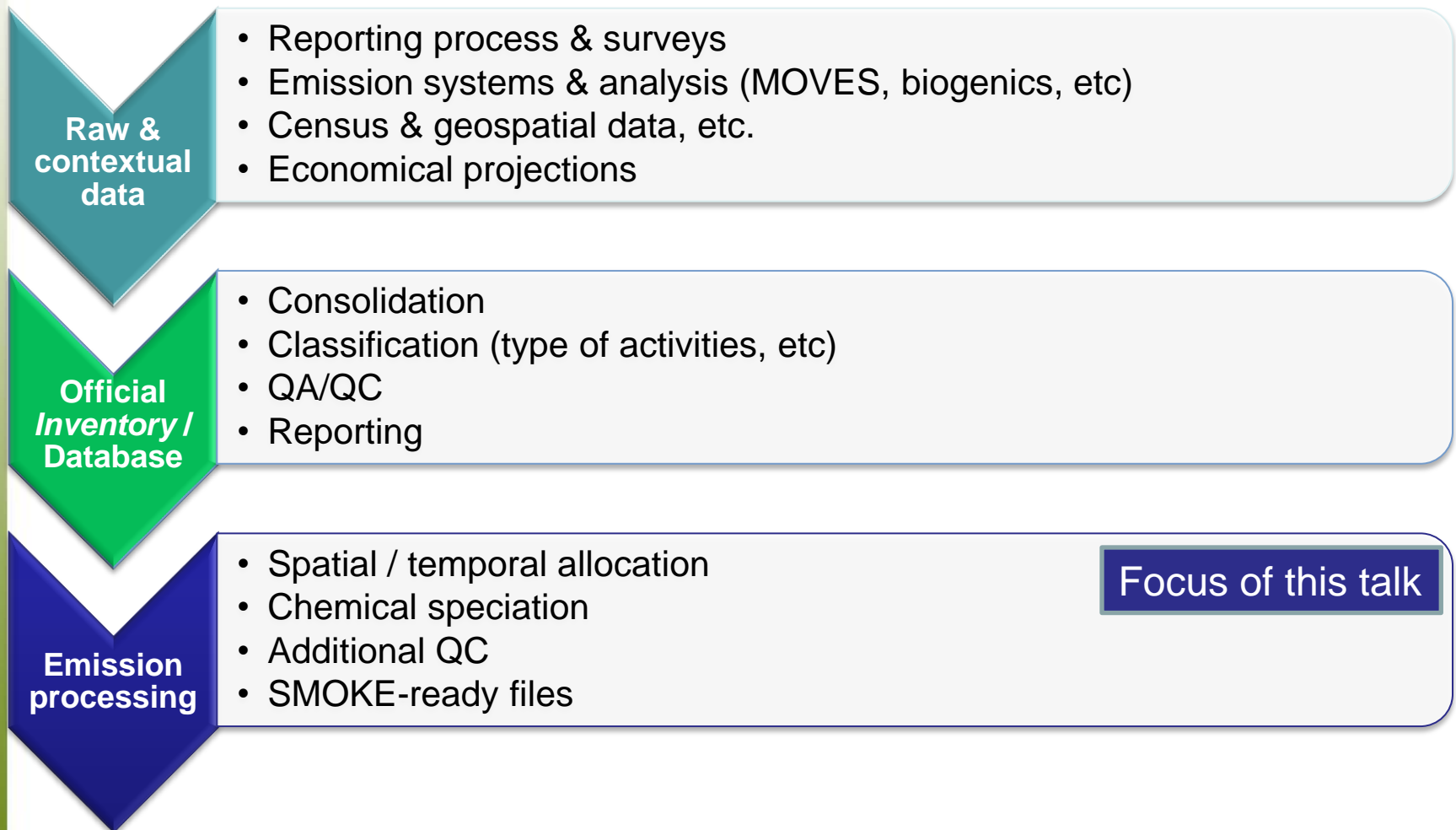As part of its mandate regarding EI, AQMAS:

- Prepares and distributes model-formatted emissions inventories (SMOKE-ready) based on diverse versions of Canada's Air Pollutant Emission Inventory (APEI)

- Documents and distributes ancillary files to support emissions processing for air quality model applications – gridding, temporal allocation, and chemical speciation of inventory emissions.

- Supports and promotes emissions modelling activities for Environment Canada's internal and external clients.

In July 2014, AQMAS transitioned from 2006 to 2010 reference emissions inventories for its Regulation Air quality modelling platform, thus the publication of this 2010 inventory.

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Talk Outline

- Canadian emission data for Air Quality Modelling: workflow
- What's new in the 2010-v1 Canadian emission inventory?
- 2010-v1 Inventory Components
  - Overview of Canadian National EI 2010 vs 2006
  - Sector by sector overview
- New developments in forest fires
- Spatial allocation
- Quality assurance
- Release of 2010 emissions inventory version 2 in Summer 2015
- Conclusion
- Accessing the 2010-v1 SMOKE-ready emissions package, as used in the Canadian Air Quality Scenario Modelling Platform

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Canadian emission data for Air Quality Modelling: workflow

Raw & contextual data
- Reporting process & surveys
- Emission systems & analysis (MOVES, biogenics, etc)
- Census & geospatial data, etc.
- Economical projections

Official *Inventory* / Database
- Consolidation
- Classification (type of activities, etc)
- QA/QC
- Reporting

Emission processing
- Spatial / temporal allocation
- Chemical speciation
- Additional QC
- SMOKE-ready files

Focus of this talk

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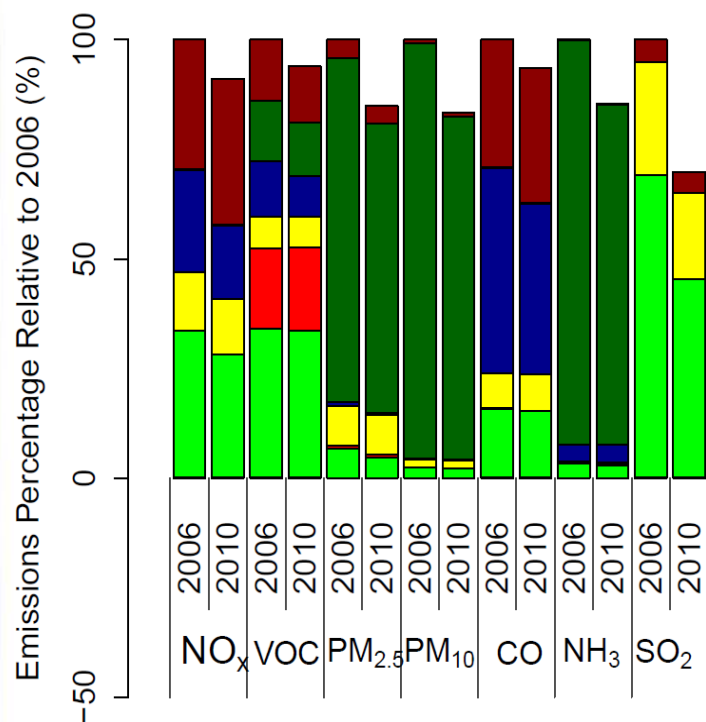# What's new in the 2010 Canadian emissions inventory ?

- Updated CAC emissions estimates
- Improved on-road mobile inventory for HDDV and HDGV (MOVES)
- More detailed point-sources with stack information than in 2006
- Point sources have individual VOC speciation (ADOM-II, CB05&6, SAPRC07). They are available on request.
- Point sources have facility-specific temporal profile rather than temporal profile based on the SCC
- Improved estimates of fugitive dust emissions based gridded land use Transportable Fraction (TF)
- NAESI agriculture emissions were spatially allocated using 54 detailed surrogates compared to only 4 surrogates for 2006.
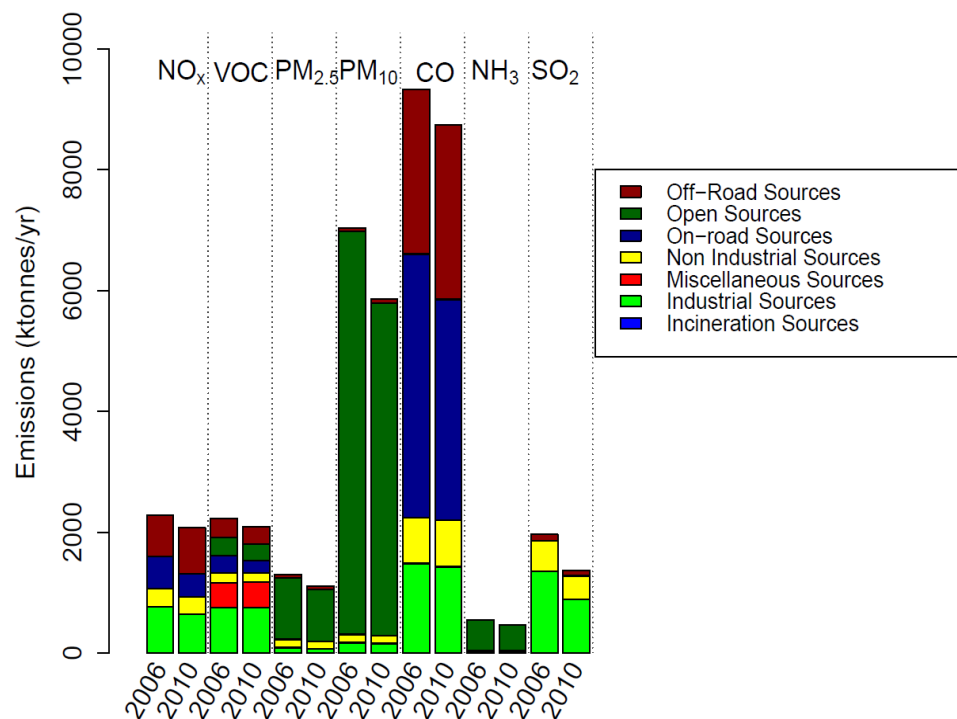- Incorporated Oil Sands fleet emissions to facilities geographic location.

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2010 Inventory Components

The 2010 Canadian emissions inventory was provided by Pollution Inventory and Reporting Division of Environment Canada.

2010 NPRI Point Source emissions	2010 Upstream Oil &Gas v1 emissions	2010 Area Source emissions
2010 MOVES & MOBILE 6C v6.7 on-road	2010 off-road transportation (train, a/c, etc.)	2010 off-road v6.7 (engines, equipment)
2010 Wildfire emissions (daily)	2010 Area dust (construction, roads)	2010 Agriculture NH3 NAESI

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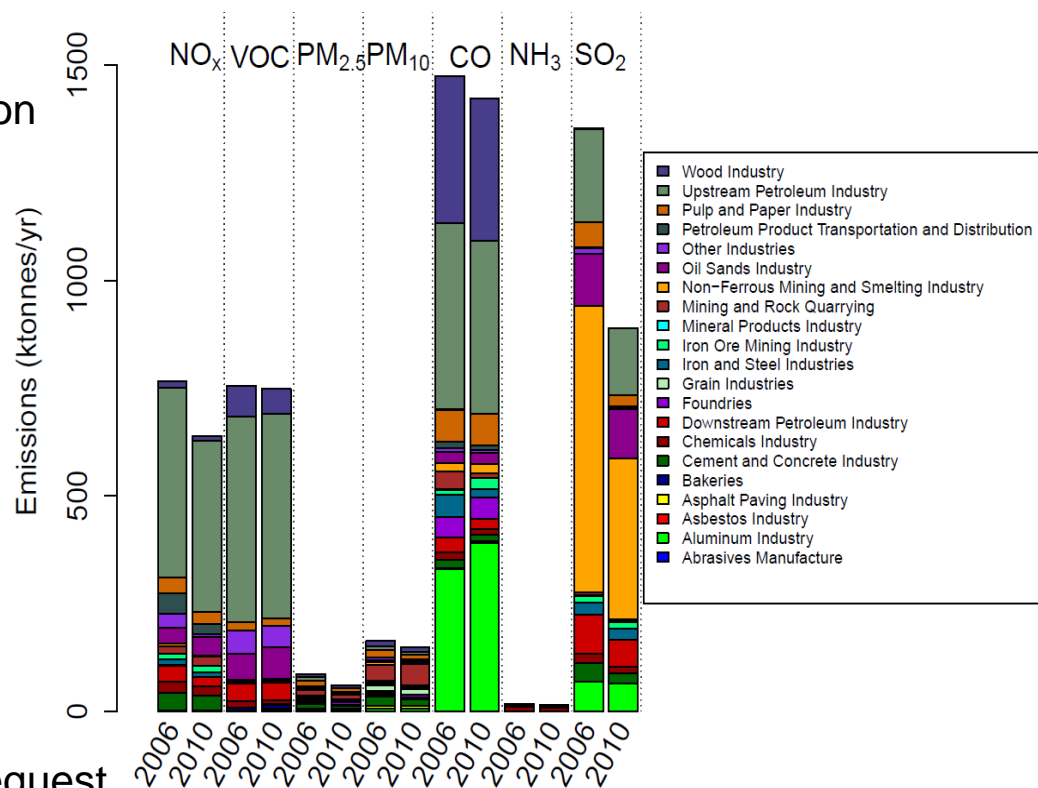
2006 versus 2010 national inventory

2006 vs 2010 annual relative percentage
by pollutant and by sector

2006 vs 2010 by pollutant
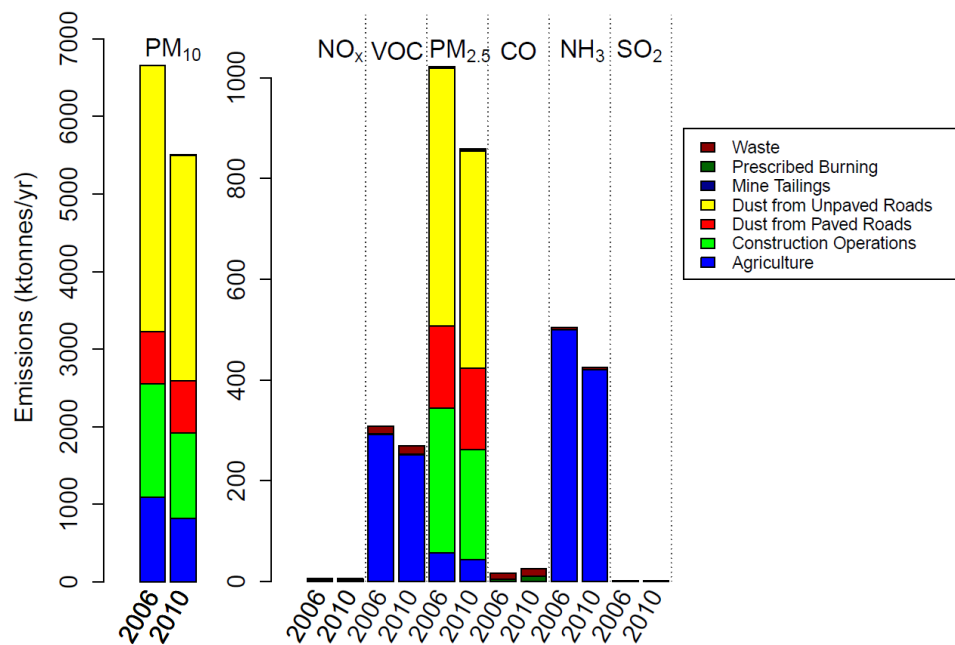and by sector

Point Sources

- Upstream Oil & Gas sector.
  - Conventional Oil & Gas production
  - Does not include Oil Sands
  - Annual resolution

- 2010 NPRI point sources.
  - Industrial Sector
  - Stack parameters
  - NPRI did not collect the data at the SCCs level
  - Monthly temporal resolution
  - Data are aggregated at the facility level
  - Detailed VOC speciation upon request
  - 2010 Electric Power Generation units emissions inventory is provided with SCCs.

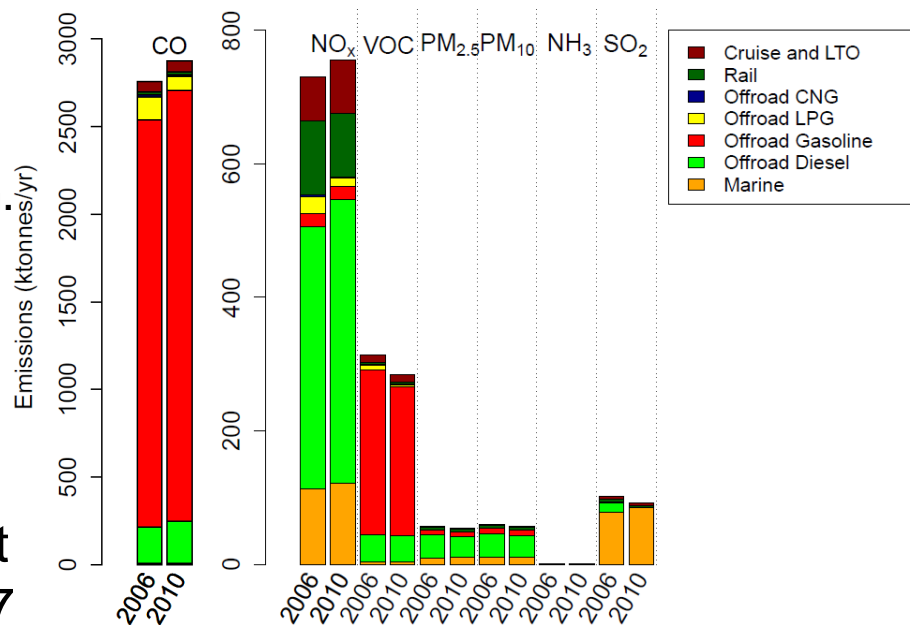2006 vs 2010 by pollutant for the industrial sector

Open Sources

- Mostly PM10 and PM2.5 from fugitive dust sources
- Includes building and road construction, paved and unpaved roads, agricultural dust and mine tailing
- Provincial and annual resolution.
- Processed separately to allow for the application of a land use based transportable fraction.

2006 vs 2010 by pollutant for the open sources

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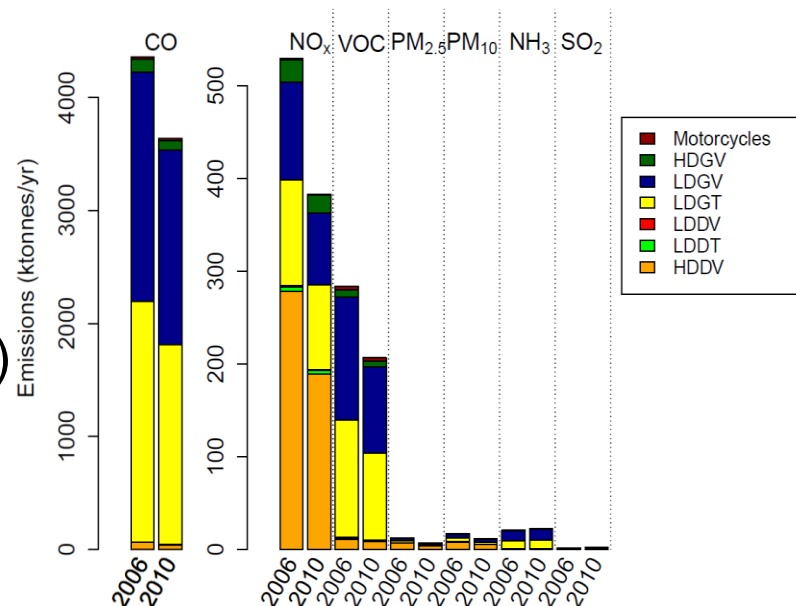
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Off-road Engines and Equipment

- Marine Emissions:
  - Commercial Marine Vessel class 1,2,3 emissions sources.
  - Province and annual resolution.

- Rail: Diesel locomotives
  - Provincial and annual

- Aircraft: Takeoff and Landing
  - Provincial and annual

- Off-road engines and equipment emissions using OFFROAD v6.7
  - Monthly emissions and provincial

- Off-road diesel Mobile mine fleet in the Oil Sands projects of Alberta.
  - Emissions were given per facility.

2006 vs 2010 annual relative percentage for the off-road sources

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On-road emissions

- Processed with MOBILE 6.2C v6.7 except HDDV and HDGV.

- The treatment of HDDV and HDGV on-road emissions benefited from an extensive update to the Motor Vehicle Emission Simulator (MOVES) system developed by US-EPA.

- The model integrates the latest measurements conducted in Canada to account for recent vehicle technology and fuel use.
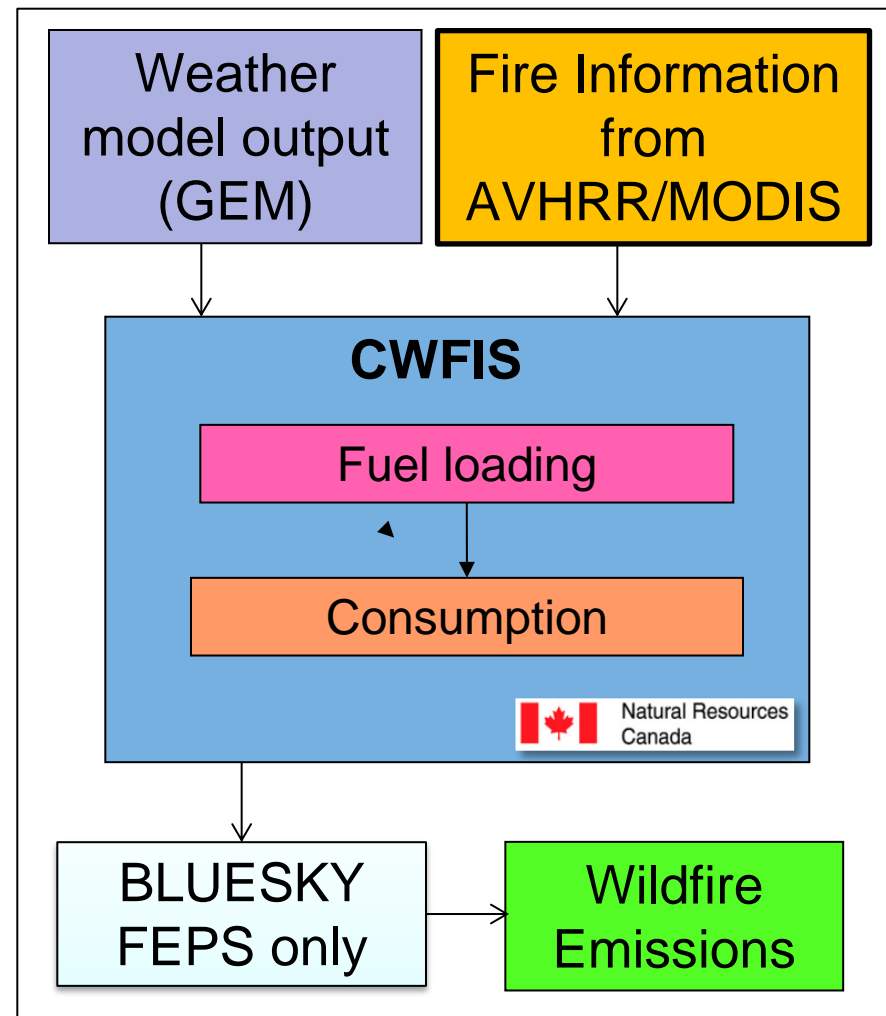

2006 vs 2010 for on-road sources

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Other Area Sources

- Primarily area sources not included in other sectors
  - Incineration Sources
  - Industrial / non-Industrial Sources
  - Commercial and Residential Fuel Combustion
  - Electric Power Generation (Utilities)
  - General Solvent Use
  - Provincial and annual resolution
- Agricultural Emission Inventory: NH3 emissions for livestock and fertilizer application from NAESI,
  - Spatially allocated using 54 detailed surrogates compared to 4 surrogates for 2006.
  - Census division
  - Monthly resolution.

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Wildfire Emissions

- Use hotspots from the Canadian Wildland Fire Information System (CWFIS).

- Data contains daily fire locations by lat/long and CWFIS estimated fuel type/consumption.

- BlueSky is used to estimate total emissions using the FEPS module.

- Emissions are generated as "Daily Total" per fire hotspot.

- Diurnal temporal profile and VOC & PM speciation is applied.
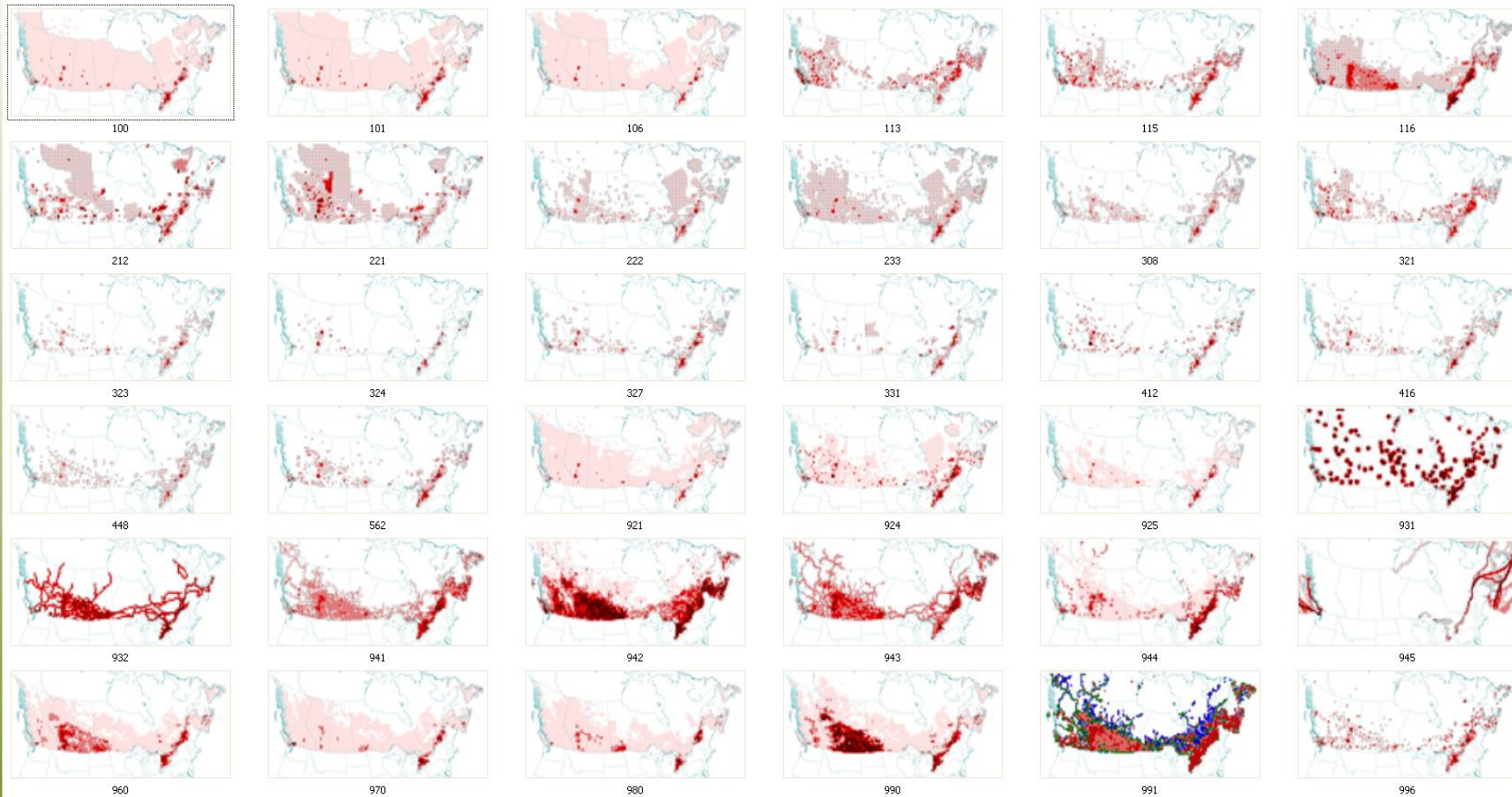

Weather model output (GEM)

Fire Information from AVHRR/MODIS

CWFIS

Fuel loading

Consumption

Natural Resources Canada

BLUESKY FEPS only

Wildfire Emissions

Wildfire emissions dataflow

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Spatial Surrogates

- Canadian spatial surrogates are based on the 2006 census data from Statistics Canada.

Code	Surrogate Description	Code	Surrogate Description
100	Population	562	Waste management and remediation services
101	total dwelling	625	Total Service
106	All instrusties	921	Commercial Fuel Combustion
113	Forestry and logging	924	Primary Industry
115	Agriculture and forestry activities	925	Manufacturing and Assembly
116	Total Ressources	931	Otherjet
212	Mining except oil and gas	932	Rail
221	Total Mining	941	Paved roads
222	Utilities	942	Unpaved roads
233	Total Land Development	945	Commercial Marine Vessels
308	Food manufacturing	946	Construction and Mining
321	Wood product manufacturing	950	Combination of Forest and Dwelling
323	Printing and related support activities	960	Total Beef
324	Petroleum and coal products manufacturing	970	Total Poultry
327	Non-metallic mineral product manufacturing	980	Total Swine
331	Primary Metal Manufacturing	990	Total Fertilizer
412	Petroleum product wholesaler-distributors	991	On-road traffic
416	Building material wholesaler-distributors	996	Urban area
448	clothing and clothing accessories stores		

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Spatial surrogates (2)

Canadian spatial surrogates overview

Quality Assurance

- The quality assurance of the 2010 emissions modelling platform is based on a suite of graphical and tabulated summaries of the input data, and spatial plots.

- Data provided by Environment Canada were reviewed to ensure proper modelling.

- SMOKE scripts settings were used to document the data and the configuration.

- The graphical QA summaries include, for all emissions output species, daily spatial plots, daily time-series plots and annual time-series plots.

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Future updates (summer 2015)

Short-term – Summer 2015

- Preparation of 2010-v2 – possible updates include
    - All on-road emissions processed with MOVES
    - Link Based Marine Emissions for 2010
        - Ship type and fuel
        - Ships sailing in Canada's waters
        - Stack parameters for plume rise
        - Monthly based emissions
    - Wildfire Emissions for 2011
    - Aircraft emissions by airport (point sources)
    - Updated surrogates using 2011 census

Longer-term – Development of EI-2014

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Conclusion

- 2010-v1 Canadian emissions inventory was developed for the 2010 AQMAS's policy air quality modelling platform and is available for download

- 2010-v2 will be available in summer 2015.

- Next EI modelling year should be 2014 and a first version is expected in 2016.

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2010-v1 Canadian EI packages

- 2010-v1 emission inventory and 2006 shapefiles package are available upon request until a permanent ftp site is available (see contact information below).

- It includes:
  - Inventory files (11 source sectors),
  - SMOKE ancillary files and scripts,
  - Documentation
  - along with the surrogates tool configuration to generate Canadian surrogates accessible on:

For any information, please contact: *REQA@ec.gc.ca*

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