Climate & Air Quality Inventory Improvement & Database Management for Developing Countries

The International Sustainable Systems Research Center (ISSRC)

September 29, 2010

Purpose

Help developing countries build a management process that achieves sustainable air quality improvements

Keys To Success

- Adoption of a well designed air quality improvement policy
- A government infrastructure with the knowledge and tools to effectively implement that policy

Air Quality Improvement is Complex

- Overlap between media and governmental organizations
- Multiple targets for improvement
- Evolving 'targets'
  - Criteria, chlorofluorocarbons, acid deposition, toxics, climate change, more to come?
- Varying scales – spatial, temporal
- Interactions among pollutants
- Unknown sources

Learning from the U.S. Experience

- Clean Air Acts of 1970/1977
  - Set Air quality standards
  - Set Attainment deadlines
  - Penalties for non-attainment
- Slower air quality improvement than originally expected
- There are still major metropolitan areas that do not meet the standards set in the 1970s today

Why?!

Partly, because:

- Focus on the wrong pollutants
- Lacked the ability to adequately project emissions and their impacts ...led to ignoring:
  - key emissions sources
  - cultural trends
- Resulted in less effective air quality management plans focusing on one pollutant at a time

Some of the Same Hurdles for Developing Countries Today

- Chongqing, Guadalajara, Sao Paulo, Shanghai have primarily point source inventories
- Little ability to understand overall sources of pollution or predict future trends
- Have no way to update or improve their pollution related information
- Difficult to compare, select and provide accurate justification of various potential policies and any potential adverse impacts.

ISSRC Identified 3 Areas to Try and Make an Initial Contribution

1. Provide a tool to estimate on-road mobile source emissions
2. Make available information designed to help developing countries implement their air quality management policies
3. Create a system to manage complex environmental related data to allow for effective and meaningful air quality improvement plan development

Partners to Date

- U.S. EPA
- Hewlett Foundation
- The Energy Foundation
- World Bank
- EMBARQ--World Resource Institute

1. The International Vehicle Emissions Model (IVE)

- Estimate emissions for passenger cars, trucks, buses, three- and two-wheel vehicles for important urban pollutants, toxics, and global warming gases
- Includes gasoline, diesel, natural gas, propane, and alcohol fueled vehicles
- Incorporates a straightforward methodology to collect the needed modeling information
- Allow users a way to update the emission factors when local data is available and adapt to the local situation

IVE Model & Implementation Status

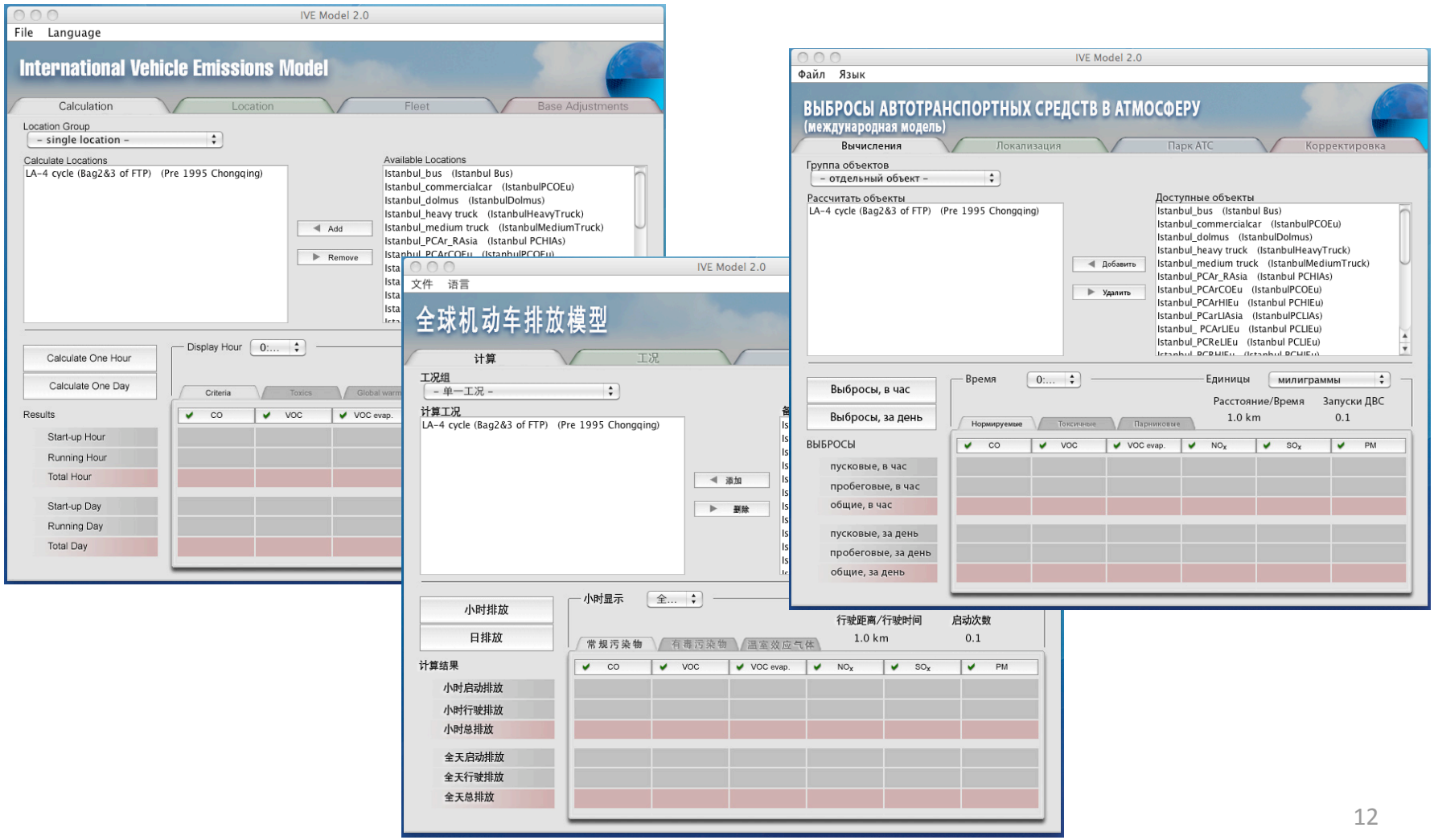
- First Release in 2003, last update in May 2010
- Available free on the internet
- Refined data collection methodology (snapshot of vehicle activity, driving patterns and starts, and in-use emissions in any remote location)
  - 2-3 weeks in field, reasonable costs
  - All major vehicle types covered
  - Laboratory not required

- Field studies have resulted in 15 location specific information to supplement the base IVE model (also available on website).

IVE Model Highlights & Progress

- 1500 registered users from air quality agencies and universities around the world
- In use in sixteen countries (that we know of)
- Recommended by INE to be the national model for calculating emissions in Mexico
- Used along with several other models as the basis of the national model for vehicles in China
- Reviewed along with other important emission models (February, 2009 AWMA Journal)
  - Rated: Easiest to use model/Most accurate model for developing countries
  - Compared with: U.S.EPA Mobile, California EMFAC, European COPERT model and others.

IVE Operates in Five Languages



IVE in the Future

- Add Black Carbon emission factors
- Provide a way to distribute emissions over a grid system to support air quality modeling
- Add off-road mobile sources
- Continually update emission factors, add new vehicles, and update driving and other adjustments as scientific research provides new data
- Would like to add Portuguese and Turkish as supported languages

2. Air Quality Management (AQM) Handbook

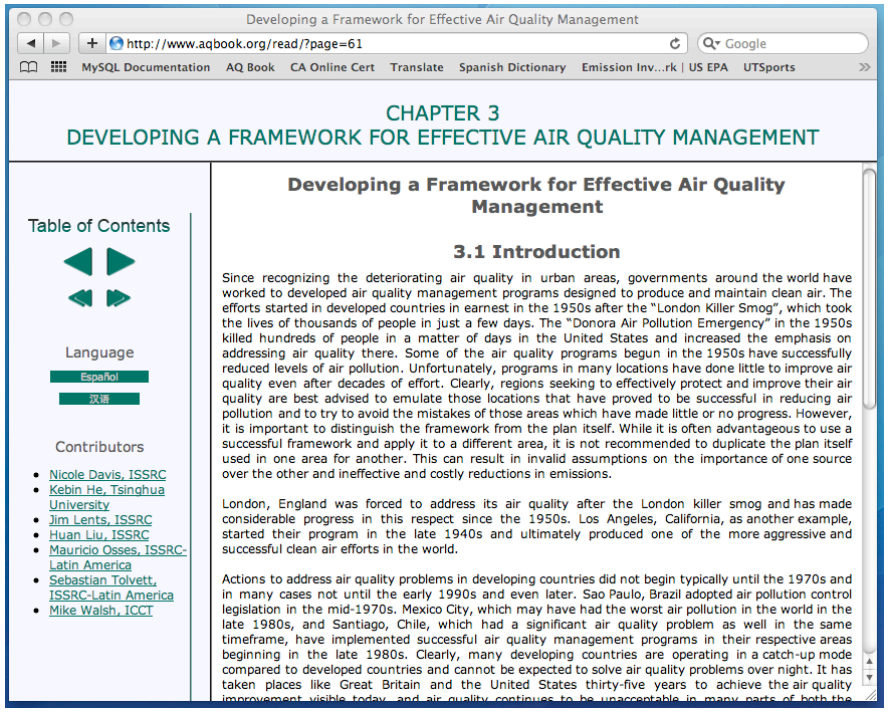
- A free internet-based information system on how to carry out effective air quality management
- 4 topics to date

www.aqbook.org

- English, with some in Spanish and Chinese.
- Can be updated remotely by approved participants.
- Used by governments, Universities, and training institutes.

AQM Handbook Status

- Work in Progress.. More chapters to come
- Will convert to text books where appropriate
- Find volunteer editors from retired air quality professionals to help

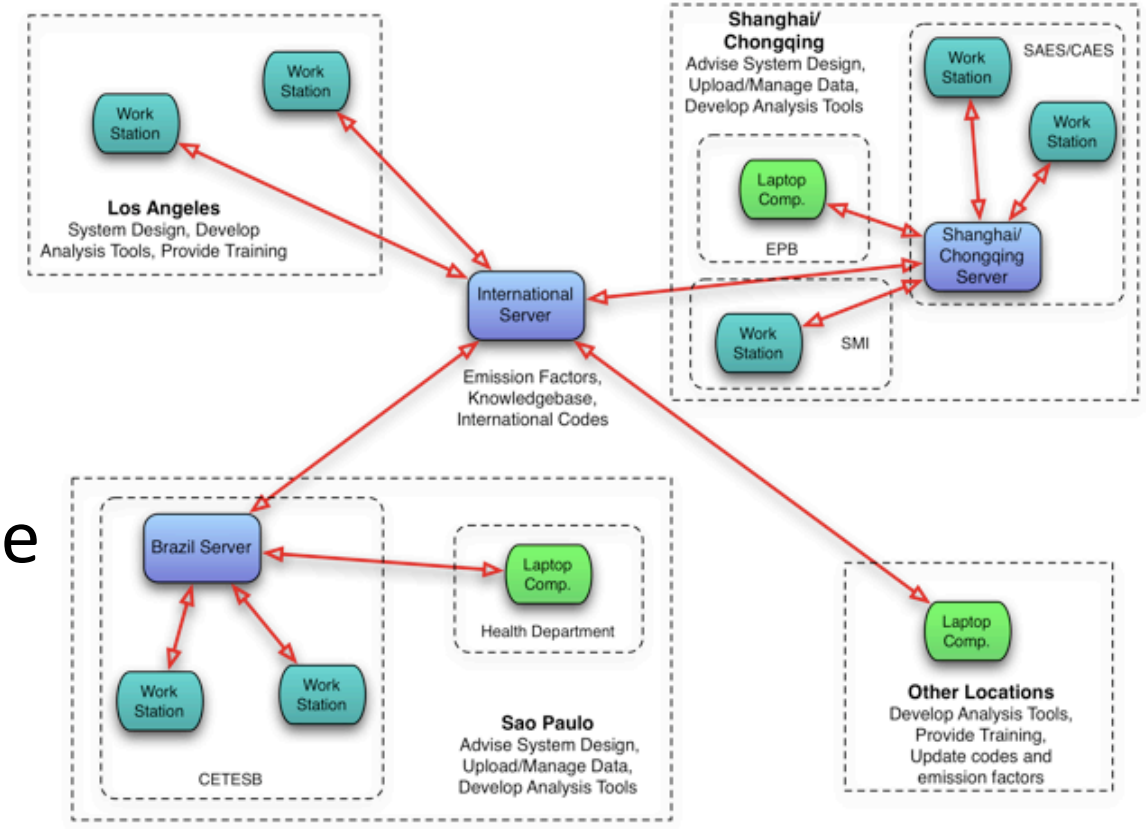


3. The IED (International Environmental Database)

- Database system to manage air quality/energy related information
- Calculate and project air quality emissions, energy requirements, fuel use for urban regions
- Integrate policy analysis for urban air, water, solid waste, and climate change pollution

IED Design Requirements

- Allow businesses to update their own information
- Support source enforcement
- Support emission caps and credit trading
- Remotely accessible
- Available free
- Secure & Flexible

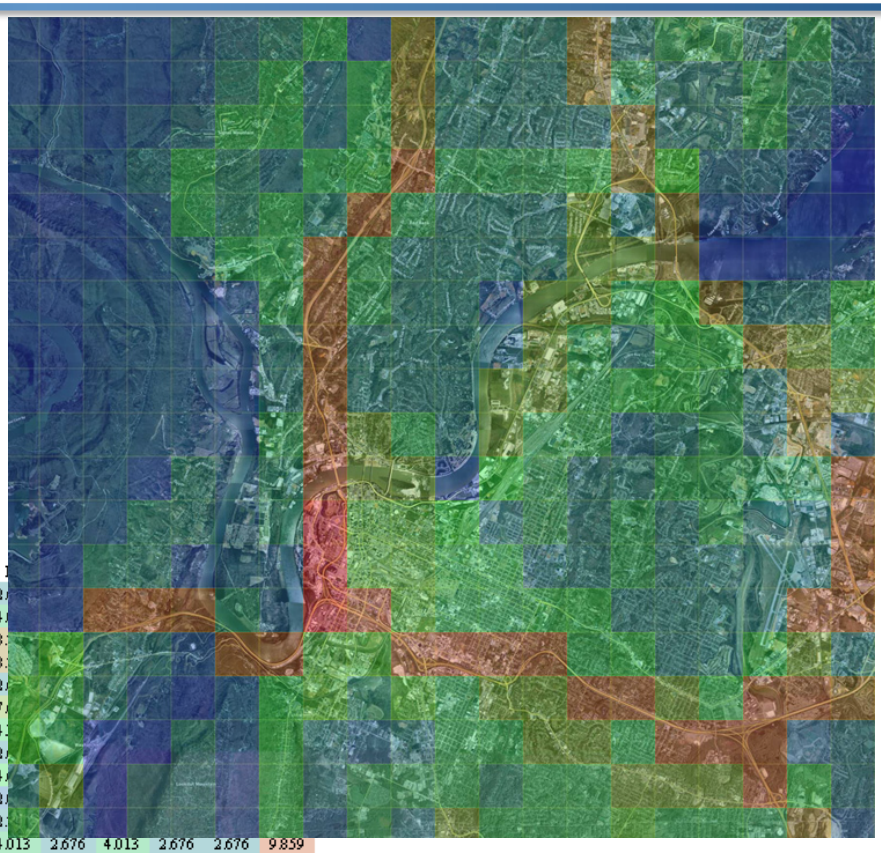


IED System Implementation Status

- Base system created
- Implementing in Mexico City, Guadalajara and Chongqing
- Several other areas in discussion

IED Uses: Support Modeling

Outputs spatially and temporally resolved data



Source Name: All Sources
Region: Metropolitan Region of Metropolis
Class: On-Road Mobile: Passenger Vehicle
Scenario: All Passenger Vehicles Electric Beginning 2015
Flow Material: Volatile Organic Compounds (VOC)
Calculation Time: 2012 - January through March/Weekday - 12:00
Number of Processes: 24
Total Emissions in Region: 1,592 kilogram

	0	1	2	3	4	5	6	7	8	9	10	11	12	13
19	0.644	0.627	0.644	0.644	1.373	2.060	2.746	4.119	0.644	8.966	2.053	2.737	2.737	8.966
18	0.644	0.627	0.644	0.644	1.373	2.746	4.214	1.931	4.013	8.966	2.676	2.676	2.676	8.763
17	1.287	1.254	0.644	1.373	2.060	4.214	4.119	1.881	4.106	8.763	2.676	2.676	2.676	2.676
16	0.620	1.241	1.241	2.060	4.214	2.810	1.931	4.106	4.483	9.859	4.013	4.013	4.013	4.682
15	0.644	0.644	0.620	1.241	4.119	2.746	4.106	2.737	9.859	4.013	2.676	2.676	2.676	7.668
14	0.637	0.637	0.637	1.241	1.985	4.013	4.106	9.859	4.013	2.676	2.676	2.676	2.676	7.587
13	0.620	0.620	1.274	1.274	1.241	1.338	4.013	9.859	4.013	2.676	2.676	1.338	7.668	7.668
12	0.620	0.620	1.274	1.274	1.241	1.241	2.676	9.859	2.676	2.676	2.676	2.191	7.668	4.382
11	0.620	0.620	1.274	1.241	1.324	1.241	2.676	9.859	2.676	2.676	2.676	7.668	7.668	4.382
10	1.254	1.254	1.287	1.254	1.338	1.338	4.013	9.859	7.668	4.382	2.676	7.668	4.382	4.382
9	1.287	1.287	1.254	0.627	2.737	2.007	3.286	10.06	7.828	7.668	1.338	5.351	4.106	2.737
8	1.287	1.287	1.254	2.676	2.737	2.007	3.286	11.20	6.709	6.709	5.463	2.676	4.013	2.676
7	1.287	0.644	2.737	2.737	1.338	2.007	2.007	11.20	6.709	6.709	4.780	4.682	2.676	2.676
6	0.627	0.627	10.09	10.09	9.859	3.286	2.007	11.20	10.06	6.709	4.473	4.382	4.682	4.682
5	4.382	6.020	2.737	2.508	1.287	9.859	9.859	6.573	6.573	9.859	10.06	9.859	9.859	4.382
4	6.020	4.382	2.676	1.254	0.644	1.373	4.682	6.573	3.286	6.573	4.382	7.668	7.668	9.859
3	6.020	4.382	0.620	0.620	2.717	1.324	4.682	2.676	2.007	2.676	4.382	4.382	7.668	7.668
2	2.676	7.668	0.620	2.717	2.717	1.324	4.682	2.676	4.013	4.013	4.382	3.286	4.382	4.382
1	4.682	1.881	0.620	2.717	2.717	1.324	4.682	2.007	4.013	2.676	7.668	4.382	4.382	4.382
0	1.239	0.627	2.574	2.746	2.746	1.324	2.007	2.007	2.007	2.676	4.382	7.668	4.382	4.382

	14	15	16	17	18	19
19	8.966	2.053	2.737	2.737	8.966	2.676
18	8.966	2.676	2.676	2.676	8.763	4.013
17	8.763	2.676	2.676	2.676	2.676	8.763
16	9.859	4.013	4.013	4.013	4.682	8.763
15	9.859	4.013	2.676	2.676	2.676	7.668
14	9.859	4.013	2.676	2.676	2.676	2.676
13	9.859	4.013	2.676	2.676	1.338	7.668
12	9.859	2.676	2.676	2.676	2.191	7.668
11	9.859	2.676	2.676	2.676	7.668	7.668
10	7.668	4.382	2.676	7.668	4.382	4.382
9	10.06	7.828	7.668	1.338	5.351	4.106
8	11.20	6.709	6.709	5.463	2.676	4.013
7	11.20	6.709	6.709	4.780	4.682	2.676
6	11.20	10.06	6.709	4.473	4.382	4.682
5	6.573	6.573	9.859	10.06	9.859	9.859
4	6.573	3.286	6.573	4.382	7.668	7.668
3	2.676	2.007	2.676	4.382	4.382	7.668
2	4.013	4.013	4.382	3.286	4.382	4.382
1	2.676	4.013	4.382	4.382	4.382	6.573
0	2.676	2.676	7.668	4.382	4.382	6.573

	20	21	22	23
19	2.676	2.676	2.676	9.859
18	2.676	2.676	2.676	9.859
17	2.676	2.676	2.676	9.859
16	2.676	2.676	9.859	9.859
15	2.676	4.682	7.668	2.676
14	2.676	4.682	9.859	9.243
13	9.859	9.859	9.859	2.007
12	7.668	7.668	9.859	4.682
11	4.483	4.106	8.763	1.881
10	3.286	2.007	8.763	1.881

Show Map

show notes/errors - ☑
color table - ☑
hold high/low coloring values - ☐

IED Uses: Support Planning

The design of the system enables answering such questions as:

- How would a rapid transit system affect fuel use? criteria pollutants? global warming emissions?
- What are the top categories of GHG emissions today and projected in the future?
- What are the differences in energy use and emissions from moving towards a natural gas fleet or an electric fleet?

IED Uses: Support Enforcement

IED is designed to track the emissions and energy from point sources, and return data from queries such as:

- What is ABC Company's emissions this year? Last year?
- Is ABC Company exceeding its emissions cap?
- How many credits are available in this location/area?

IED Status & Future

- Base System Developed
- Currently populating local data
- Will be used to support the development of effective/integrated control programs in participating cities starting with Chongqing, Mexico City, and Guadalajara
- Training session planned for November 2010 to begin that process

Thank You!

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