Air Quality Photochemical Modeling in the MAVM (Metropolitan Area of the Valley of Mexico)

Gustavo Sosa
Instituto Mexicano del Petróleo (IMP)
Massachusetts Institute of Technology (MIT)

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Research Program on Environment and Safety (PIMAS)

• How does PEMEX affect the environment?
• How pollution is transported and transformed from sources to final receptors?
• How the pollutants come apart into the various environment pathways?
Resources at PIMAS: (Air Quality and MET Research)

minated by 10 researchers leading Air Quality and Meteorology Modeling

- Air Quality Models: MARS, CIT-SAPRC99*, Models3-EPA, CALGRID, OZIPR

- Inverse Modeling: CMB

- Met Models: RAMS, MM5, MEMO, CALMET

- 3 radiosonde systems, met stations, Origin 2000 with 48 processors, Origin 3800 with 40 processors

- Analytical Labs, Aerosols Lab, etc.

* In collaboration with MIT
Research Fields on Air Quality and MET

Air Quality:
- Photochemical Modeling
- Secondary aerosol formation modeling
- Aerosols: size and chemical characterization, optical properties and sampling
- Transfer Radiation Models
- Smog Chambers (outdoors)
- Emissions Finger Prints
- Car emissions characterization (gas-phase and particles)

Meteorology
- Boundary Layer
- Micro Meteorology and Turbulence
- Complex Terrain Meteorology Modeling
Past and Current Comprehensive Research Projects on the MCVM

- **MARI-EGCA: IMP and LANL (1990-1993)**
  - (aircraft, remote sensing, VOC´s and extensive ozone modeling)

- **IMADA-AVER: IMP (CAM, IPN, UNAM) and DOE´s National Labs (LANL, PNNL, ANL, DRI, NOAA) (1994-1998)**
  - (PM10 and PM2.5 chemical characterization, extensive MET measurements and modeling)

  - (to reduce uncertainties on the current knowledge of air pollution in the MCVM, based ambient measurements and modeling for both, gas-phase and particles pollutants)
## MET Measurements during IMADA-AVER (Mach 1997)

<table>
<thead>
<tr>
<th>Site</th>
<th>Equipment</th>
<th>MET Variables</th>
<th>Time/freq.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FES-Cuautitlan. Campo IV</td>
<td>Radiosonde</td>
<td>Td, Tw, P, wind (0-10 Km)</td>
<td>8, 11, 13 :30, 16 :30 y 18 :30 continuos continuos</td>
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<tr>
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<td>Wind profiler</td>
<td>wnid (100 m - 10 km)</td>
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<td>Sodar</td>
<td>Wind (de 50 m - 1 km)</td>
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<tr>
<td>Teotihuacan: Zona Arqueológica</td>
<td>Radiosonde</td>
<td>Td, Tw, P, wind (0-10 Km)</td>
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<td>Chalco : FMVZ_UNAM</td>
<td>Radiosonde</td>
<td>Td, Tw, P, wind (0-10 Km)</td>
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<td>UNAM : Centro Cultural Universitario</td>
<td>Radiosonde</td>
<td>Td, Tw, P, wind (0-10 Km)</td>
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<td>La Reforma, Hgo.</td>
<td>GPS Radiosonde</td>
<td>Td, Tw, P, wind (0-10 Km)</td>
<td>13 :30, 16 :30 y 18 :30</td>
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<td>FMVZ-UNAM Tres Marías, Edo. México</td>
<td>Radiosonde</td>
<td>Td, Tw y P (0-10 Km)</td>
<td>13 :30 y 16 :30</td>
</tr>
<tr>
<td>Aeropuerto Benito. Juárez</td>
<td>Radiosonde</td>
<td>Td, Tw, P, wind (0-10 Km)</td>
<td>8, 11, 13 :30, 16 :30 y 18 :30</td>
</tr>
</tbody>
</table>
Monitoring Sites on the MCVM
Tools developed at IMP; displaying monitoring data

http://itzamna.eco.imp.mx/wxdf/
Ozone Comparison – Average of all Stations

Mar. 1-2

Mar. 3-4

Mar. 8-9

Mar. 10-11

Mar. 13-14

Mar. 17-18
Surface Winds and Ozone: Mar. 2, 1997

10-11

12-13
Surface Winds and Ozone: Mar. 2, 1997

14-15

16-17
Surface Winds and Ozone: Mar. 14, 1997

10-11

12-13
Surface Winds and Ozone: Mar. 14, 1997

14-15

16-17
Conclusions

- Modeling air quality at IMP is not intended for real-time forecasting purposes, but for answering what if questions.

- Models are used as a complementary tool with ambient measurements to better understand the air pollution science.