



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

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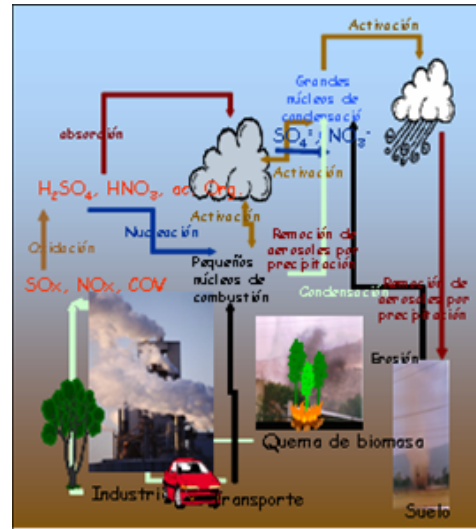
Massachusetts Institute of Technology (MIT)

GURME Expert Workshop on Air Quality Forecasting

24-26 October, 2002

Cuernavaca, Morelos

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)

- ❖ 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**

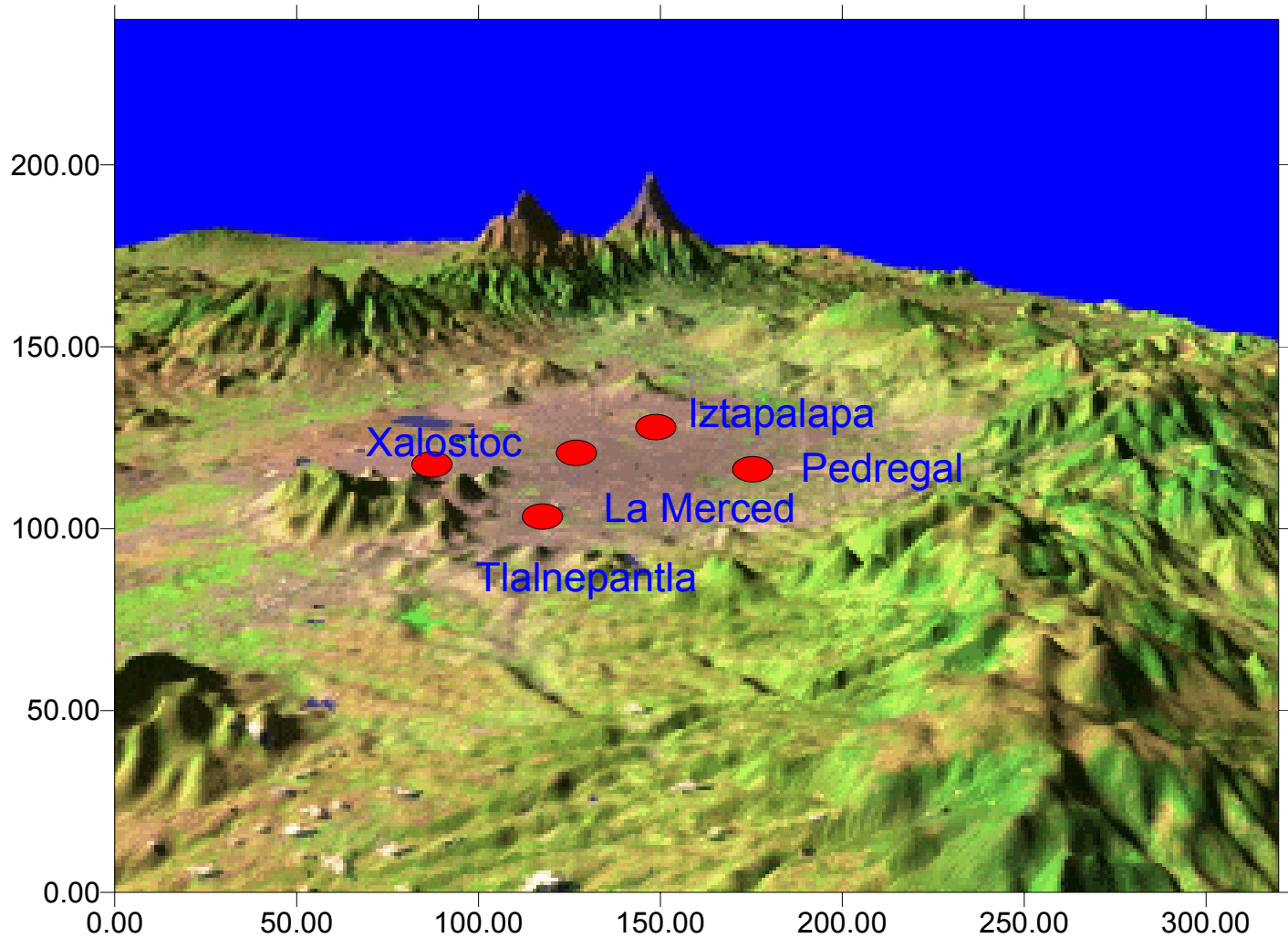
Past and Current Comprehensive Research Projects on the MCVM

- ❖ **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)
- ❖ **MIT-CAM: Integrated Program on Urban, Local and
Global air pollution (2000- 2003)**
(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)

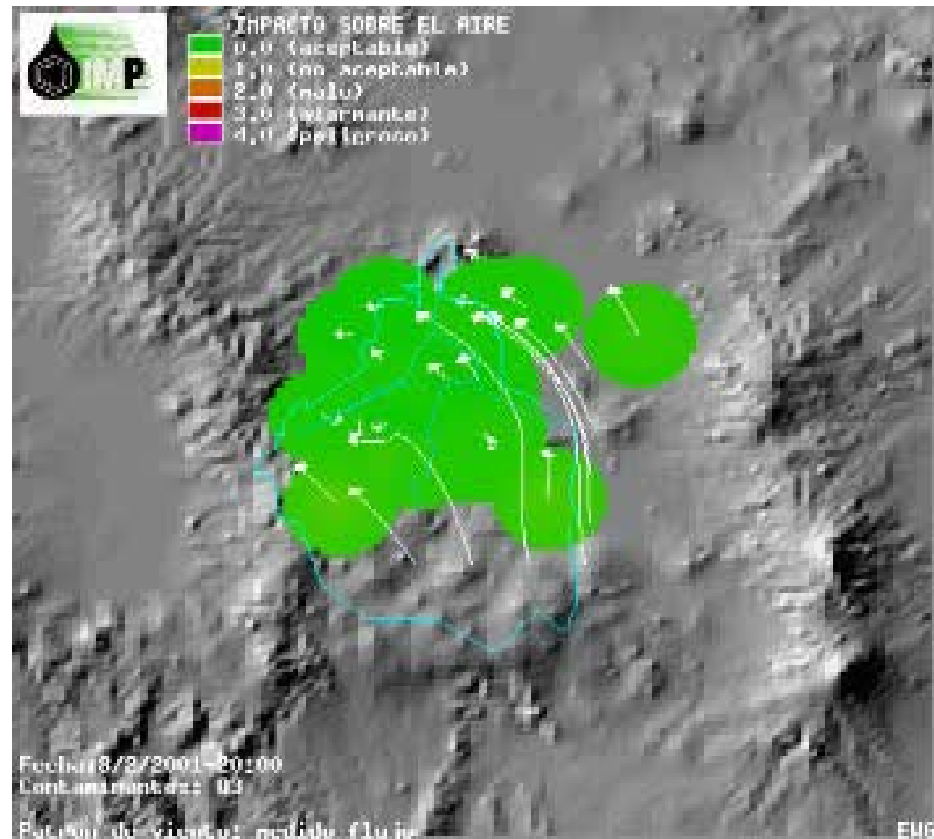
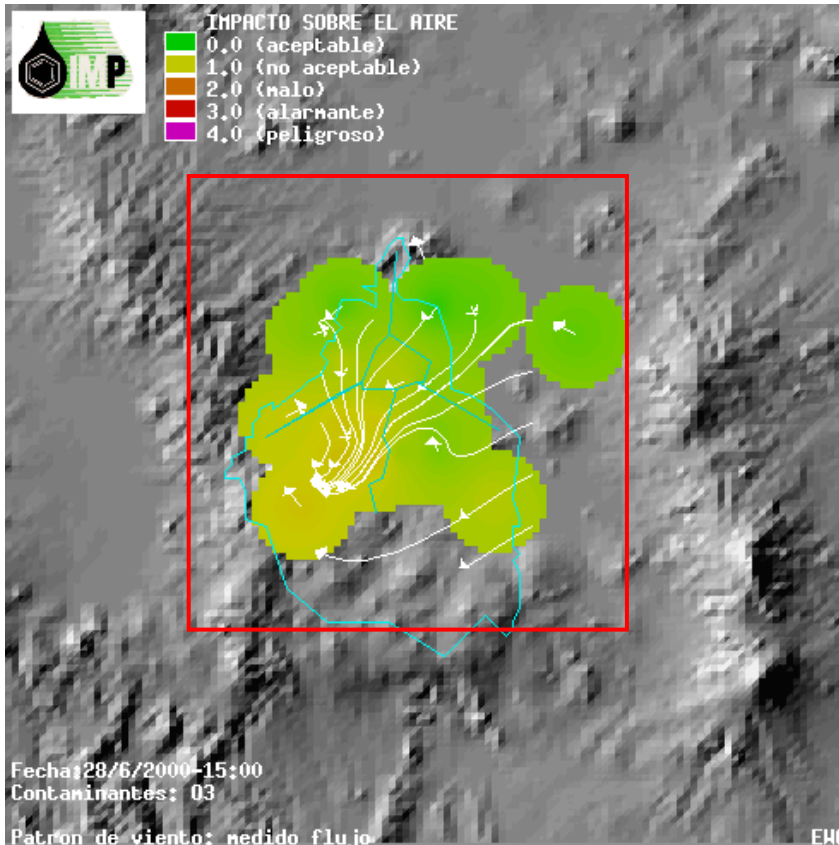
MET Measurements during IMADA-AVER (Mach 1997)

Site	Equipment	MET Variables	Time/freq.
FES-Cuautitlan. Campo IV	Radiosonde Wind profiler Sodar	Td, Tw, P, wind (0-10 Km) wnid (100 m - 10 km Wind (de 50 m - 1 km)	8, 11, 13 :30, 16 :30 y 18 :30 continuos continuos
Teotihuacan: Zona Arqueológica	Radiosonde Wind profiler Sodar	Td, Tw, P, wind (0-10 Km) Wind (100 m - 10 km Wind (de 50 m - 1 km)	8, 11, 13 :30, 16 :30 y 18 :30 continuos continuos
Chalco : FMVZ_UNAM	Radiosonde Wind profiler Sodar	Td, Tw, P, wind (0-10 Km) wind (100 m - 10 km wind (de 50 m - 1 km)	8, 11, 13 :30, 16 :30 y 18 :30 continuos continuos
UNAM : Centro Cultural Universitario	Radiosonde Wind profiles Sodar	Td, Tw, P, wind (0-10 Km) wind (100 m - 10 km wind (de 50 m - 1 km)	8, 11, 13 :30, 16 :30 y 18 :30 continuos continuos
La Reforma, Hgo.	GPS Radiosonde	Td, Tw, P, wind (0-10 Km)	13 :30, 16 :30 y 18 :30
FMVZ-UNAM Tres Marías, Edo. México	Radiosonde	Td, Tw y P (0-10 Km)	13 :30 y 16 :30
Aeropuerto Benito. Juárez	Radiosonde	Td, Tw, P, wind (0-10 Km)	8, 11, 13 :30, 16 :30 y 18 :30

Monitoring Sites on the MCVM



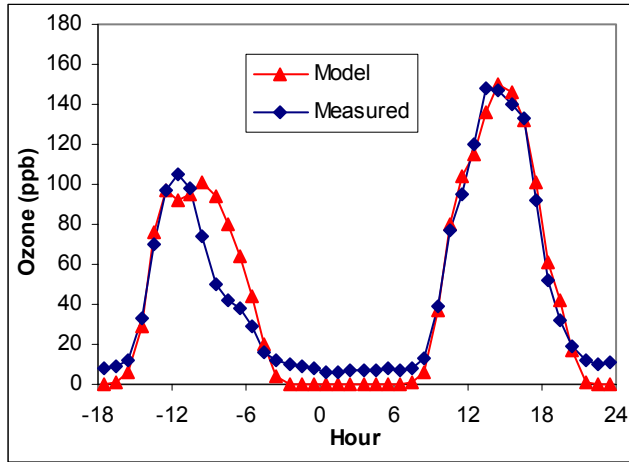
Tools developed at IMP; displaying monitoring data



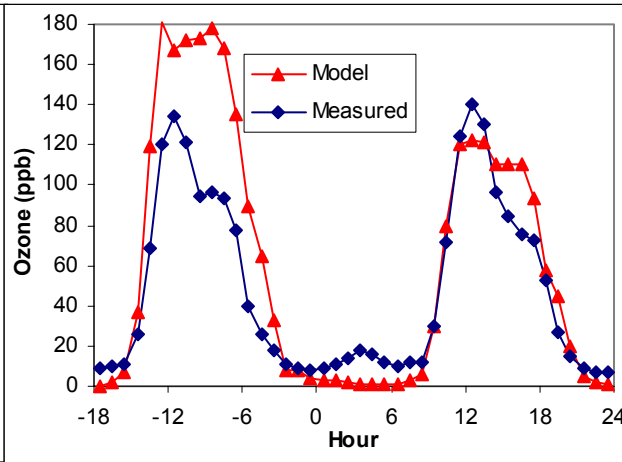
<http://itzamna.eco.imp.mx/wxdf/>

Ozone Comparison – Average of all Stations

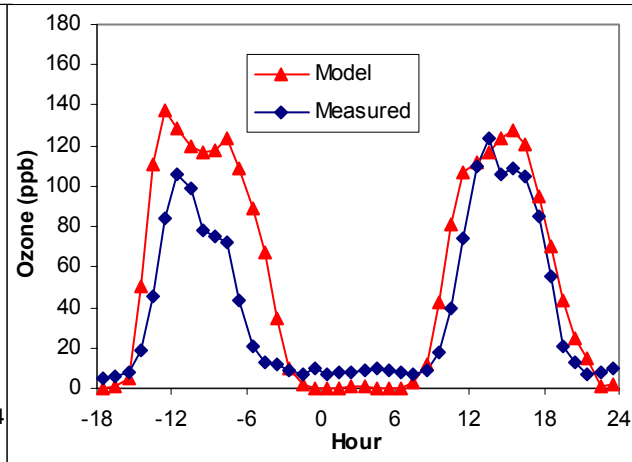
Mar. 1-2



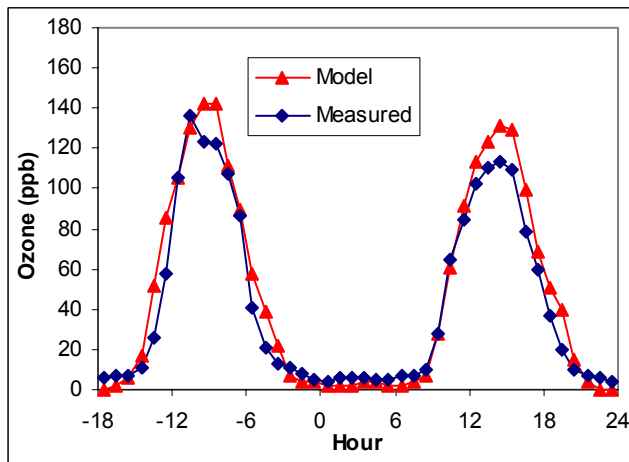
Mar. 3-4



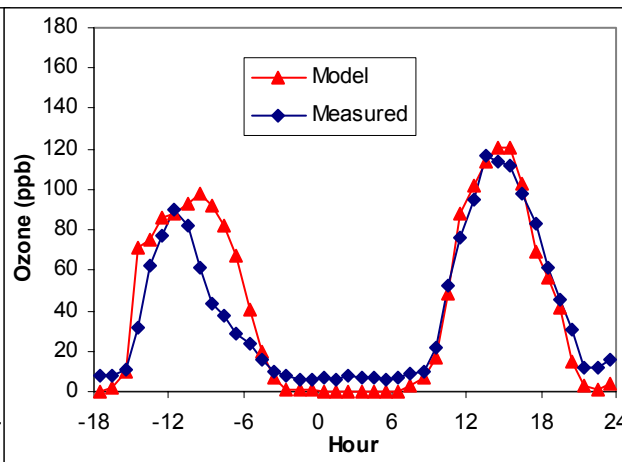
Mar. 8-9



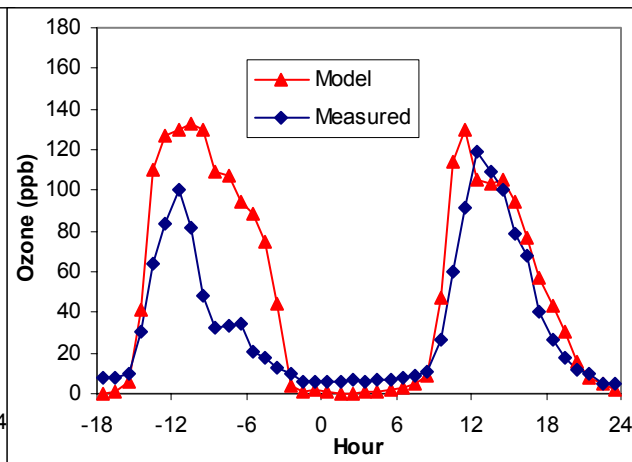
Mar. 10-11



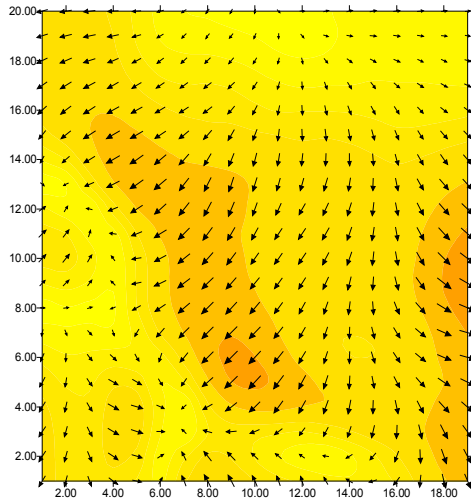
Mar. 13-14



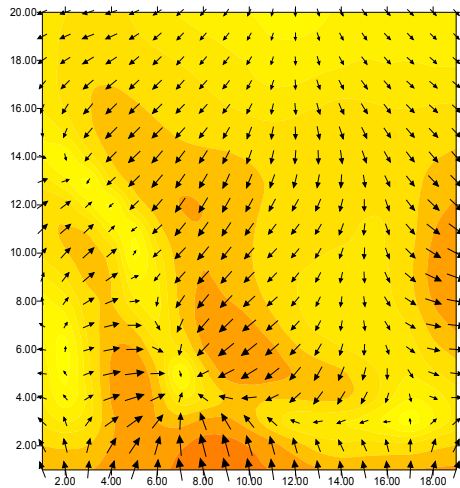
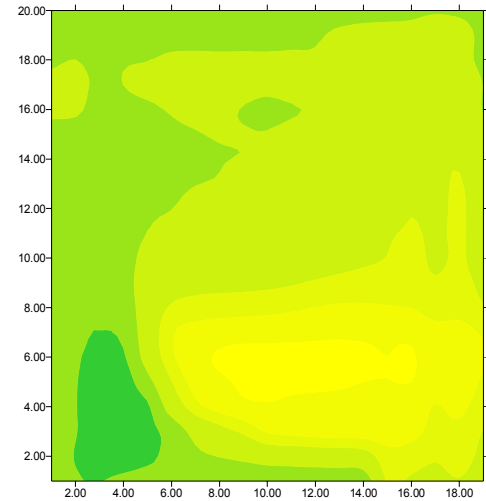
Mar. 17-18



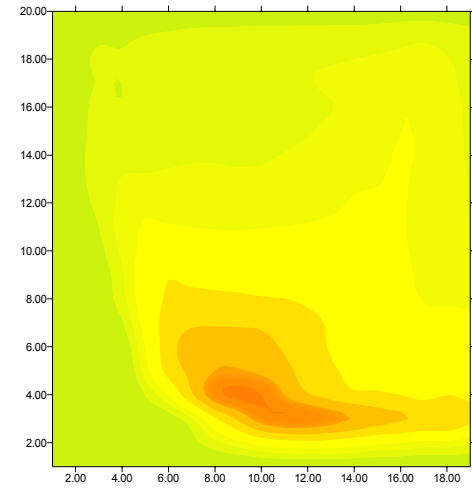
Surface Winds and Ozone: Mar. 2, 1997



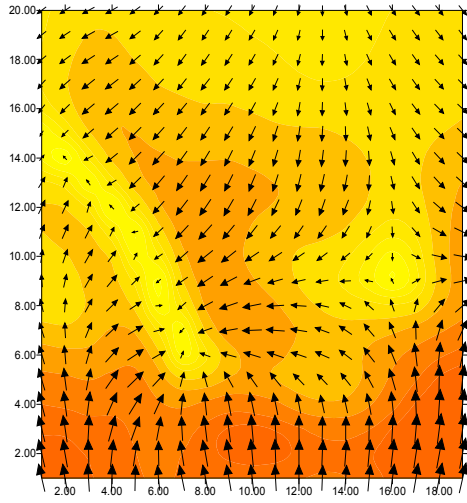
10-11



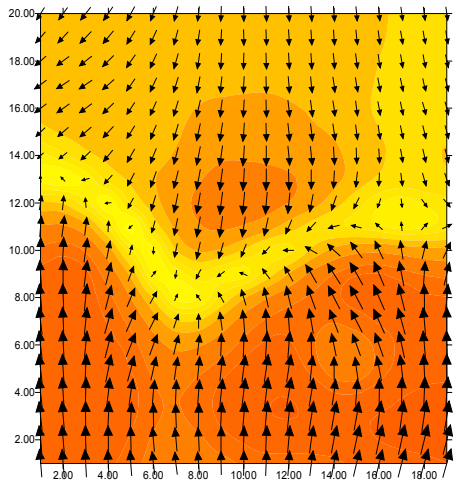
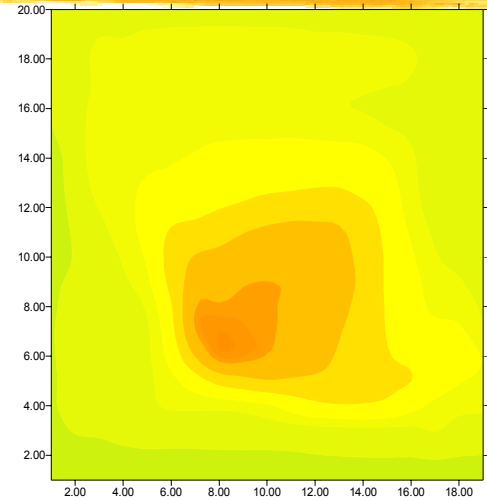
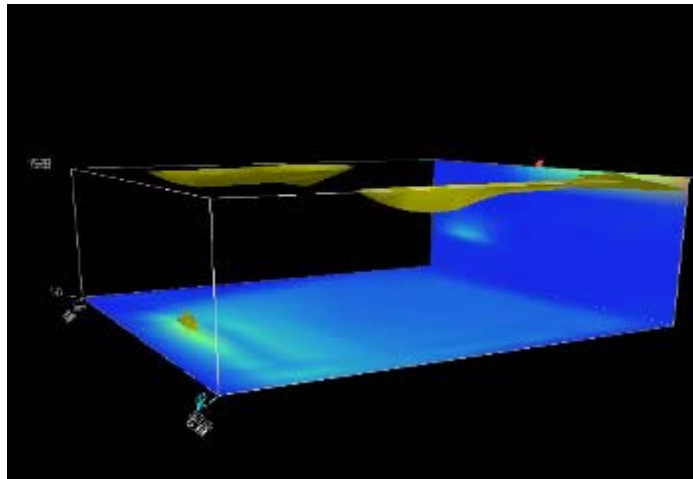
12-13



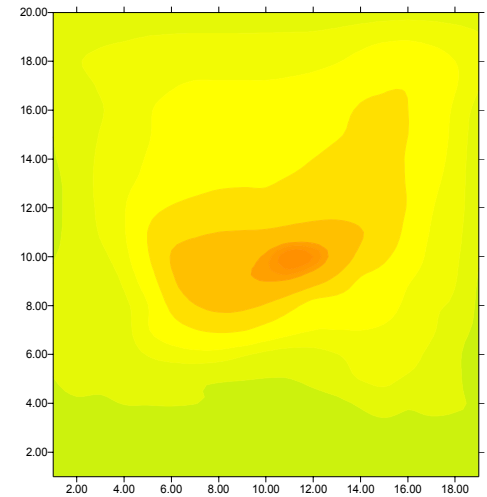
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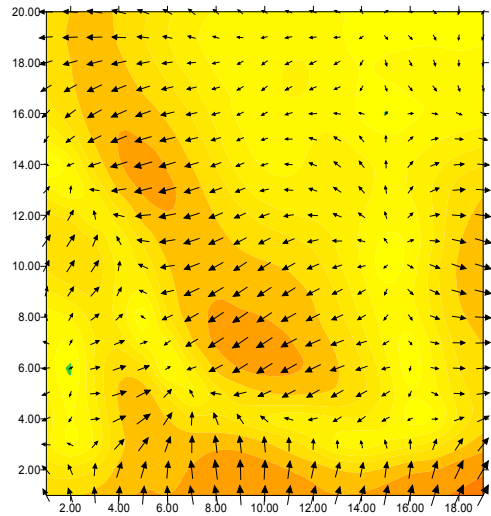
14-15



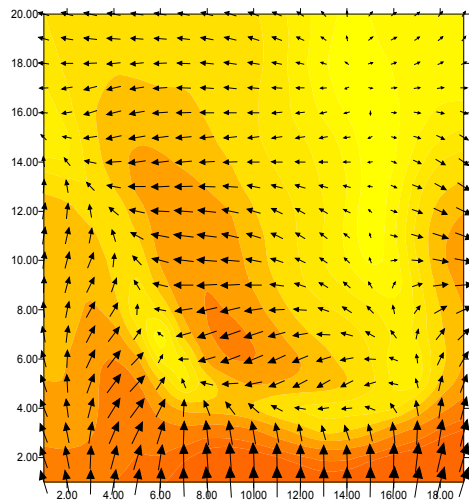
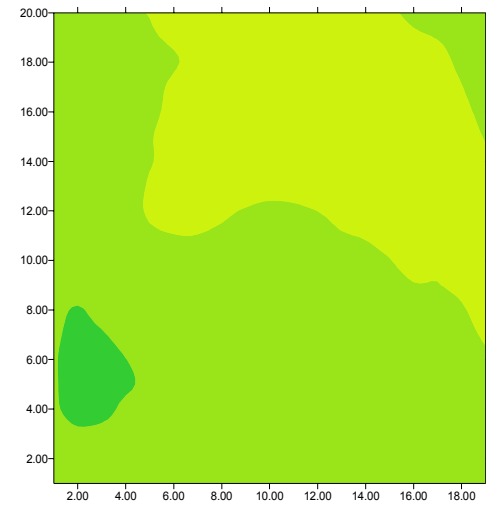
16-17



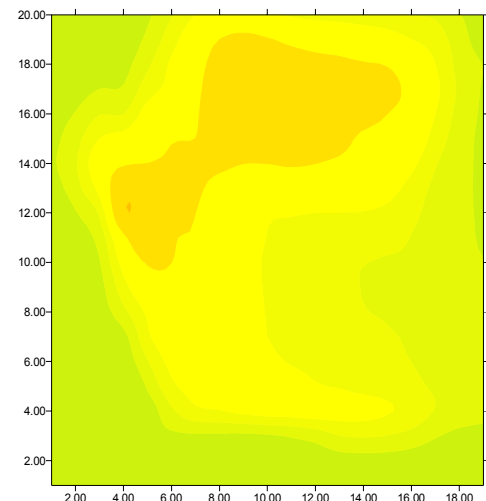
Surface Winds and Ozone: Mar. 14, 1997



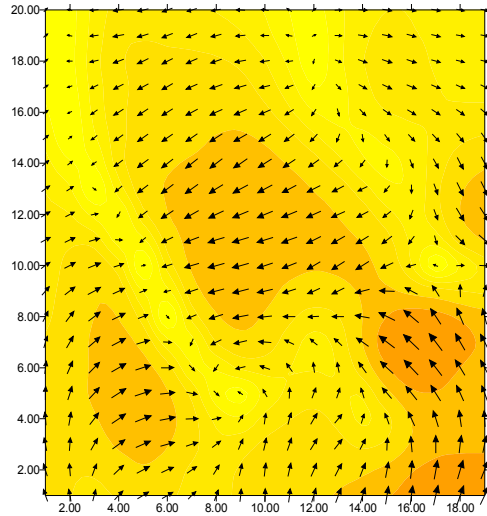
10-11



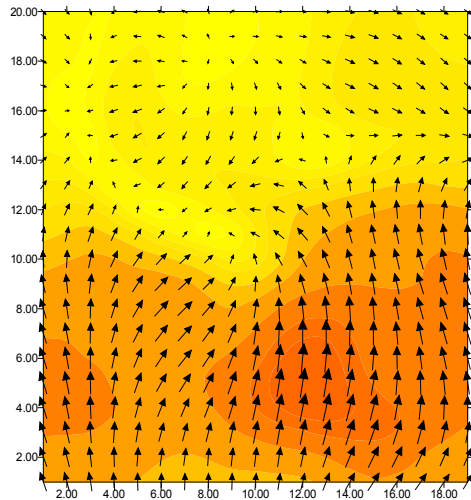
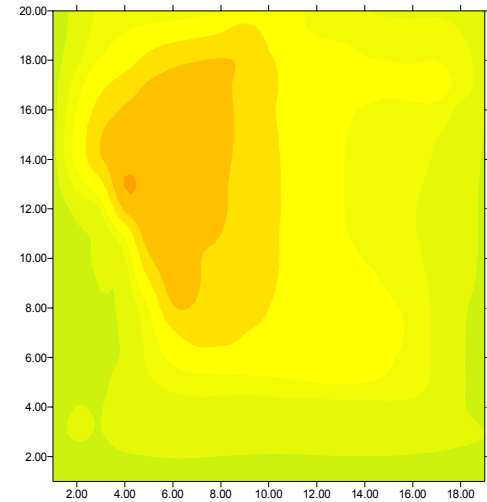
12-13



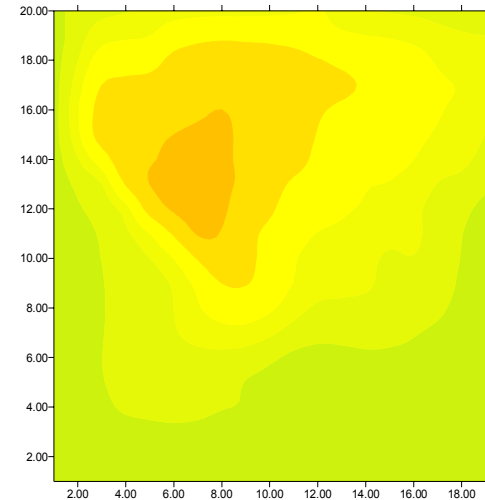
Surface Winds and Ozone: Mar. 14, 1997



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.