Report of Forecasting/Modeling Working Group for MILAGRO and INTEX

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Modeling Investigators

Ernesto Caetano, Victor Magaña, UNAM, MM5

Agustín García: CCA/UNAM, MCCM (using MM5-UNAM as input)

Benjamin de Foy: University of California - San Diego, MM5+FLEXPART+CAMx

Bill Skamarock: NCAR / MMM, WRF

Xuexi Tie: NCAR / ACD, WRF-chem

Andreas Stohl: Norwegian Institute for Air Research, FLEXPART

Greg Carmichael, Youhua Tang, Marcelo Mena: University of Iowa, STEM

Peter Hess, Louisa Emmons: NCAR / ACD, MOZART

Daniel Jacob: Harvard University, GEOS-chem

Brad Pierce: NASA Langley, RAQMS

Other investigators that may contribute:

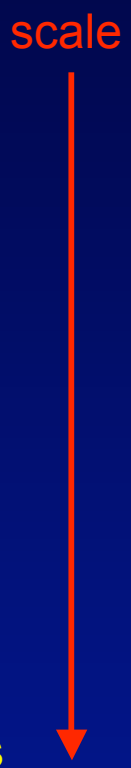
Georg Grell: NOAA, operational version WRF-chem

Alma Hodzic, NCAR / ACD, CHIMERE (using MM5-UCSD as input)

Forecasting Models

Likely Models

MM5	Local - Regional, meteorology, Δx = 24, 8 km
MCCM	Local - Regional, chemistry, Δx = 24, 8 km
MM5+CAMx	Local - Regional, meteorology, chemistry, trajectories, dispersion, Δx = 36, 12, 3 km
WRF	Local - Regional, meteorology and tracers, Δx = 9, 3 km
WRF-chem	Local - Regional, meteorology, chemistry, Δx = 6 km
STEM	Regional - Continental, meteorology, tracers, chemistry, particulates, Δx = 60, 12, 4 km
FLEXPART	Global, passive scalar using GFS forecasts Δx = 1 degree
MOZART	Global, chemistry, Δx = 2 degree
GEOS-Chem	Global, chemistry, Δx ~ 50 km
RAQMS	Global, chemistry, ozone assimilation, Δx = 2 x 2.5 degrees



Possible models

WRF-chem	Continental, meteorology, chemistry, particulates, Δx = 40 km
CHIMERE	Local - Regional, chemistry and particulates

Investigator Field Locations

Veracruz:

Jerome Fast, Bill Skamarock, Marcelo Mena, Greg Carmichael (part time), Daniel McKenna (?)

Houston:

Peter Hess, Louisa Emmons, Daniel Jacob, Brad Pierce, Youhua Tang, Greg Carmichael (part time)

Mexico City:

Ernesto Caetano, Victor Magaña, Benjamin de Foy, Virginia Mora

Remote:

Xuexi Tie: (coordinate with Bill Skamarock)

Andreas Stohl: (coordination with Owen Cooper or Daniel McKenna)

Key Issues (1)

- Communications
  - Video conferencing between Houston and Veracruz operation centers - this is a critical need ($)
  - Phone or web-cam conferencing between Veracruz operation centers and Mexico City modelers
  - Bandwidth sufficient at Veracruz to handle all of the graphical products produced by the models?

- Model Operation
  - Investigate use of common emissions for field campaign: scenario 1) use existing Mexico City inventory and develop a regional inventory or 2) get improved gridded emissions from INE that may be available soon
  - Short documentation on model configuration / assumptions for each model

Key Issues (2)

- Forecasting procedure
  - Exactly what time of day is a forecast briefing required?
  - What types of products do scientists and aircraft staff need? Static products are easier to put together ahead of time - last minute requests will be more difficult.
  - Prior to forecasting briefing: Spent time on examining new model output, each modeler get together to get a consensus of model performance both short range and long range perspective, probably need 3 - 5 h
  - Houston and Veracruz operation centers prepare forecasts largely independently prior to video conference
  - Daily forecasting briefing: video conference between Houston and Veracruz
  - After forecasting briefing: compare model forecasts with real-time observations
  - Make sure certain field measurements are available in real-time (e.g. radar wind profiler, soundings, satellite)

Action Items

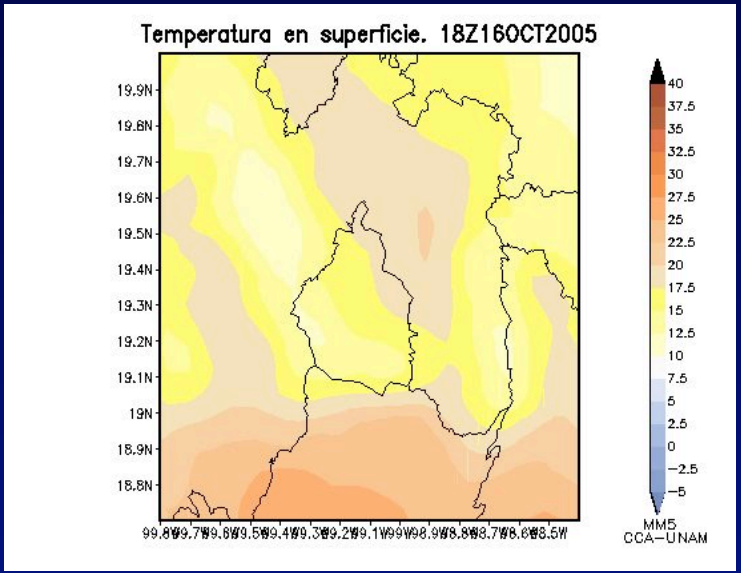
- Refine possible forecast products, consult with aircraft PI
  - Cloud, rain, fog forecasts from mesoscale models
  - Horizontal and vertical cross sections of tracers
  - Taging tracers by source (Mexico City, Tula, volcano, biomass burning sites, etc.)
  - Detailed wind, temperature, humidity profiles at primary surface measurement sites (T0, T1, T2, Veracruz) and others
- When will Veracruz operation center become operational?
  - Decide on an initial start date of model forecasts that can be made available to the center web site (~2 weeks prior to the field campaign)
  - Forecasting staff will want to utilize operations center ~2 days prior to the start of the field campaign
- Additional forecasters in Veracruz
  - Local National Meteorological Service forecasters for Veracruz and Mexico City ($)
  - Local graduate students ($)
  - Additional modeling investigators and/or their graduate students / post-docs ($)
- Soil moisture measurements - request from surface observations group

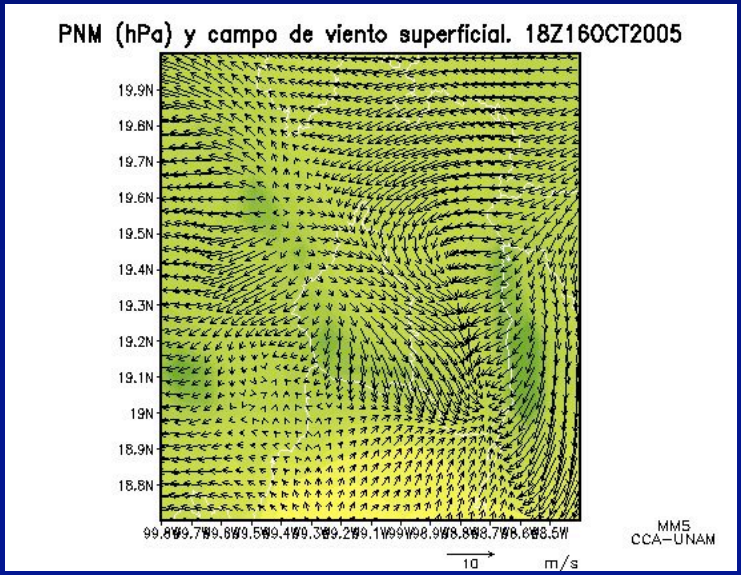
Example 1: MM5 - UNAM

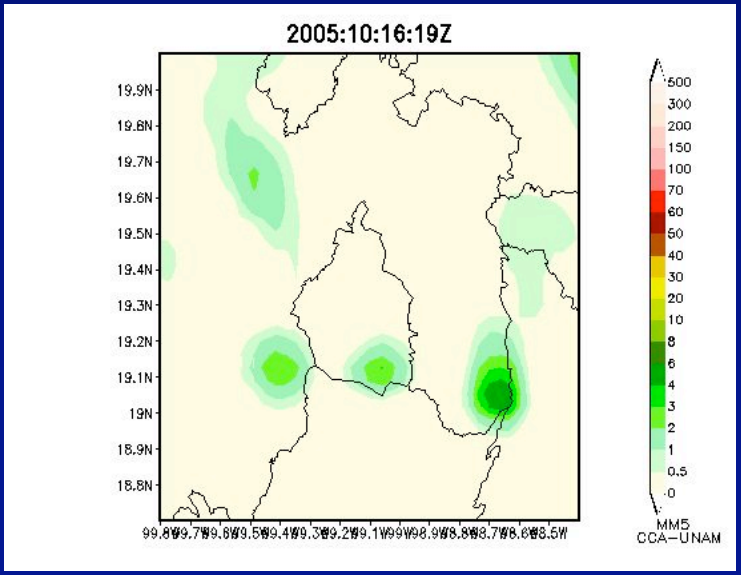
Local-Scale Products:

- hourly forecasts and animations
- surface winds, temperature, and precipitation

30-h forecast from
12 Z 15 October simulation

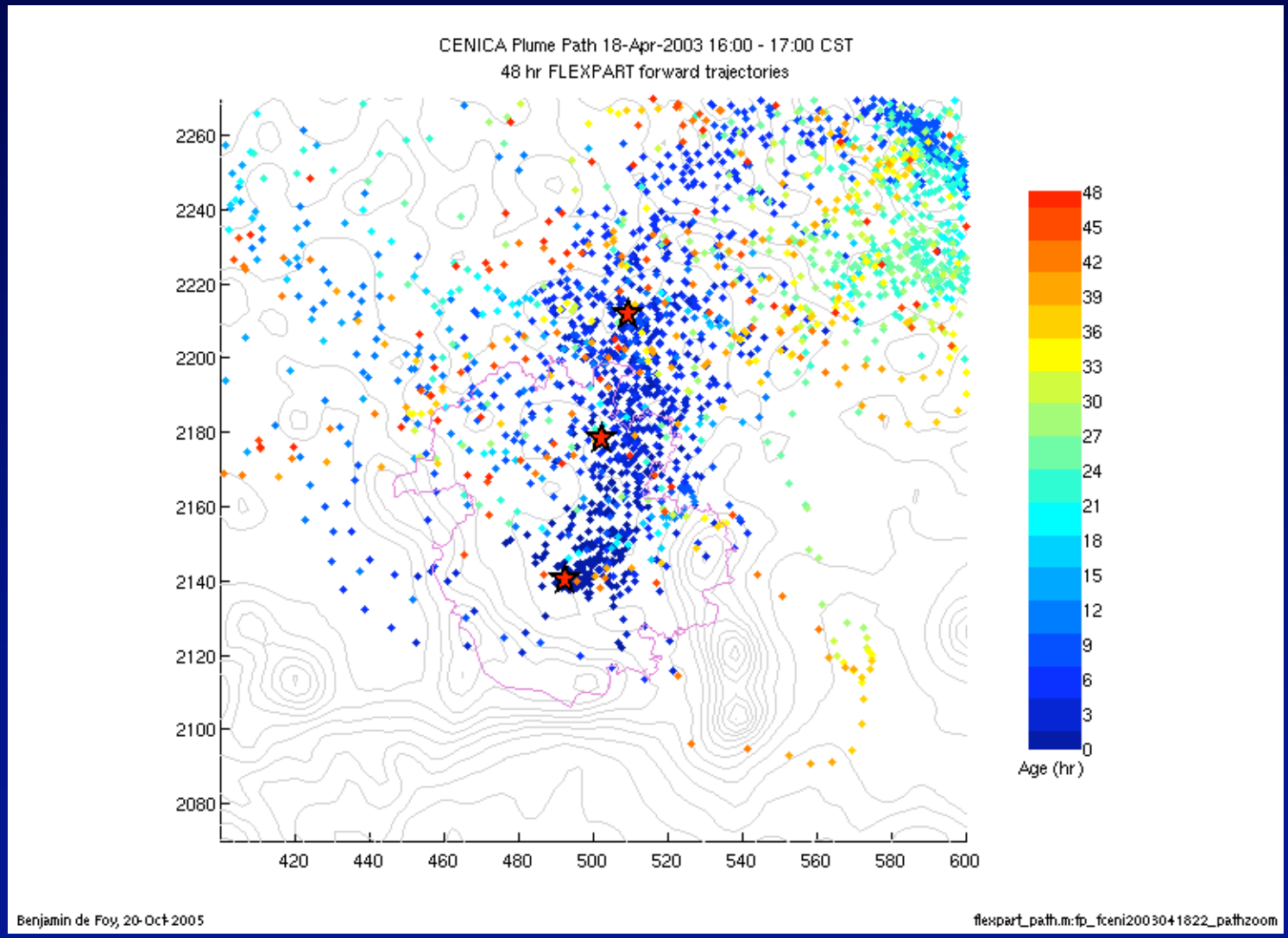






Example 2: MM5 - UCSD

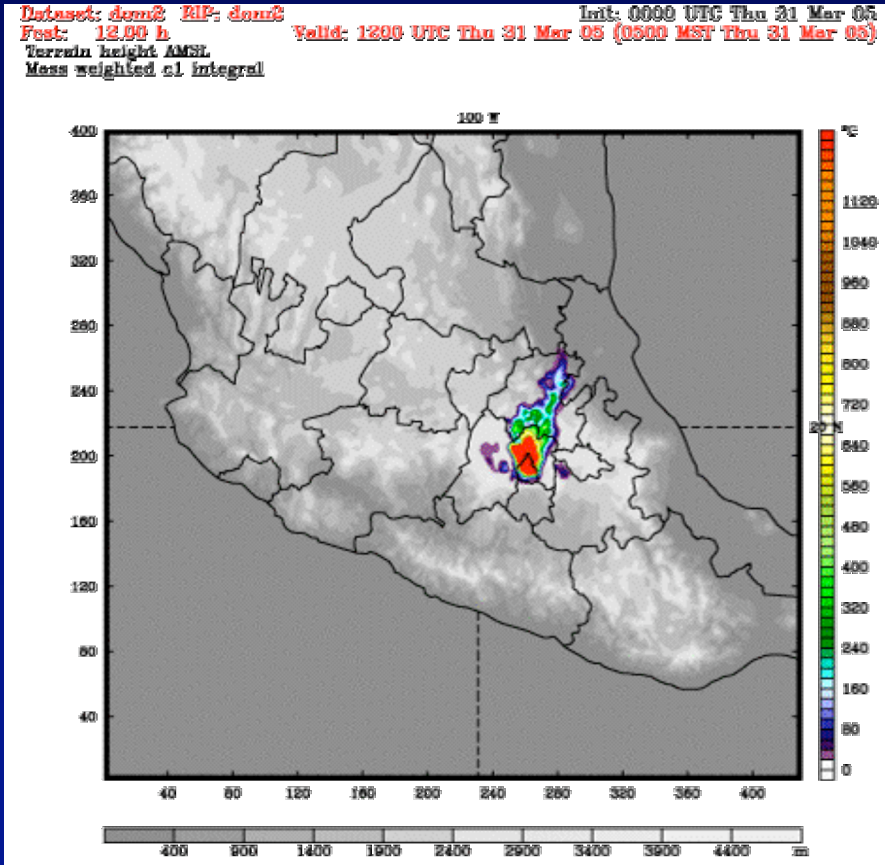
Particle Dispersion using FLEXPART



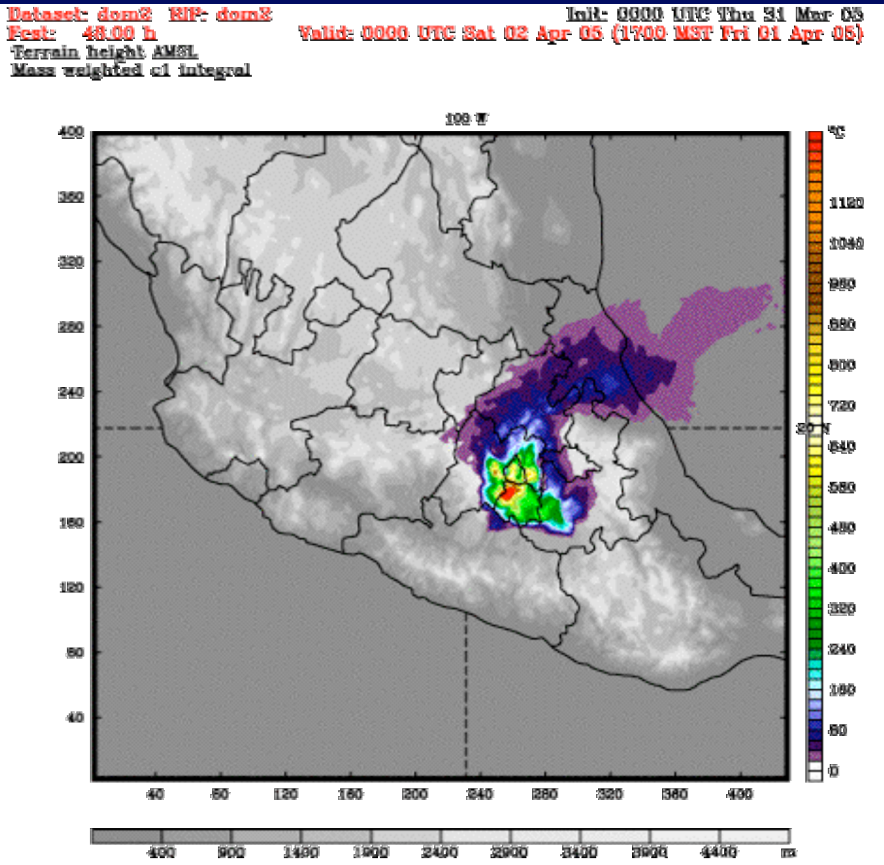
Example 3: WRF - NCAR

Tracers Predicted by WRF - Bill Skamarock, NCAR
0-4 km Integrated Tracer Mass, 3 km Grid

12-h Forecast



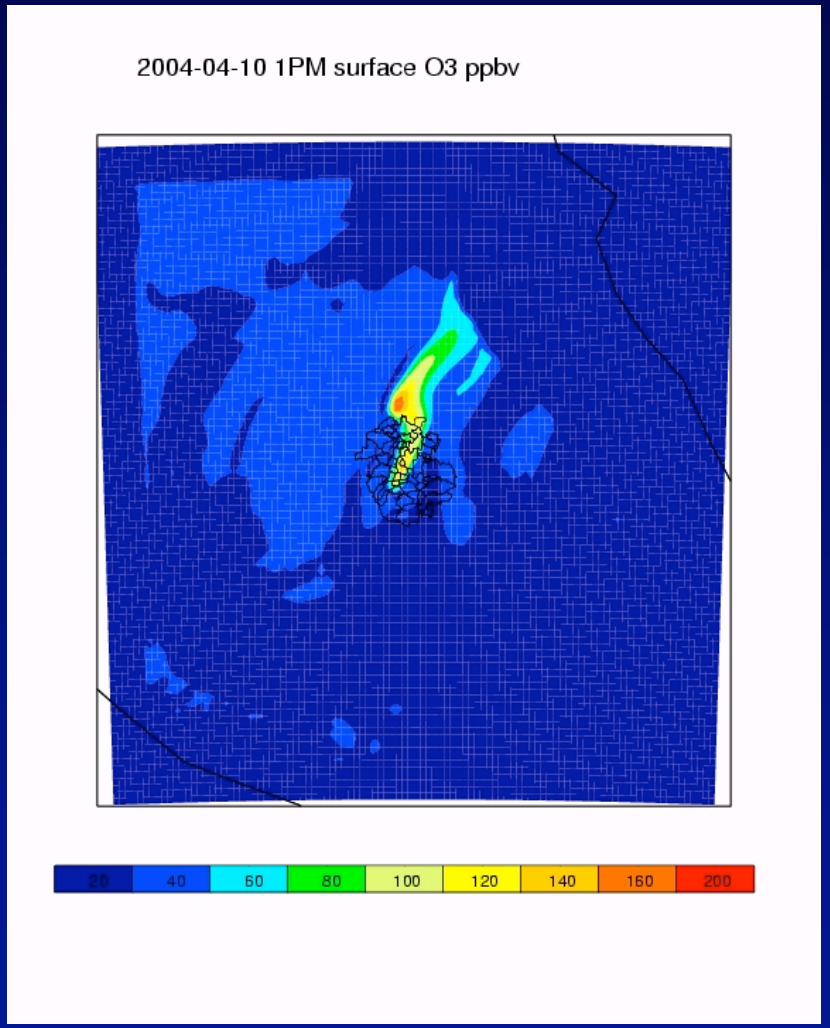
48-h Forecast



Example 4: WRF-chem - NCAR

Chemistry version of WRF:

- Regional chemical transport model
- Meteorology and chemistry are fully-coupled
- RADM photochemical mechanism
- MADE / SORGRAM aerosol model - modal approach
- Lateral boundary conditions:
- one domain, Δx = 6 km that encompasses central Mexico

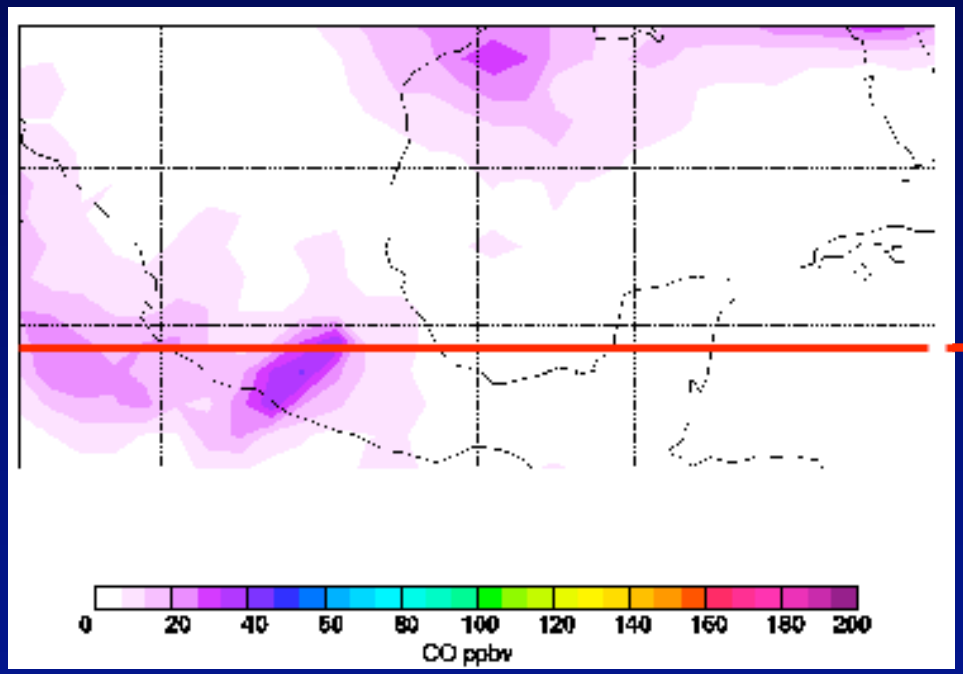


Example 5: FLEXPART - NILU

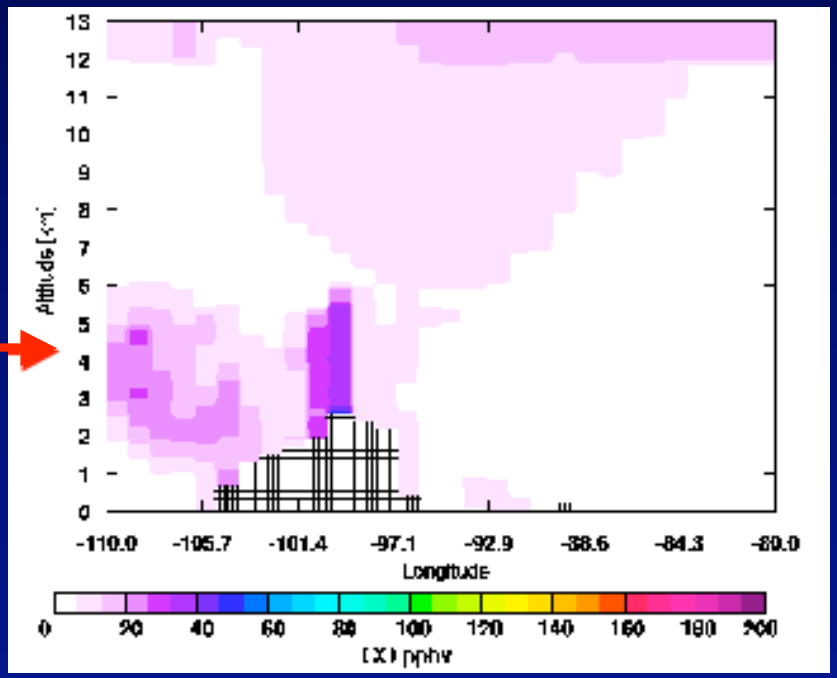
Example from ICARTT 2004:

- North American anthropogenic CO

15 July 18 UTC, 3000 m MSL



15 July 18 UTC, 19° N



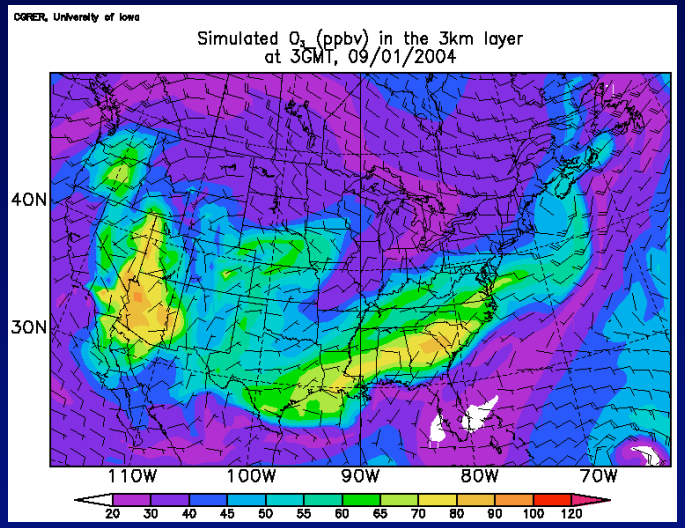
Similar Operation for 2006:

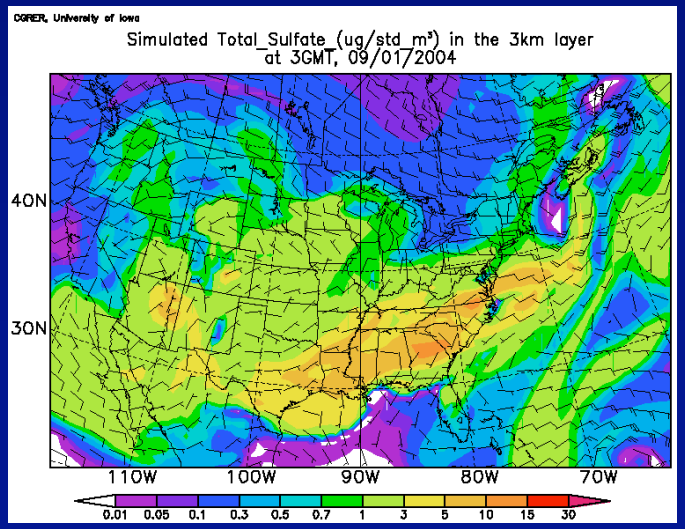
- Testing to start in January
- Run the model from Boulder (faster access to GFS data)
- Forecasts produced 4 times per day

Example 6: STEM - UI

Example from ICARTT 2004:

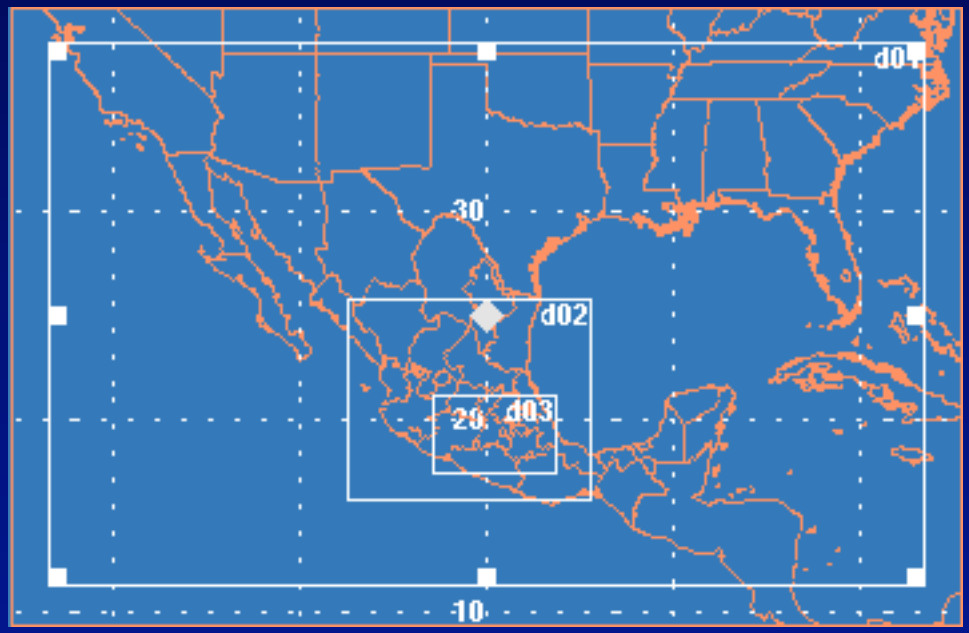
- North American 60-km grid





Proposed MIRAGE-Mex domain:

- Grid 1: 60 km, 80x50
- Grid 2: 12 km, 111x91
- Grid 3: 4 km, 166x106



RAQMS

Example from March 2001:

- Lagrangian analysis (reverse domain filling of 10-day back trajectory)
- Boundary layer NOy