FLIGHT PLANNING IN INTEX-A

The DC-8 at MidAmerica airport

FROM MISSION DESIGN TO DAY-TO-DAY FLIGHT PLANNING
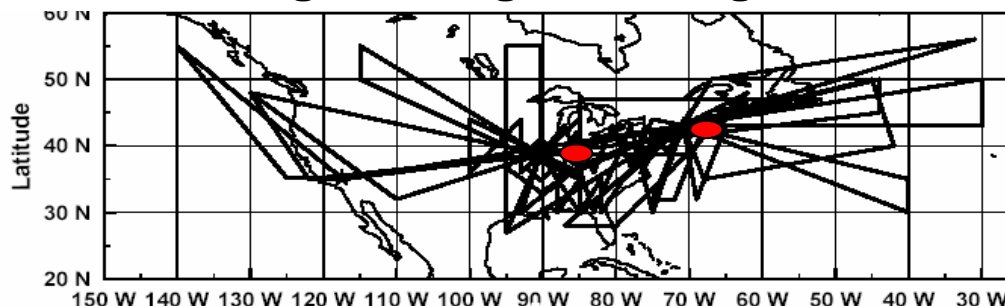
INTEX-A mission objectives

A priori information:
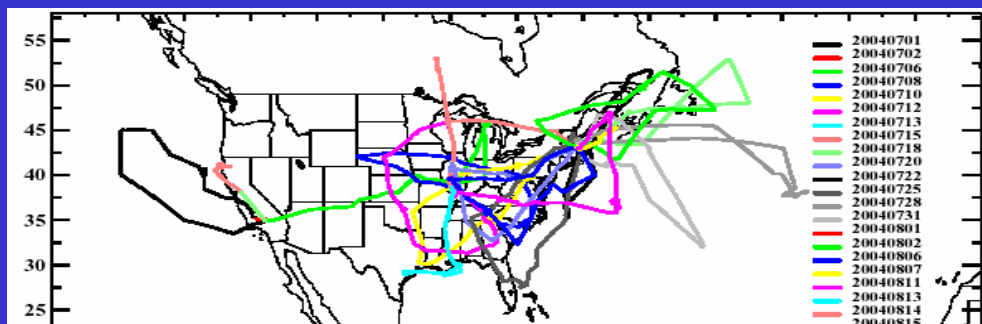- *past observations*
- *models*

Observational resources

Mission design: timing, sites, flight menu

INTEX-A pre-mission flight plan

Get in the field; throw away the plans

day-to-day flight planning

Actual flight plan

HOW WAS DAY-TO-DAY FLIGHT PLANNING DONE?

- **MIND THE VISION:** mission objectives, evolving priorities, flight menu

- **IDENTIFY OPPORTUNITIES:**
  - Near-real-time observations (aircraft, satellite)
  - Synoptic meteorological forecasts
  - Plans of other ICARTT aircraft

- **DESIGN FLIGHT PLAN:**
  - Lagrangian trajectories
    - Forward: track current events of interest
    - Backward: define areas of influence for proposed flight tracks
  - Eulerian CTMs: convolve meteorological forecasts with source and chemical information; fly aircraft through model

- **GENERAL FLIGHT PLAN CRITERIA:**
  - Satellite validation (Terra, Aqua, Envisat)
  - Extensive vertical profiling
 - Extensive geographical coverage

FLIGHT PLANNING TEAM AND PRODUCTS

- **Fuelberg:** weather forecasts, forward trajectories (boundary layer influence), back-trajectories (potential flight tracks)

- **Thompson/Pickering/Pfister:** forward trajectories, Lagrangian influence maps (ozonesondes, TOMS AI, ligthning, convection)

- **McMillan:** NRT AIRS CO + forward trajectories

- **Richter:** NRT SCIAMACHY NO_2, HCHO

- **Chu:** NRT MODIS AOD, NOAA GASP AOD, smoke product

- **Edwards/Emmons:** MOPITT CO + MOZART global CTM forecasts

- **Carmichael:** STEM regional CTM forecasts

- **Pierce:** RAQMS global CTM forecasts

- **Jacob/Jaegle/Pawson:** GEOS-4 global CTM forecasts

- **Crawford:** flight planning and satellite orbit software

INTEX flight#14 plan – Pease local 6 on 7/31

Objectives:

1. Low-level continental outflow
2. Chemical aging and recirculation around Bermuda High
3. Intercomparison with P-3
4. Triple-whammy satellite validation: Terra, Aqua, Envisat
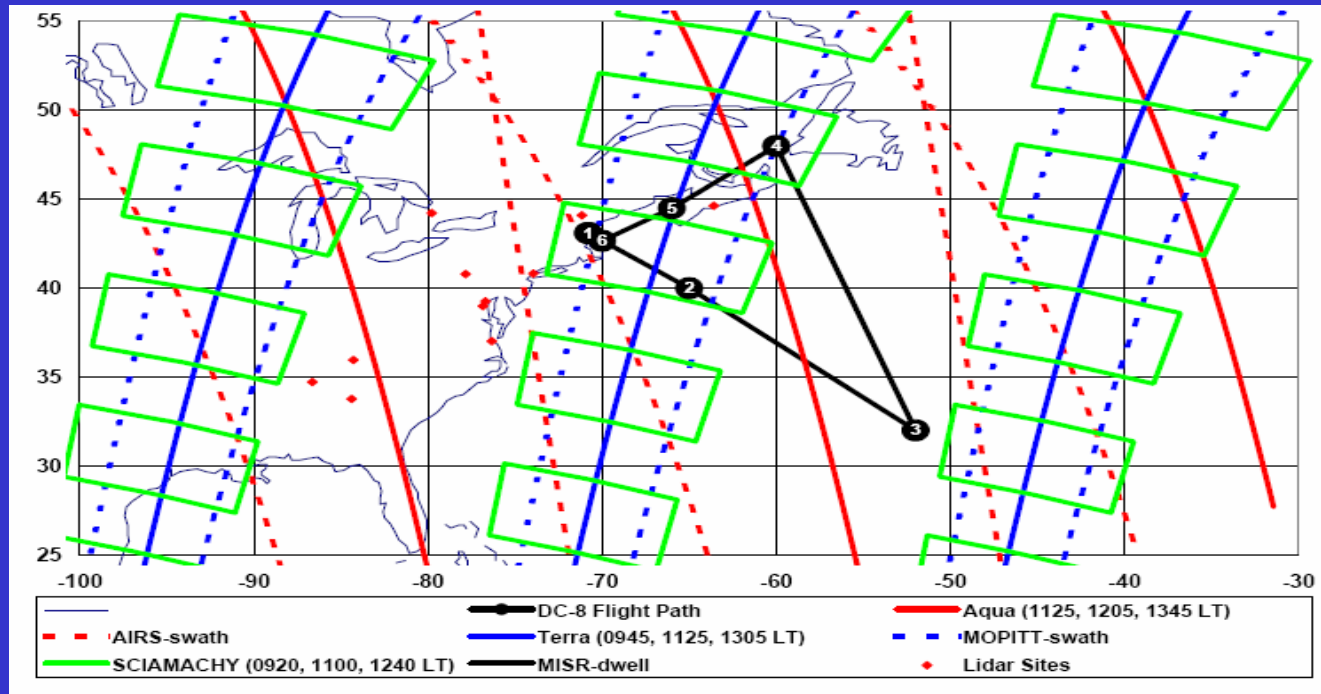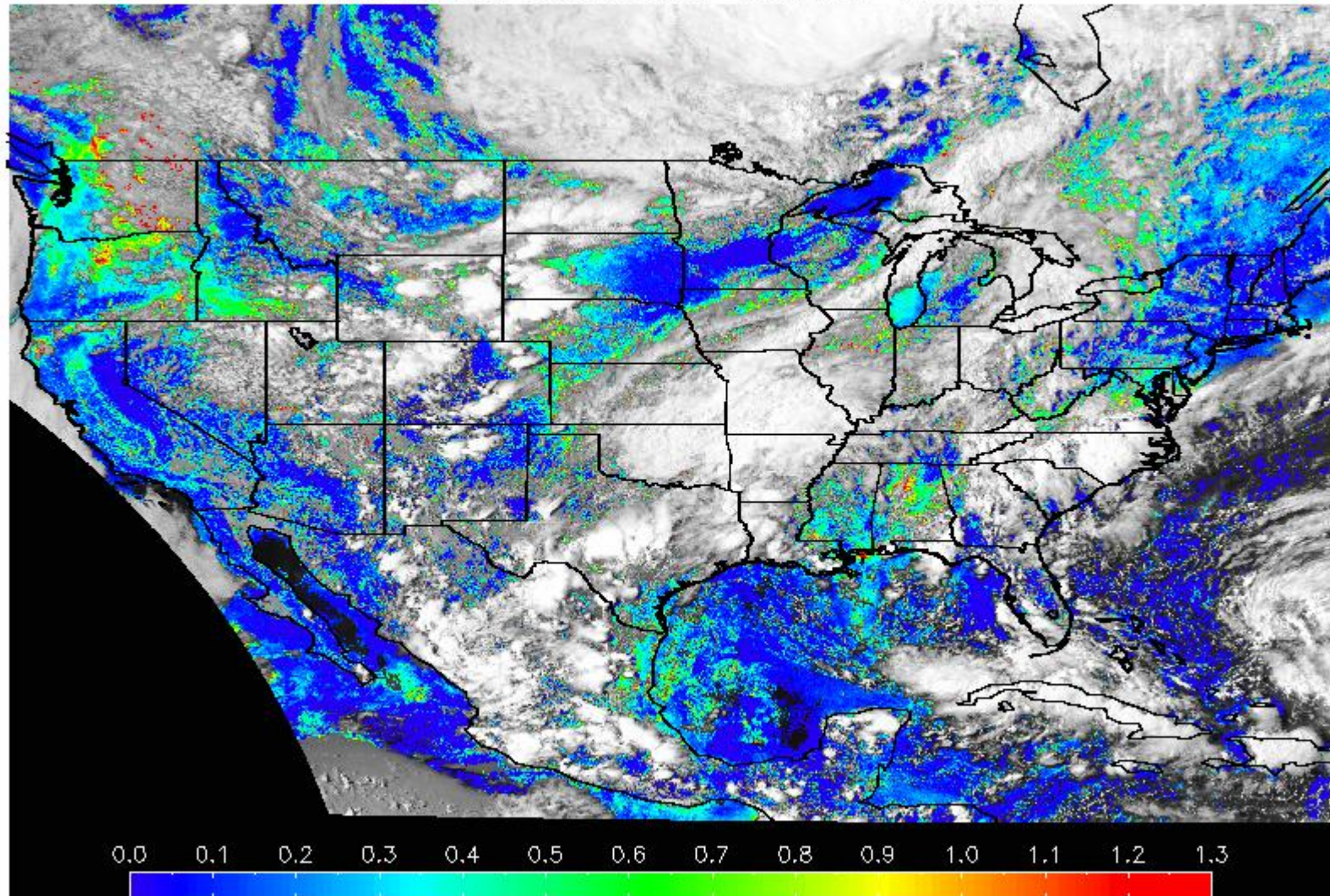

Full vertical profiling along points 1-2-3-4;
Spiral at point 2 (satellite validation);
Low-altitude 1-15K legs along points 4-5;
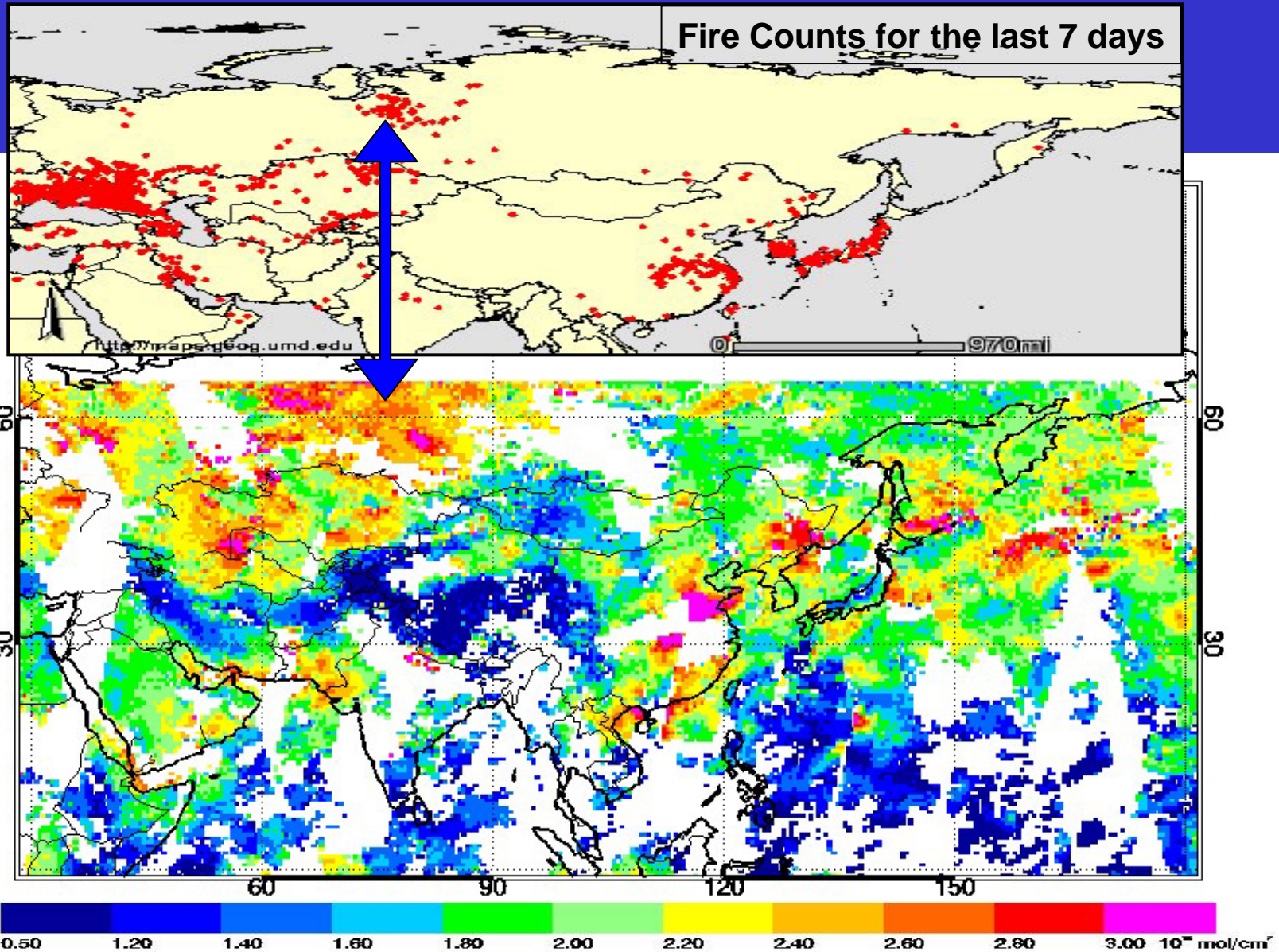P-3 rendez-vous at point 5, intercomparison along points 5-6

NOAA GASP AOD and Fire and Smoke 7/29 at 22Z: Fires in Washington State

GASP Aerosol Optical Depth   22:15UTC 7/29/04

0.0   0.1   0.2   0.3   0.4   0.5   0.6   0.7   0.8   0.9   1.0   1.1   1.2   1.3

Fires in western Siberia

MOPITT CO Column for 20040725-20040729
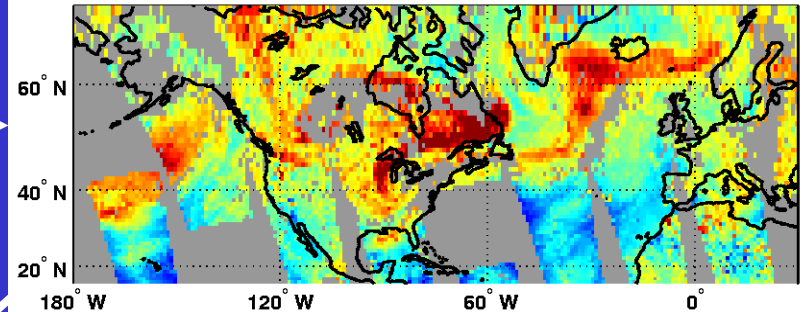

Fire Counts for the last 7 days

AIRS CO mixing ratio on 7/27-29:
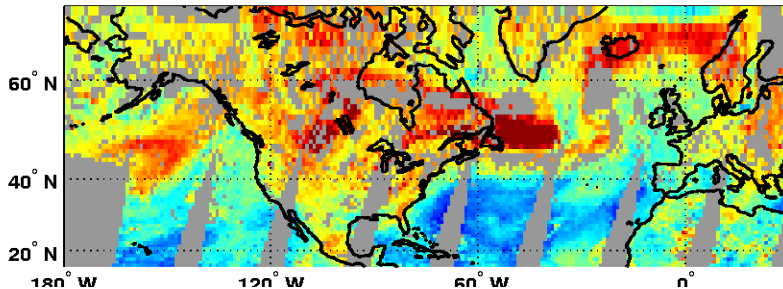## Elevated CO transported over to the Atlantic Ocean, Asian plume reaching west coast
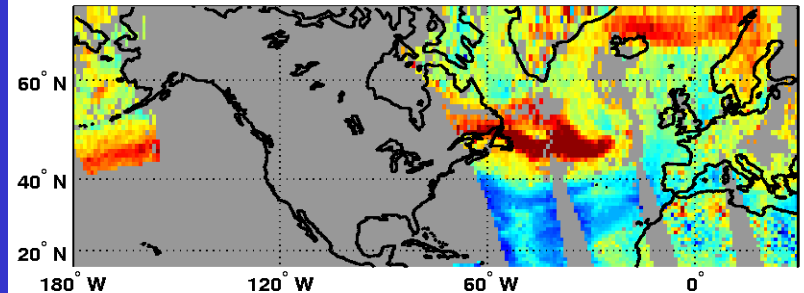

Local AM (descending) AIRS CO at 500 mb on 20040727
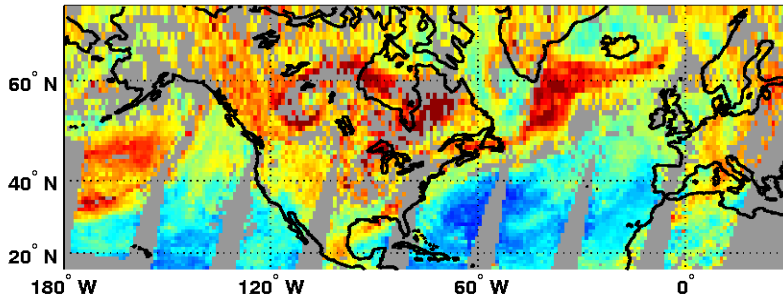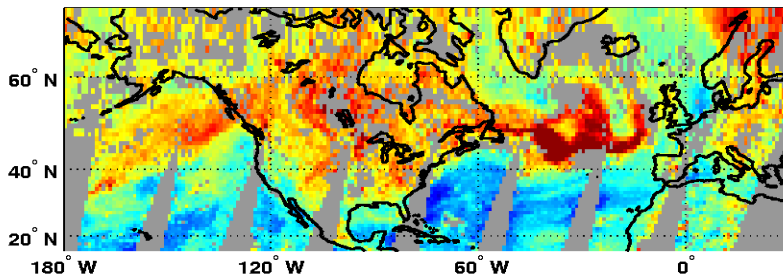
Local PM (ascending) AIRS CO at 500 mb on 20040727

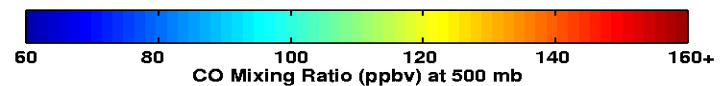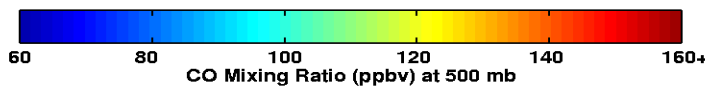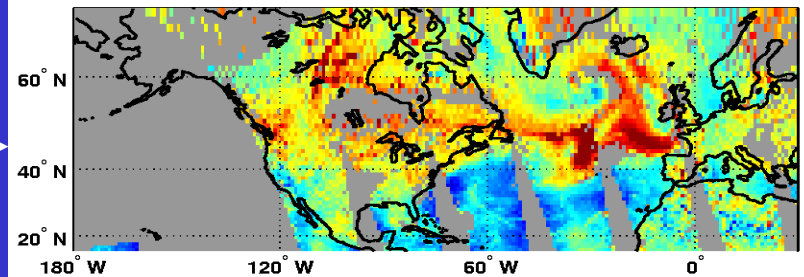Local AM (descending) AIRS CO at 500 mb on 20040728

Local PM (ascending) AIRS CO at 500 mb on 20040728

Local AM (descending) AIRS CO at 500 mb on 20040729
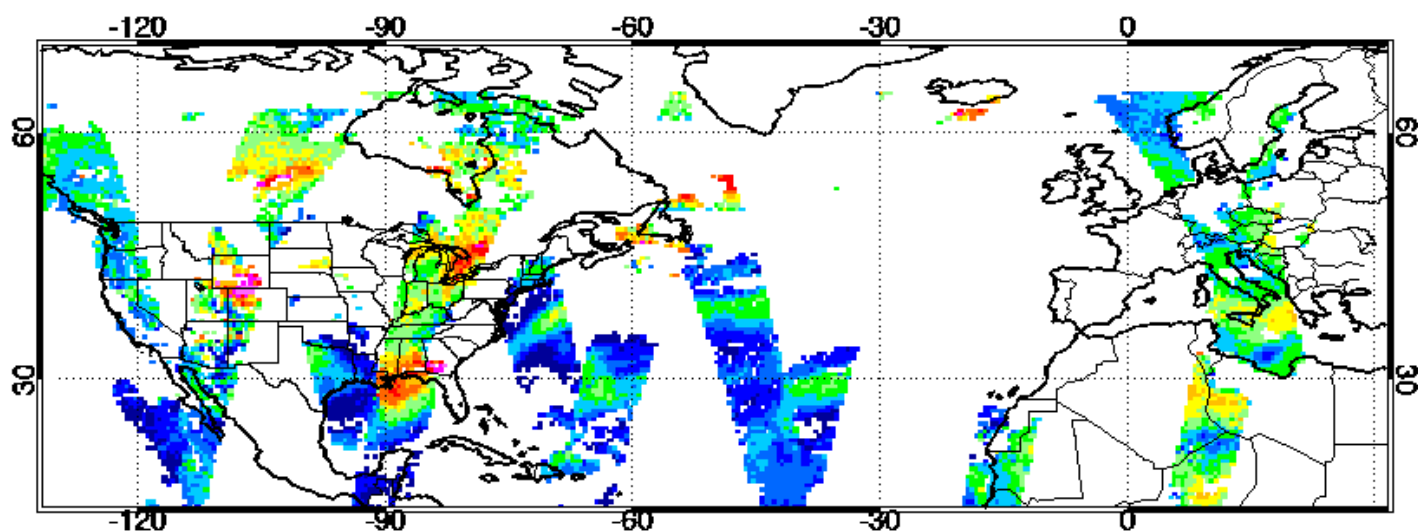
Local PM (ascending) AIRS CO at 500 mb on 20040729

CO Mixing Ratio (ppbv) at 500 mb

CO Mixing Ratio (ppbv) at 500 mb

MOPITT CO for 20040728

MOPITT CO (V3) Column Jul 28, 2004

Outflow between ~45-50N
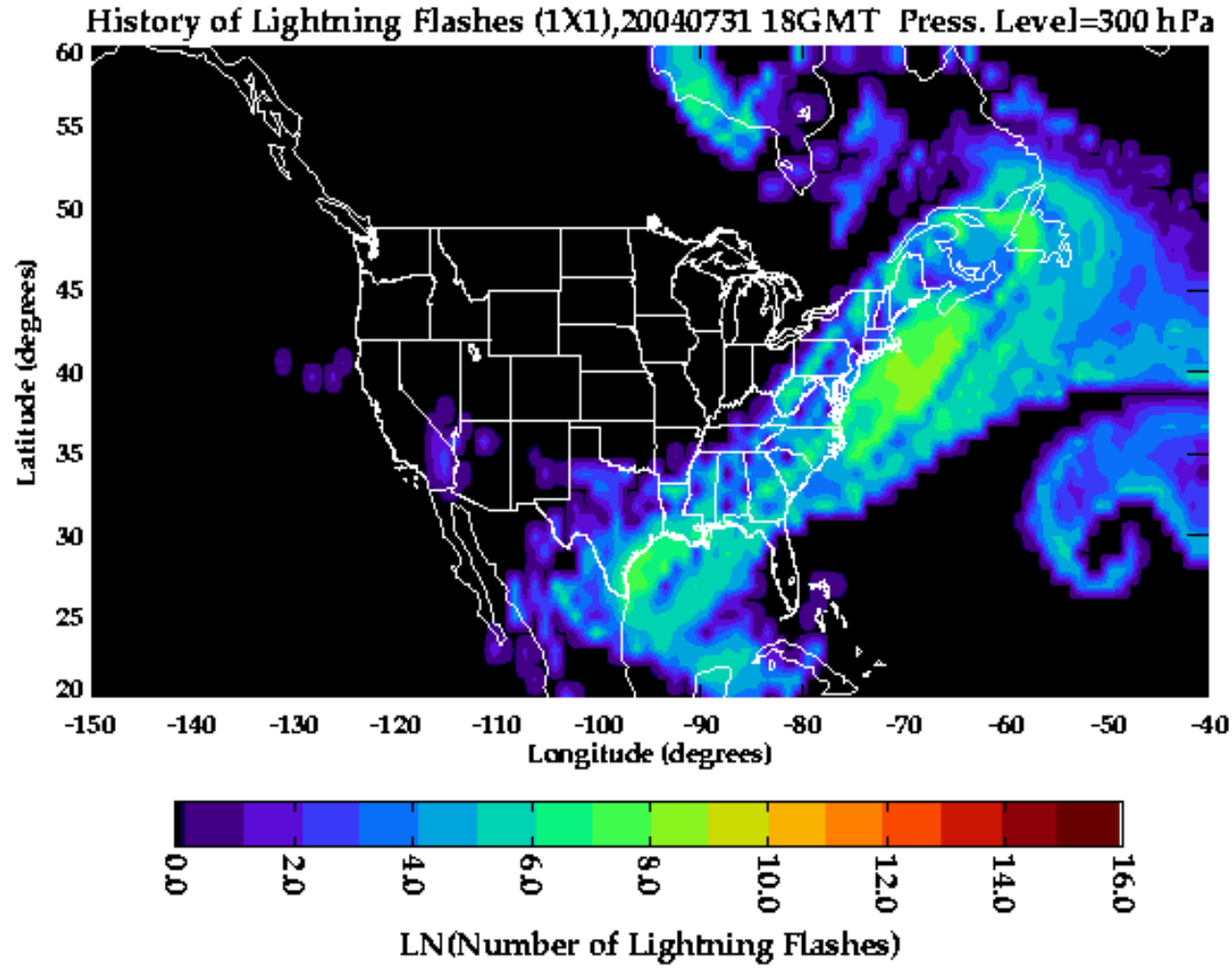
Recirculation

Column
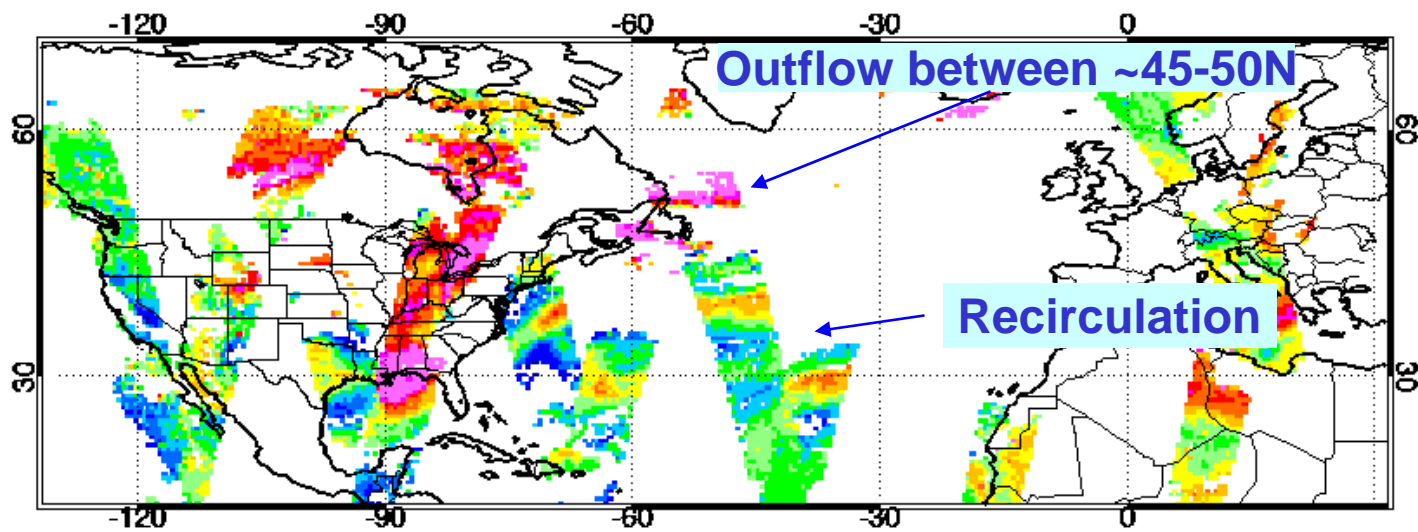
MOPITT CO (V3) 700hPa Jul 28, 2004

700 hPa

Gridded at 0.5x0.5deg from MOP02F-20040728-L2V6.1.2.prov.hdf (apriori fraction < 50%)

# Lightning Influence over 5 days maximum SE of New England Coast

History of Lightning Flashes (1X1), 20040731 18GMT Press. Level=300 hPa

LN(Number of Lightning Flashes)

NASA/GSFC/916/kinetic/TK

latest lightning data 040729 full day

GEOS-4 7/29 12Z forecasts for 7/31 18Z:
low-altitude outflow, high-altitude recirculation

CO column

0.30   1.03   1.77   2.50   [1e^18 molec/cm²]

CO at 300 hPa

0   50   100   150   [ppbv]
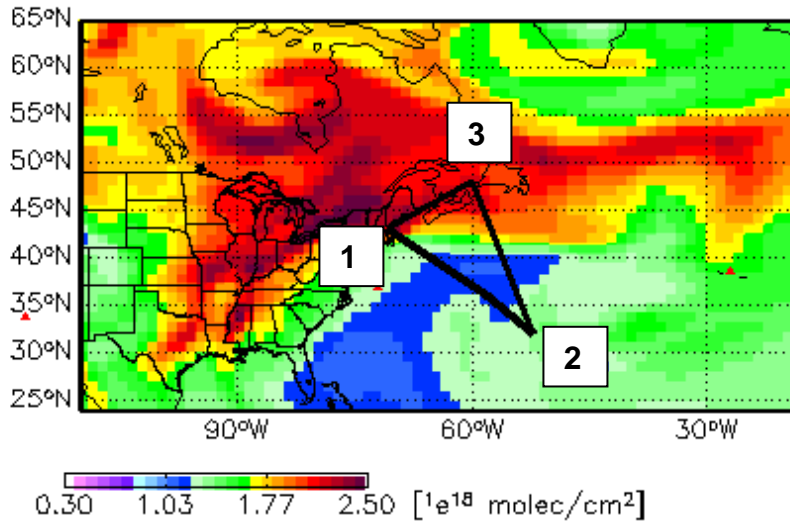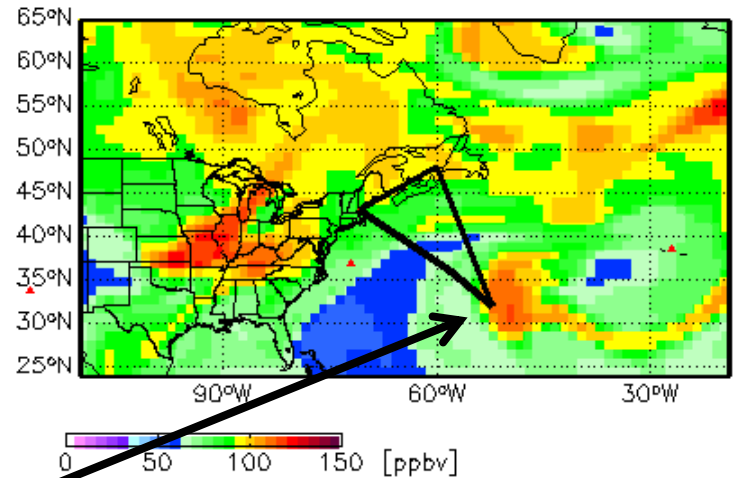
CO curtain plot along flt. track

0   37   75   112   150   [ppbv]
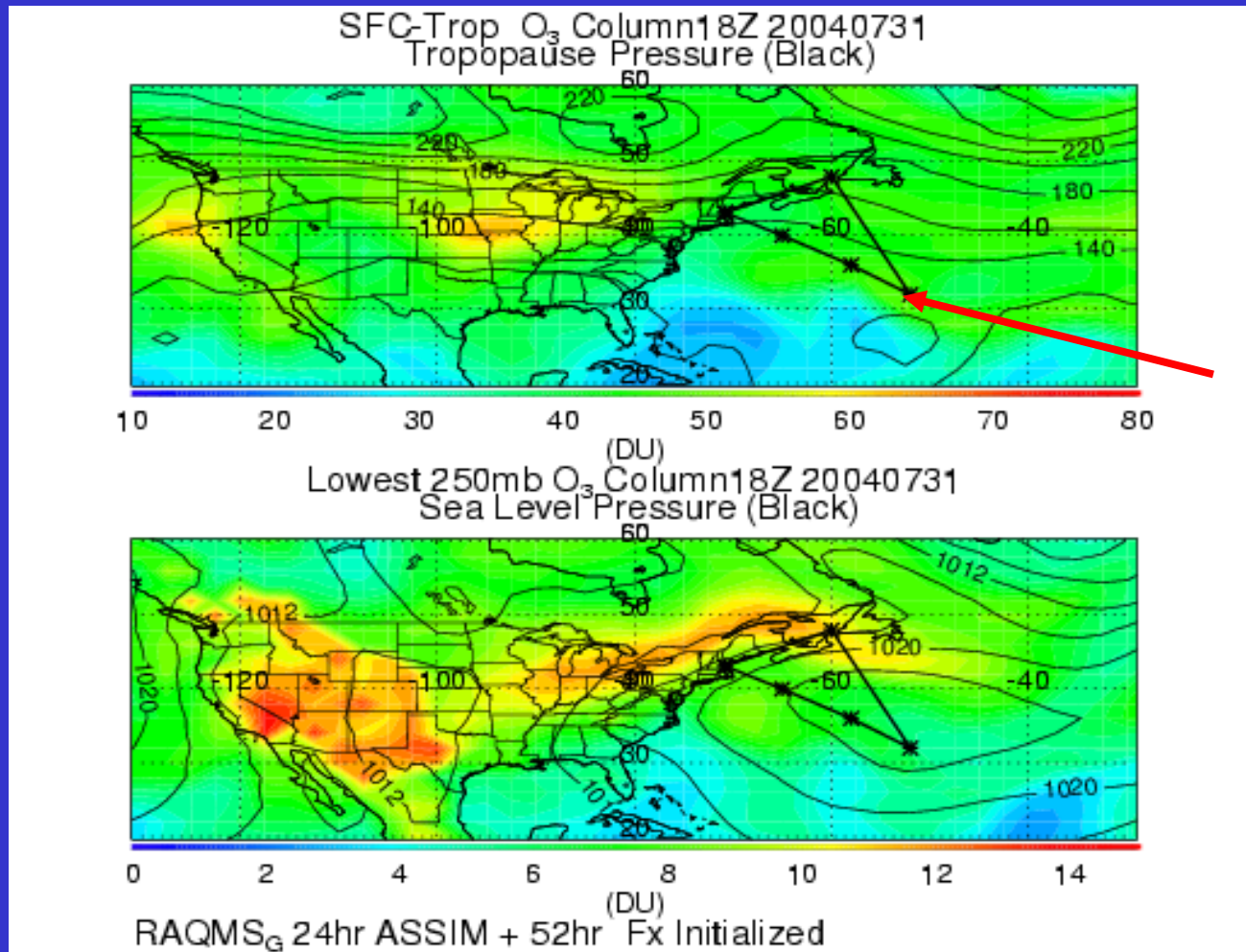
CO at 800 hPa

0   50   100   150   [ppbv]
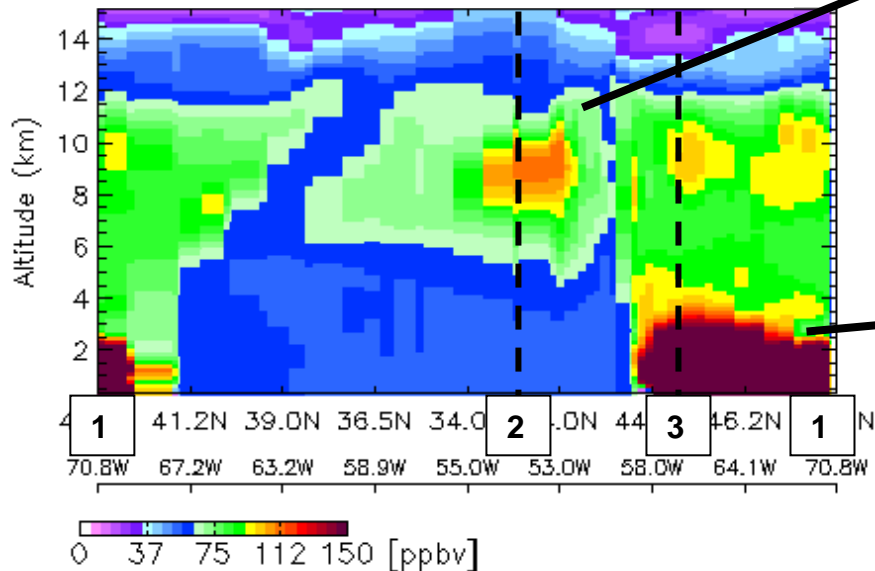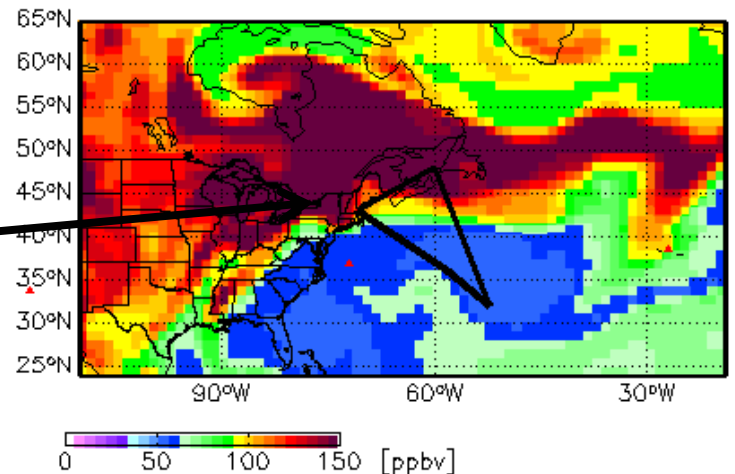
RAQMS 54hr fx valid 07/31 18Z

Tropospheric O_3 columns
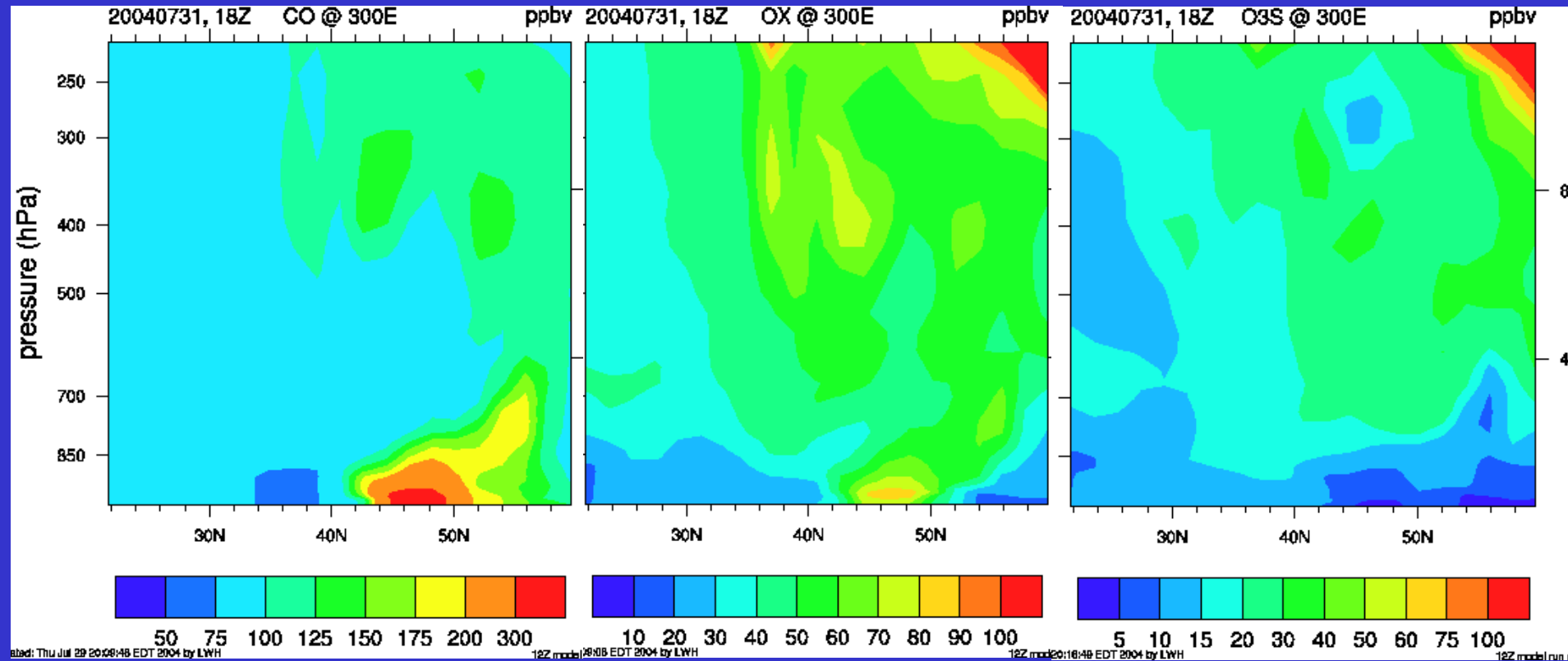

Recirculated air in Bermuda High

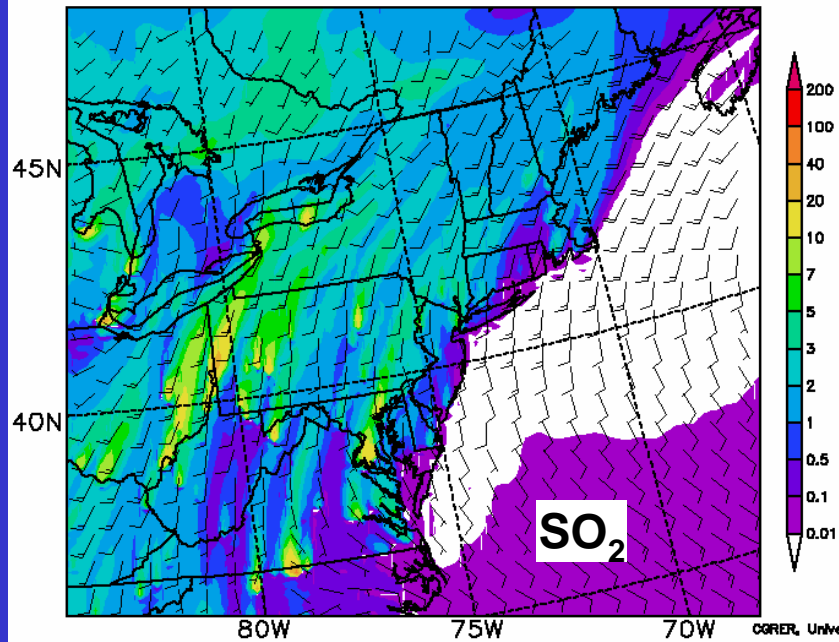MOZART-2 Forecast for 20040731/18Z, Cross Section 60W: low-altitude outflow at 45-50N
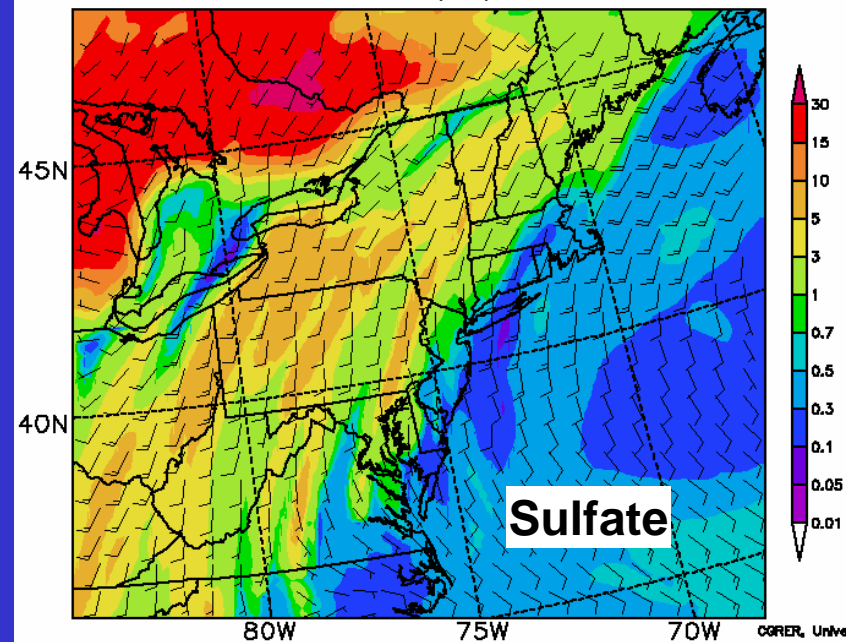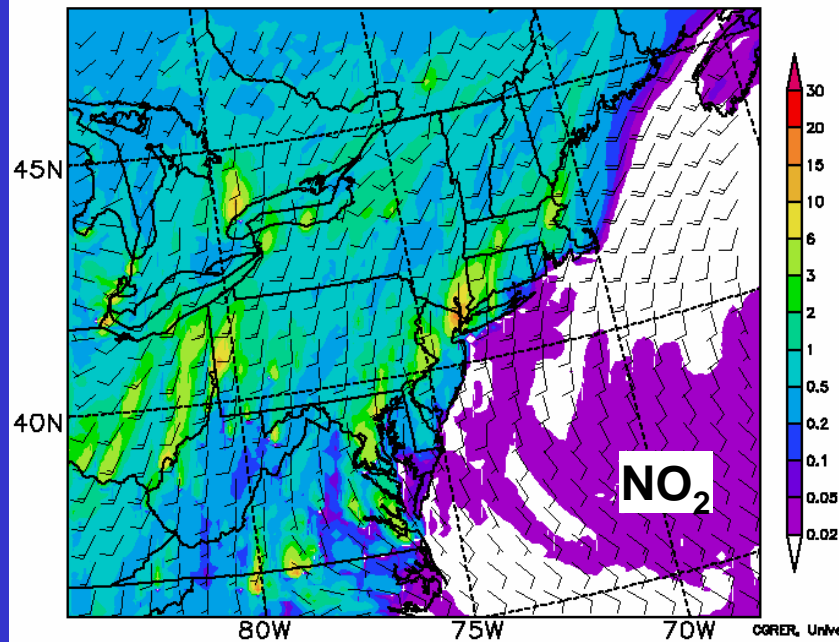
Total CO   Total O3   Strat. O3

Forecast from 20040729/12Z
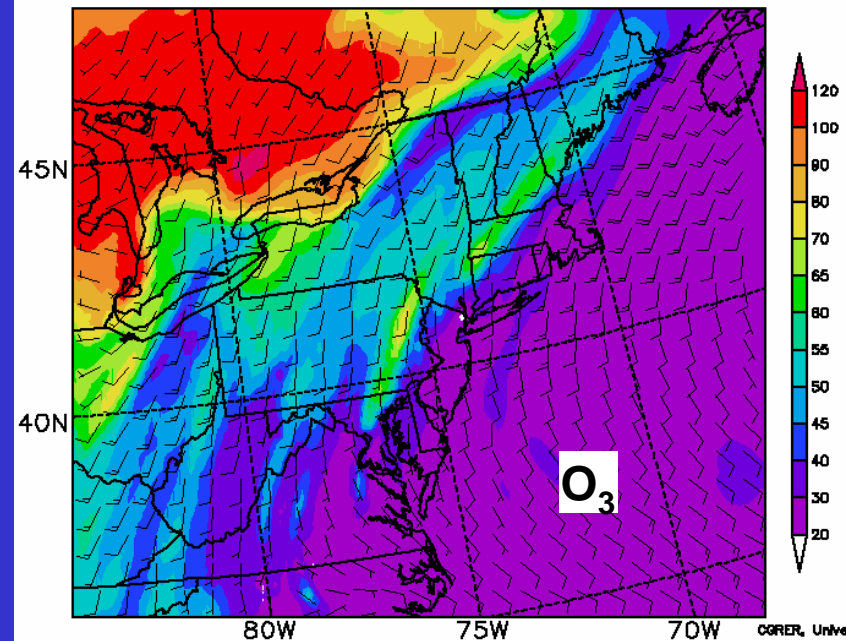
Simulated SO₂ (ppbv) in the 400m layer at 21GMT, 07/31/2004 — SO₂

Simulated Total_Sulfate (ug/std m³) in the 400m layer at 21GMT, 07/31/2004 — Sulfate

Simulated NO₂ (ppbv) in the 400m layer at 21GMT, 07/31/2004 — NO₂

Simulated O₃ (ppbv) in the 400m layer at 21GMT, 07/31/2004 — O₃

MODEL-GUIDED FLIGHT PLANNING, MODEL-ASSISTED DATA ANALYSIS

• **Flights designed to test models targeted at INTEX-objectives – models in broadest sense! statistical relationships, conceptual models, 0-D, 3-D**

• **3-D models are versatile tools – integrate them in data analysis. The modelers don't have to be in the driver's seat!**

• **Integration of multi-platform aircraft observations, satellite observations, and 3-D models offers a powerful approach for addressing INTEX-A objectives.**