MAP MODELING EFFORTS

- **MAP: Building Integrated Earth System Analysis (Modeling): IESA**

- **CTM work funded by MAP will be seen as part of the overall Earth System Model**
  - **Testing components**
  - **Comparison to observations**
  - **Assessments?**
  - **Support eventually one overall structure/code which can be run in different modes.**

- **A large portion of GMI's algorithms has been incorporated into the GEOS-5 framework.**

MAP 08 ATMOSPHERIC CHEMISTRY "THEMES"
(Those I have heard about definite proposal plans are in red).

- **Hindcast of atmospheric composition (including aerosols) – ACC and activity 1.**
  - **Use available long-term data**
  - **Help in improving forecast by climate models, others (more general?)**

- **"Synergistic" interaction between CTM and fully coupled models**
  - **Drive GMI with other met. fields**
  - **Comparison to satellite data, others, particularly in UT/LS**

- **Testing of processes that determine composition of troposphere above 5 km (ACC activity 2)**
  - **Emphasis on wet depositon / convection, but also others**
  - **"Controlled" process studies – model intercomparison**
  - **Coordinate with CCMval, HTAP, AeroCOM**
- **Coupling to other elements of Earth system**

- **USE SATELLITE DATA.**

IGAC/ A C and C ACTIVITIES

- **Hindcast of atmospheric composition (P. Hess, J. F. Lamarque, J. Logan, M. Prather).**
  - **Proposals need to iron out a lot of details…**
  - **Methane?**
- **Processes determining compositon above 5 km (J. Rodriguez, J. Penner, C. Mari – Multi-model).**
  - **Convection experiment: Test with ^{222}Rn, CO, others?**
    - **No convection, different met. fields**
    - **Same convection parameters for all models (convective transport)**
    - **Relax convection parameters**
    - **Fix emissions same as HTAP?**
    - **Use GMI as initial test, also NCAR (June meeting).**
  - **Similar set of experiments for wet deposition, use ^{210}Pb, HNO_3 …**
- **Activity 2 part of "core" GMI proposal?**

Model Hierarchy

- Traditional Chemistry-Transport Model (off-line CTM)
  - Reads archived winds, convective, & diffusive parameters at specific temporal resolution
  - Interpolation of transport fields for intermediate times
- On-line CTM
  - Reads boundary conditions for GCM; reads analyses if necessary
  - GCM processes compute transport each timestep
  - No feedback of chemical state to GCM (e.g., radiation, microphysics)
- Chemistry-Circulation Model/Chemistry-Climate Model
  - Reads boundary conditions for GCM
  - GCM processes compute transport each timestep
  - Chemical state impacts GCM (e.g., radiation, microphysics)

“Embedded” CTM

- Concept
  - GMI chemical mechanisms is one element of a set of code
  - Transport modules, deposition models, etc., are also available
  - GMI CTM is one model built from user-selected components
  - GEOS-5 based chemistry-climate model is another such model

Desirable Features of “Embedded” CTM

- Address Range of Science Questions with Same Code Base:
  - Chemical and Aerosol Mechanisms
  - Advective, Convective and Diffusive Transport
  - Deposition, Including Interactions with Hydrology
  - Emissions - Distributions and Processes
  - Impacts of Composition on Circulation
- Modeling Constituent Cycles
  - Coupling to Ocean - Land - Biosphere Processes
  - Integration into Earth System Models

ISSUES BEING ADDRESSED

- **“Learning curve” (for core group, SIVO, other users).**
  - **ESMF framework**
  - **User – “friendliness” ?**

- **Running model exclusively in NCCS computers.**

- **“Embedded” CTM will have same capabilities of current GMI code**
  - **Current code will be supported until transition completed, tested.**

- **Additional support to help transition (computational, scientific).**

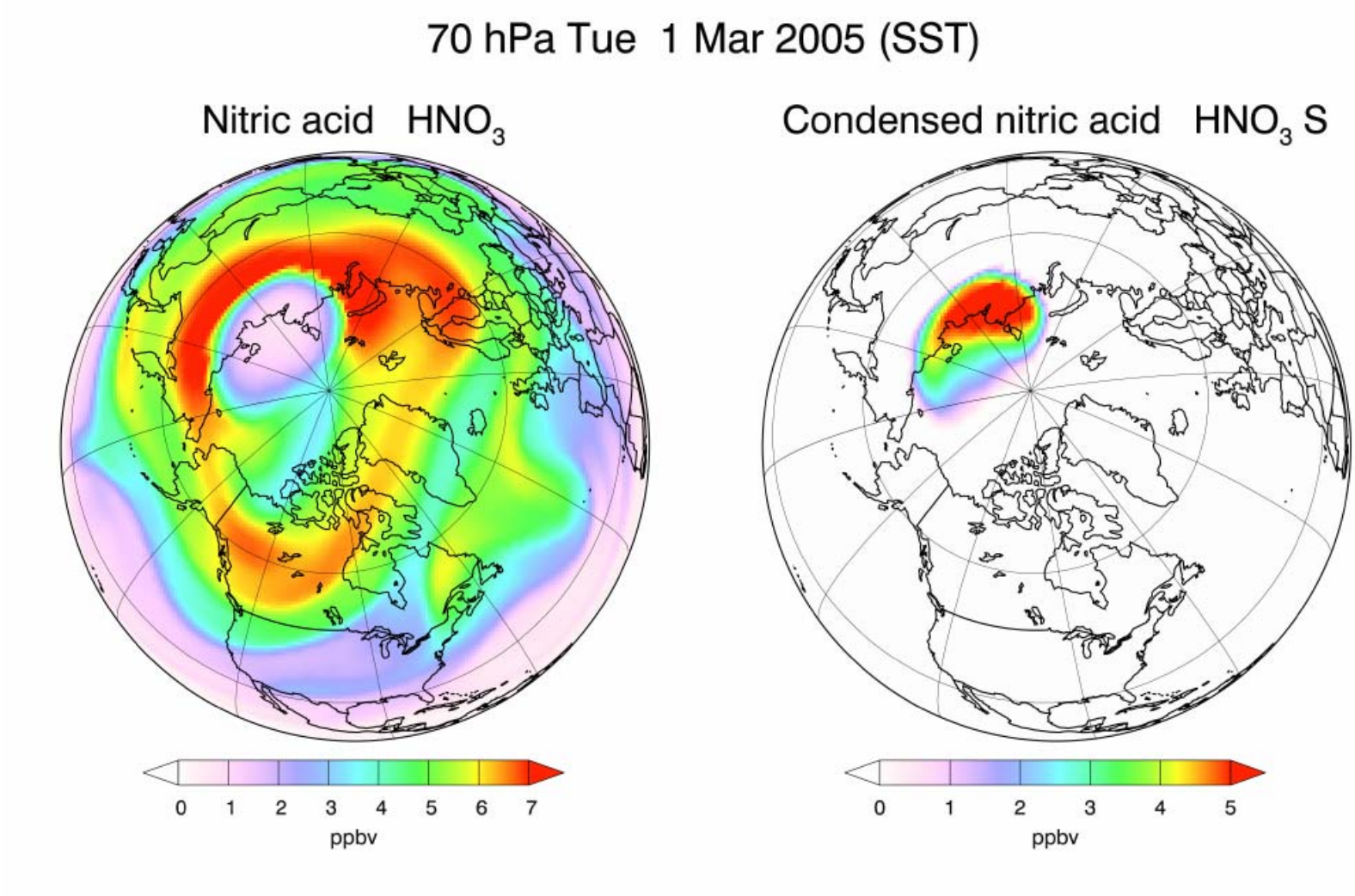
- **Coding standards**
  - **Note: Current implementation into GEOS-5 is providing “practical” lessons.**

Progress With Integration

GMI COMBO in the MAP Modeling Environment:

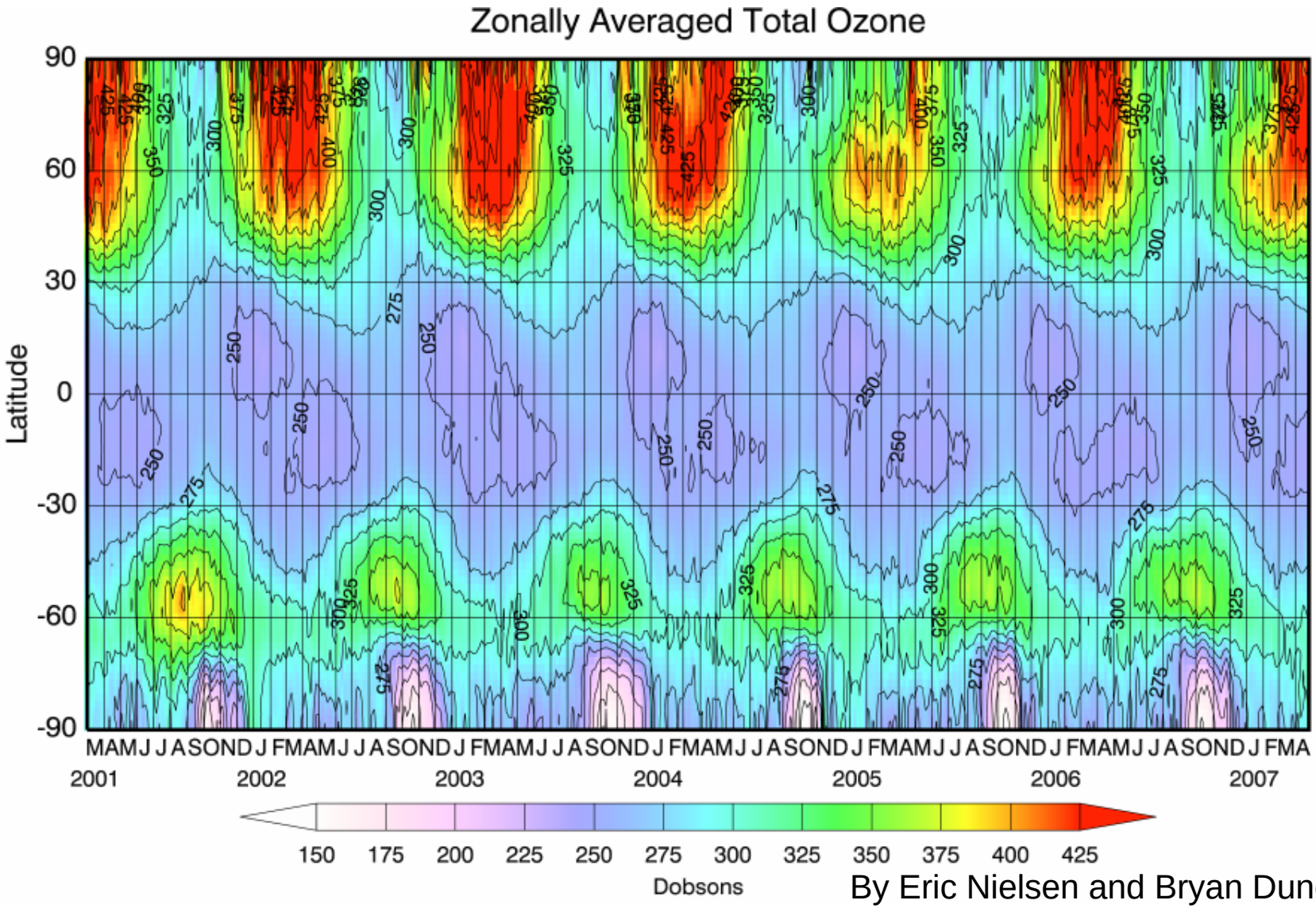
- ✓ ESMF-compatible GMI COMBO code [SIVO: Clune, Womack, et al.]
- ✓ MAPL toolkit updates for functionality [Suarez et al.]
- ✓ COMBO code implemented in “Aerochem” interface to GEOS-5 GCM [Nielsen, da Silva, Kouatchou]
  - GEOS CCM, Version 3 - presently being tested
- ✓ New GEOS-5-compatable transport core developed and tested [Sawyer, Suarez]
- → ESMF “wrapping” of transport, convection and diffusion cores into MAPL/GEOS-5 package

Gaseous and Condensed Nitric Acid



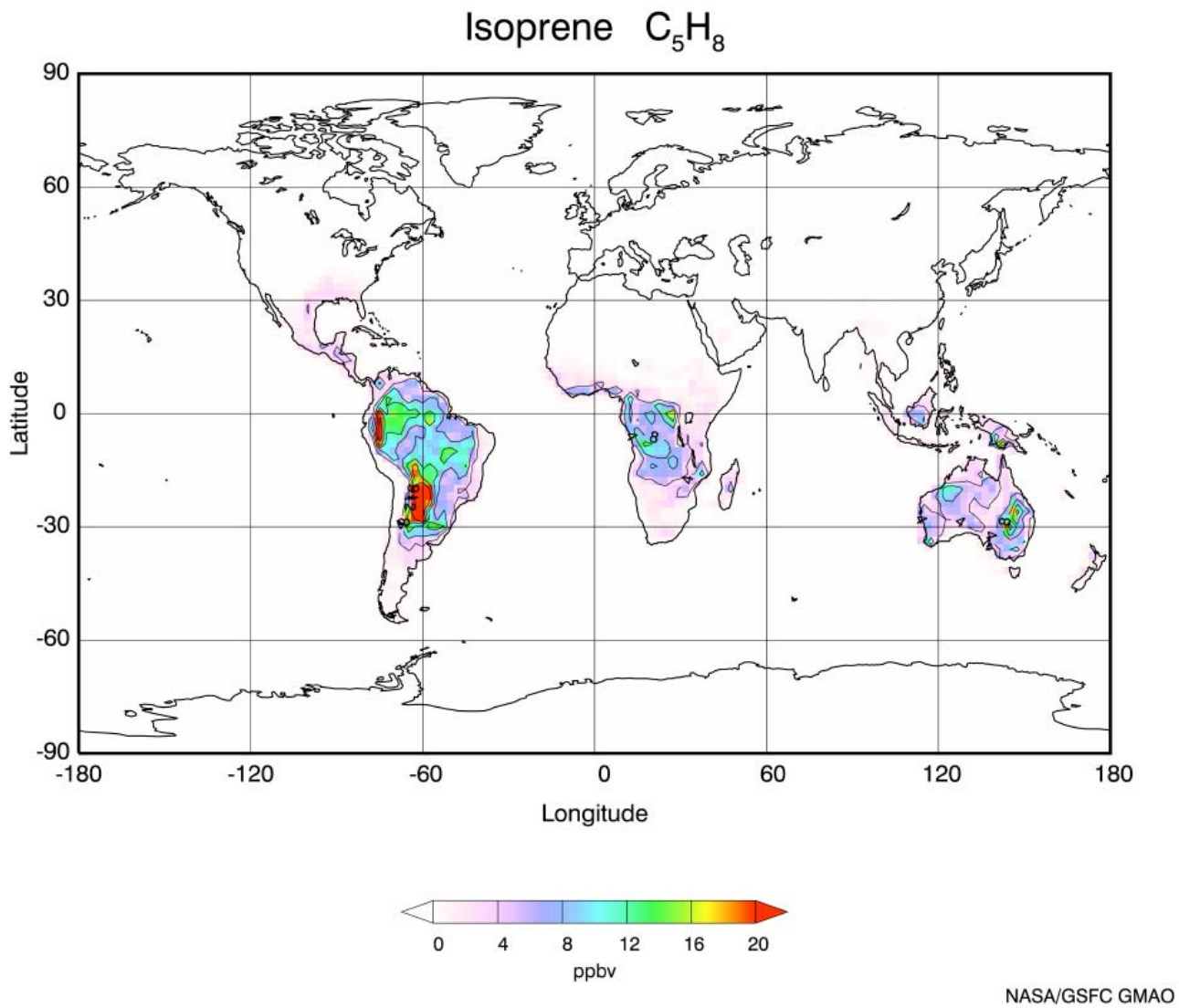
By Eric Nielsen and Bryan Duncan

Time Series of Total Ozone



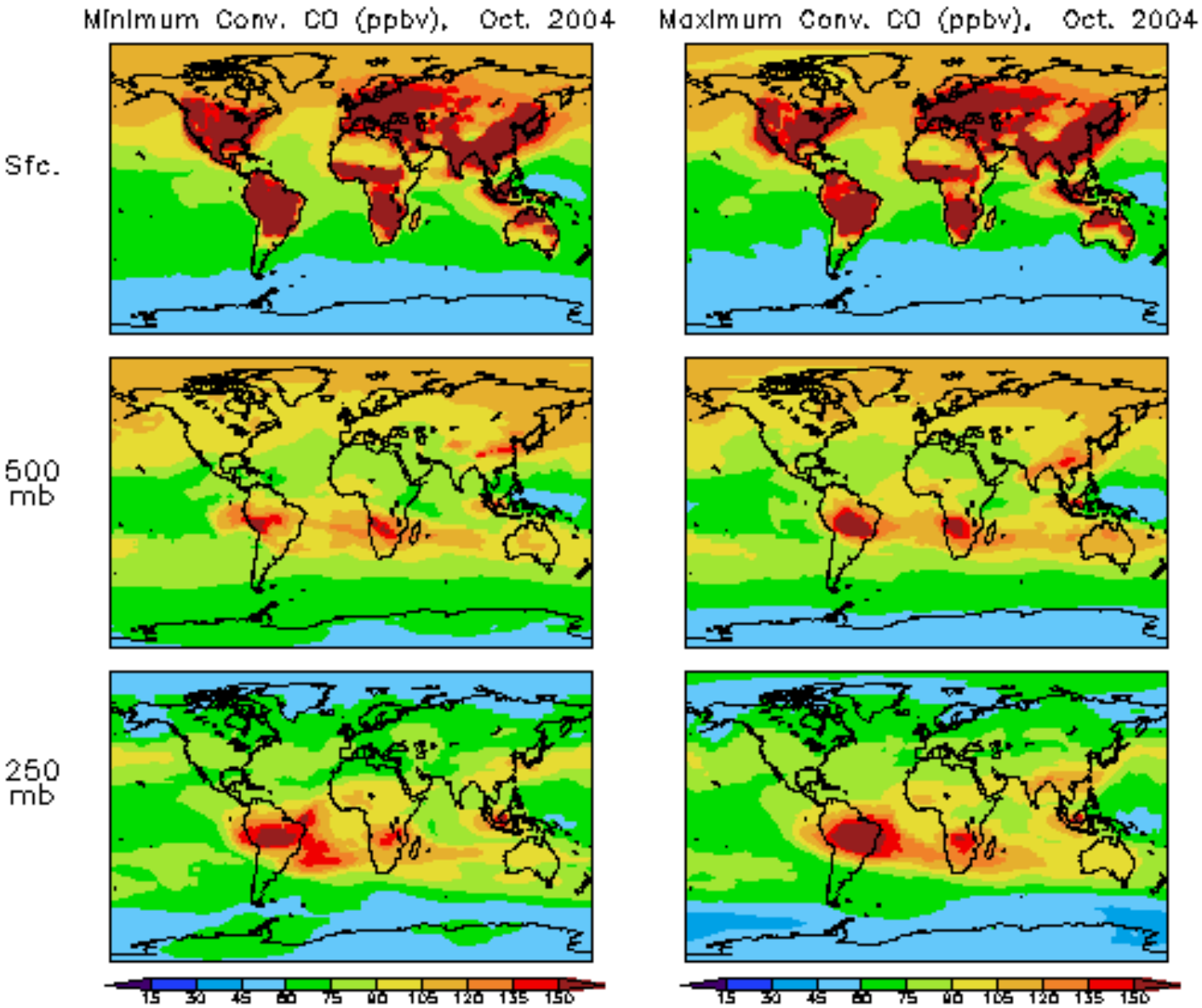
By Eric Nielsen and Bryan Duncan

After Some Interesting Challenges …



By Eric Nielsen and Bryan Duncan

Convective Transport of CO in GEOS-5



By Lesley Ott

Next Steps for GMI “embedded CTM”

Complete construction/implementation of advective, convective and diffusive transport cores

Run side-by-side tests of “on-line” and “traditional” CTMs using identical GMI COMBO chemistry codes

Examine impacts of the approximations on transport (six-hour averaging, “bulk” - versus “plume” convection, …)

Work towards using other advective cores and other meteorological datasets

Possible extension to “NCEP analyses” as NCEP physics are implemented in GEOS-5/MAPL structure

6-12 Month Objectives

“EMBEDDED” CTM AND MAP (NEED FEEDBACK)

- **MAP: Building Integrated Earth System Analysis (Modeling): IESA**
- **CTM work funded by MAP will be seen as part of the overall Earth System Model**
  - **Testing components**
  - **Comparison to observations**
  - **Assessments?**
  - **Support eventually one overall structure/code which can be run in different modes.**
- **A large portion of GMI’s algorithms have been incorporated into the GEOS-5 framework.**
- **Propose transition of about 1 year.**
- **More details, “training” at the next GMI meeting.**
- **“Research” models supported by MAP insofar as they contribute elements to the IESA.**

ITEMS FOR DISCUSSION
(Not necessarily in this order…)

- **Questions on MAP 08 NRA.**

- **Questions on AC and C**
  - **Too many assessments?**

- **Other research themes?**
  - **More detailed discussion tomorrow.**

- **Concerns/questions about “embedded” CTM.**