TIEGCM
Community Release of Version 1.94

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June, 2011 CEDAR Workshop

With acknowledgements to the TIEGCM development group at HAO/AIM:

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See also the Contact Information page of the User's Guide

Thermosphere-Ionosphere-Electrodynamics GCM

The TIEGCM is a first-principles numeric simulation model of Earth's Thermosphere-Ionosphere system. The model uses a time-dependent finite-differencing method on a 3-d spatial grid to solve the fundamental equations of hydrodynamics, thermodynamics and continuity.

This talk will focus on:

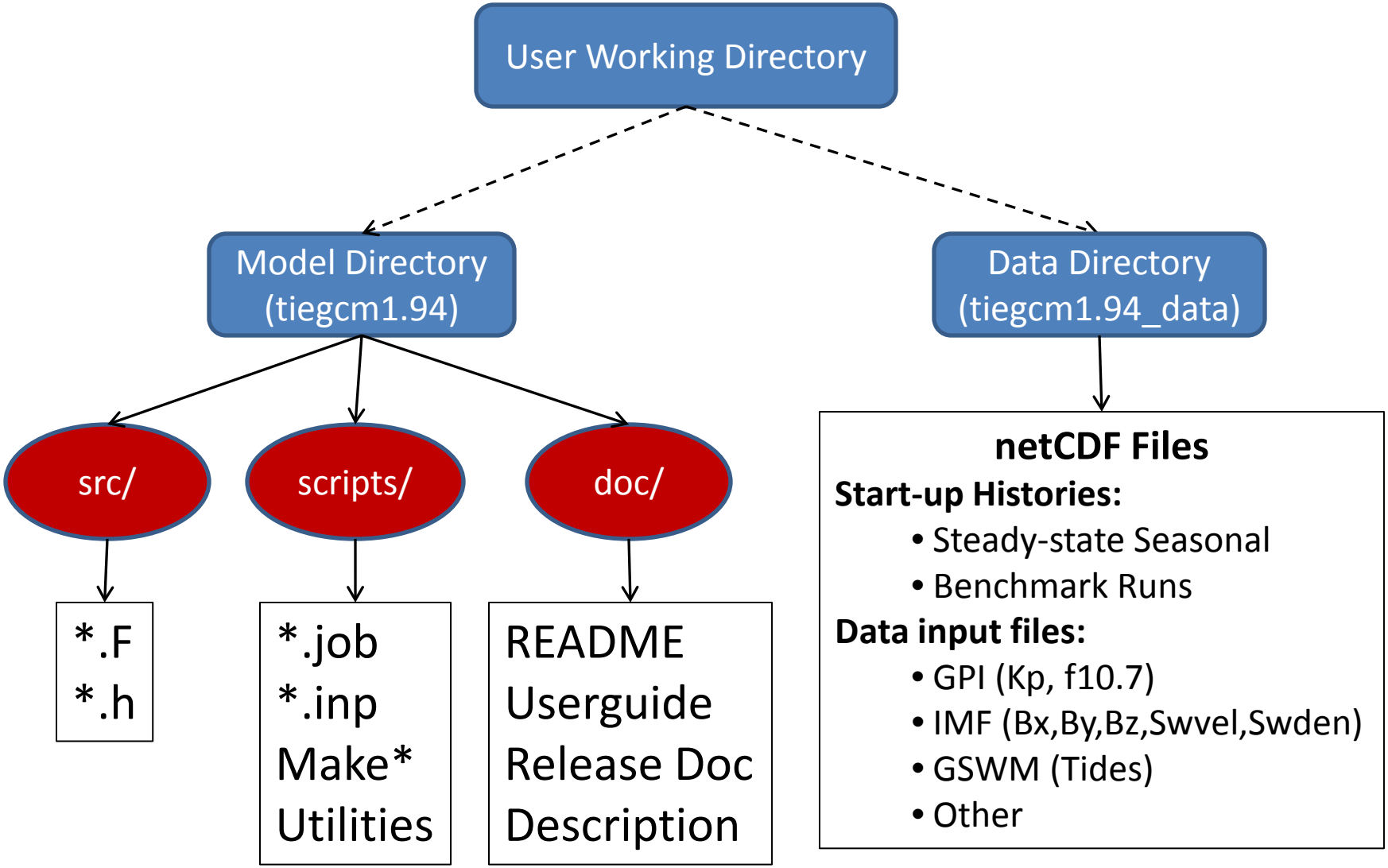
- Version 1.94, released June 3, 2011
- Selected results from the v1.94 Benchmark Runs
- Future development goals

For more information about the NCAR/HAO TGCM Models, please see
http://www.hao.ucar.edu/modeling/tgcm

Summary of v1.94 Release Notes

- Weimer 2005 Electric Potential Model
  - For auroral parameterization and transition to high-latitude ion convection
  - Optionally driven by OMNI IMF data Bx, By, Bz, Swvel, Swden
  - See Weimer Agreement, and Weimer05 in the TIEGCM model
- New build/compile system (scripts directory)
  - *Make.machine* files for platform-specific compilers and libraries
  - Support for Intel ifort/OpenMPI on 64-bit Linux systems (Make.intel_hao64)
  - Simplified Makefile without platform-dependent conditionals
- New module saves diagnostics to secondary history files
  - 22 "sanctioned" diagnostic fields are available in v1.94 (diags table)
- Benchmark Runs by v1.94 are released for validation and testing
  - Seasonal steady-state histories for model start-up (solar min and max)
  - Five-day control runs, started from the seasonal steady-state histories
  - Full year climatology (constant solar forcing)
  - Data-driven storm cases: dec2006, nov2003, whi2008
- All new User's Guide, Release Document, and Model Description

TIEGCM Directory Structure

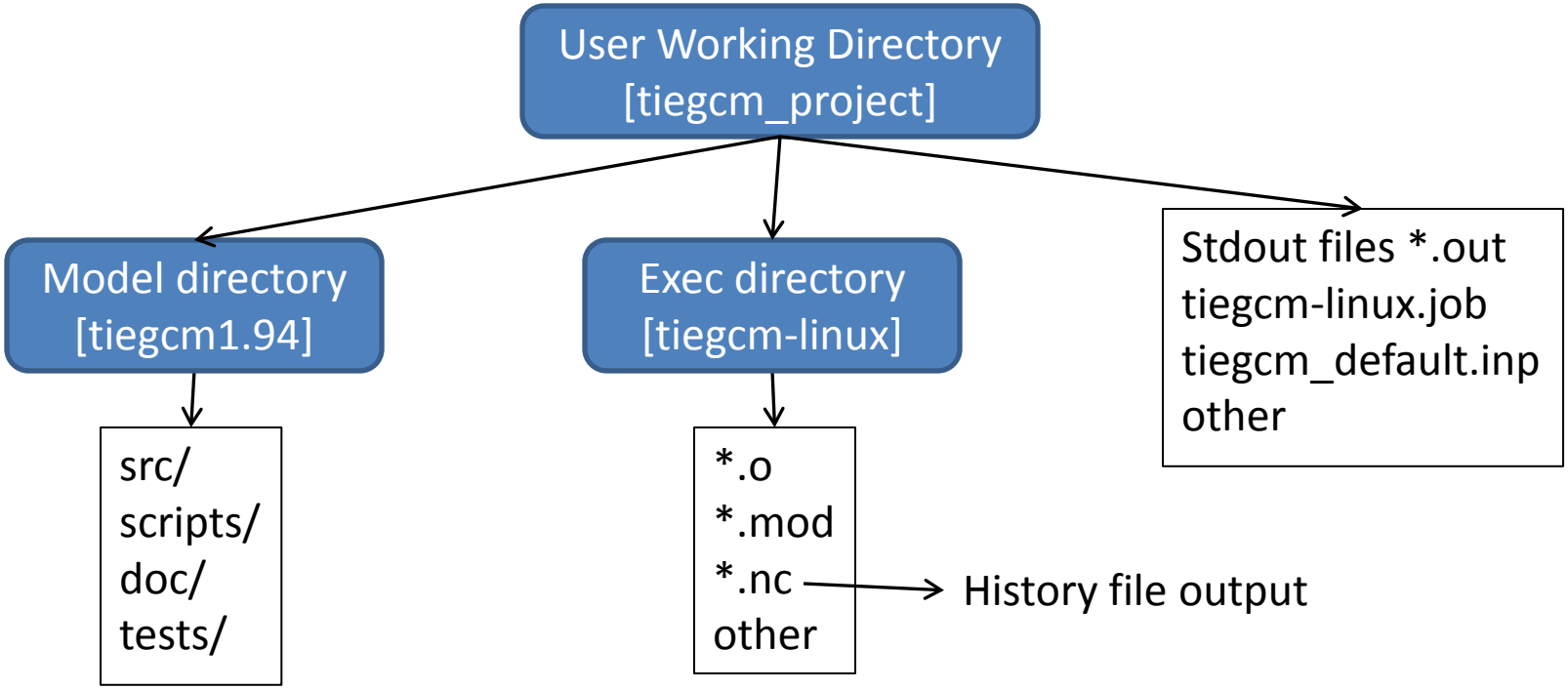


Quick-Start Procedure

see also Quick-start chapter of the User's Guide

Obtain and build the model, and execute a default run:

1. Download and extract model and data tar files (download page)
2. Set modeldir and other shell variables in the job script tiegcm-linux.job
3. Set env var TGCMDATA to the data directory (.cshrc file or job script)
4. Execute by typing "tiegcm-linux.job &" (build and execute default run)
5. Rename and edit namelist input file tiegcm_default.inp for a new run



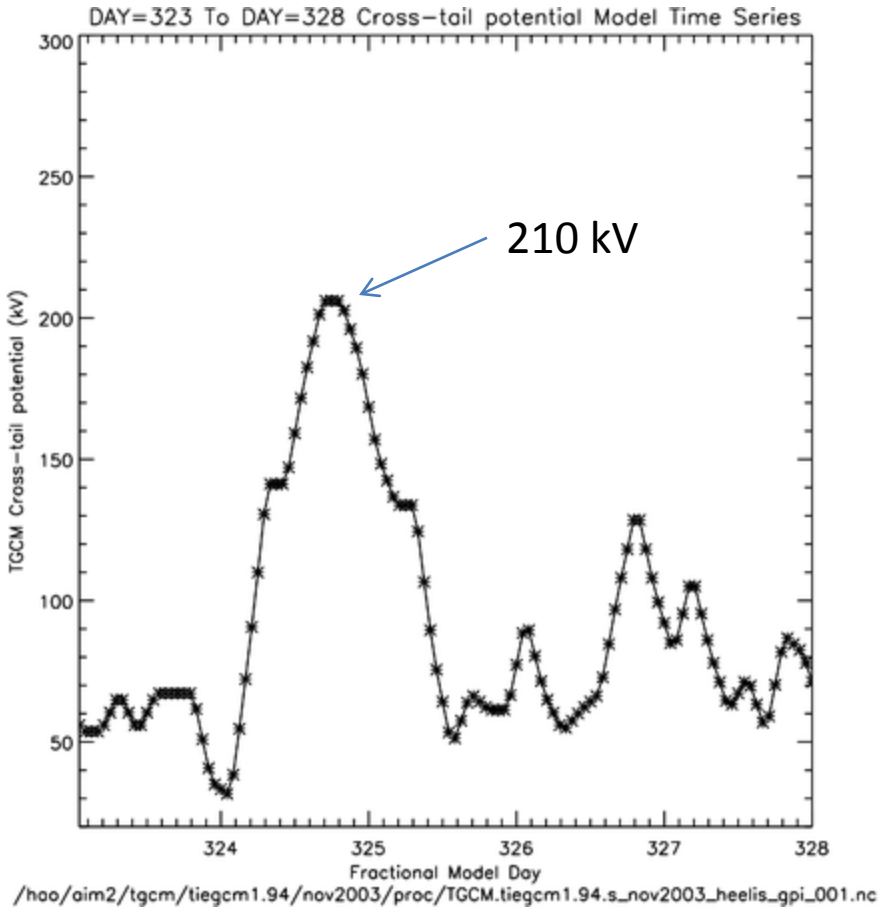
Selected results from a tiegcm1.94 Benchmark Run: November 19-23, 2003 Storm

These figures were made with post-processors tgcmproc_f90 and tgcmproc_idl, both of which are available on the TGCM download website

For more plots and movies of Benchmark Runs, please see
tiegcm1.94 Release Document
netCDF output files are available for download at the
NCAR Community Data Portal

Cross-Tail Potential (kV): Nov 19-23, 2003

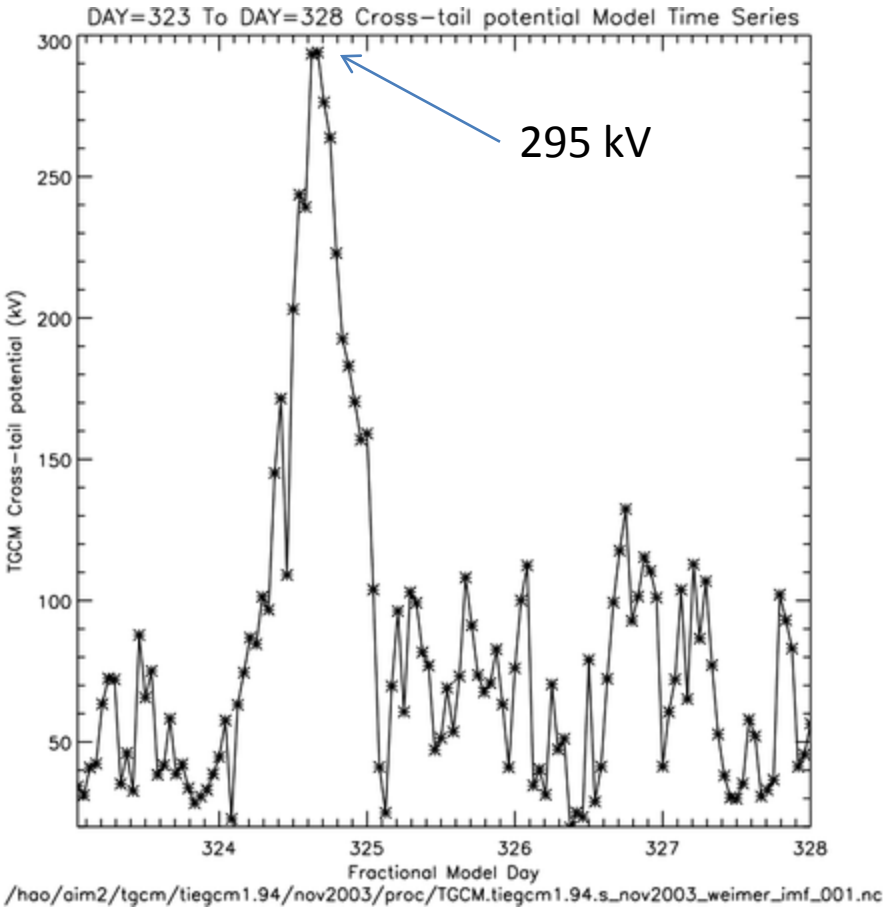
Heelis/GPI



Min,Max = 32, 206

ctpoten = 15+15*Kp+0.8*Kp^2

Weimer/IMF



Min,Max = 20, 294

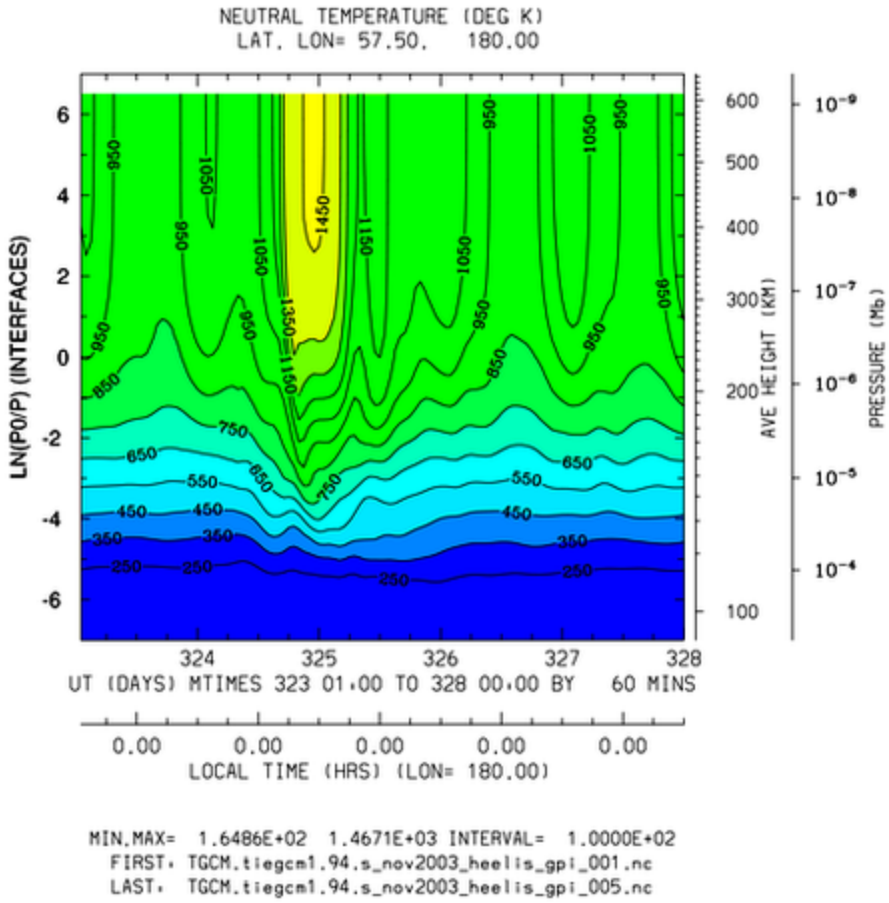
ctpoten = Cross-cap potential drop from Weimer model (hemispheric average)

Selected Results: tiegcm1.94 Benchmark Runs

November 19-24, 2003

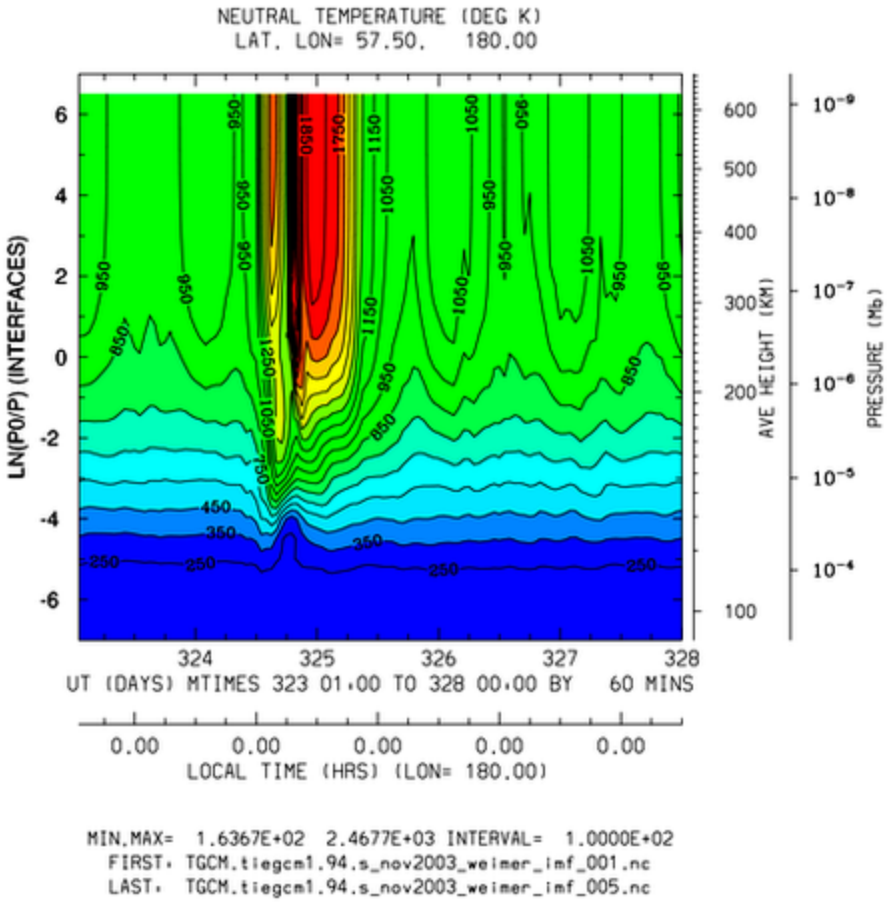
Ut vs Zp: TN (deg K) at Latitude 60N

Heelis/GPI



Min,Max = 165, 1467 Interval=100

Weimer/IMF



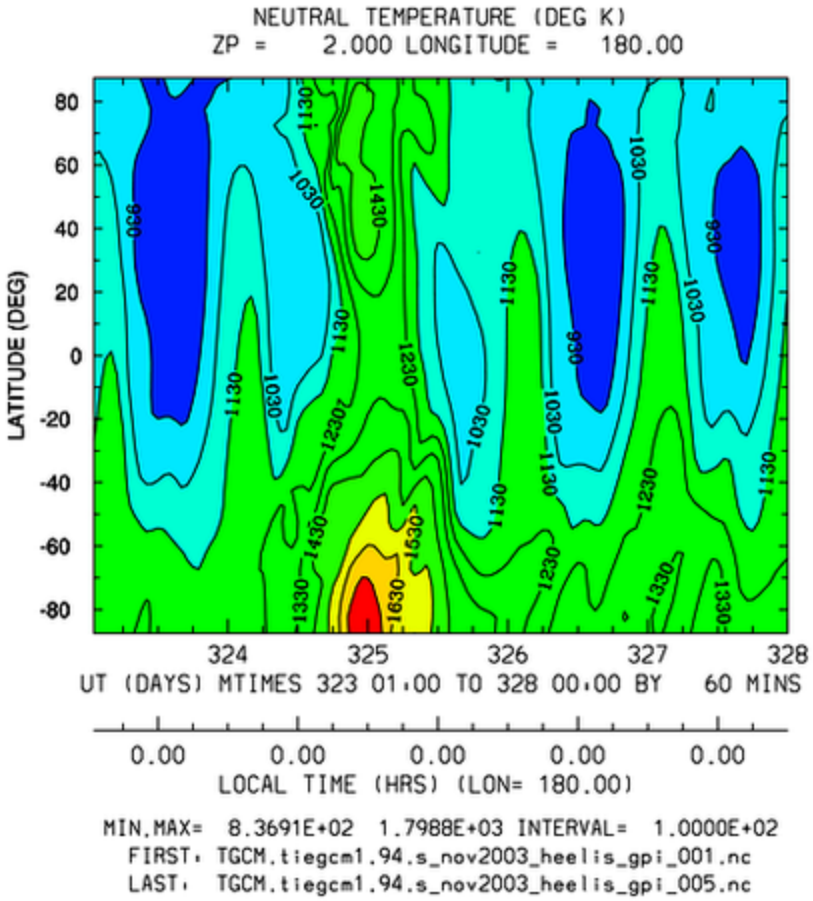
Min,Max = 164, 2468 Interval=100

Selected Results: tiegcm1.94 Benchmark Runs

November 19-24, 2003

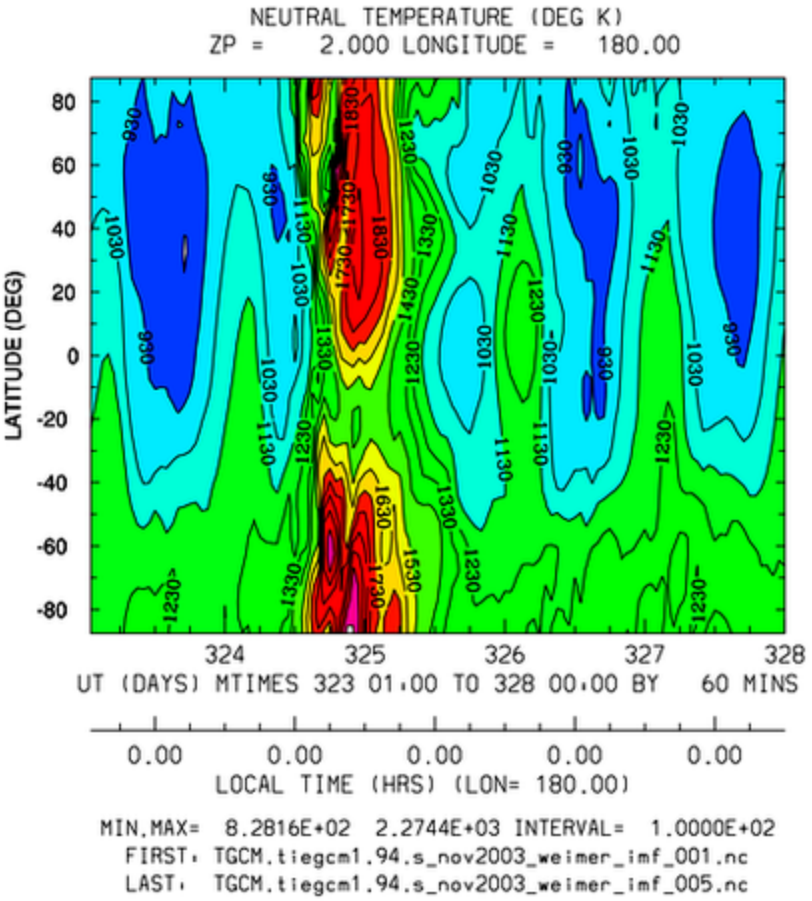
Ut vs Latitude: TN (deg K) at Zp +2

Heelis/GPI



Min,Max = 837, 1800 Interval=100

Weimer/IMF

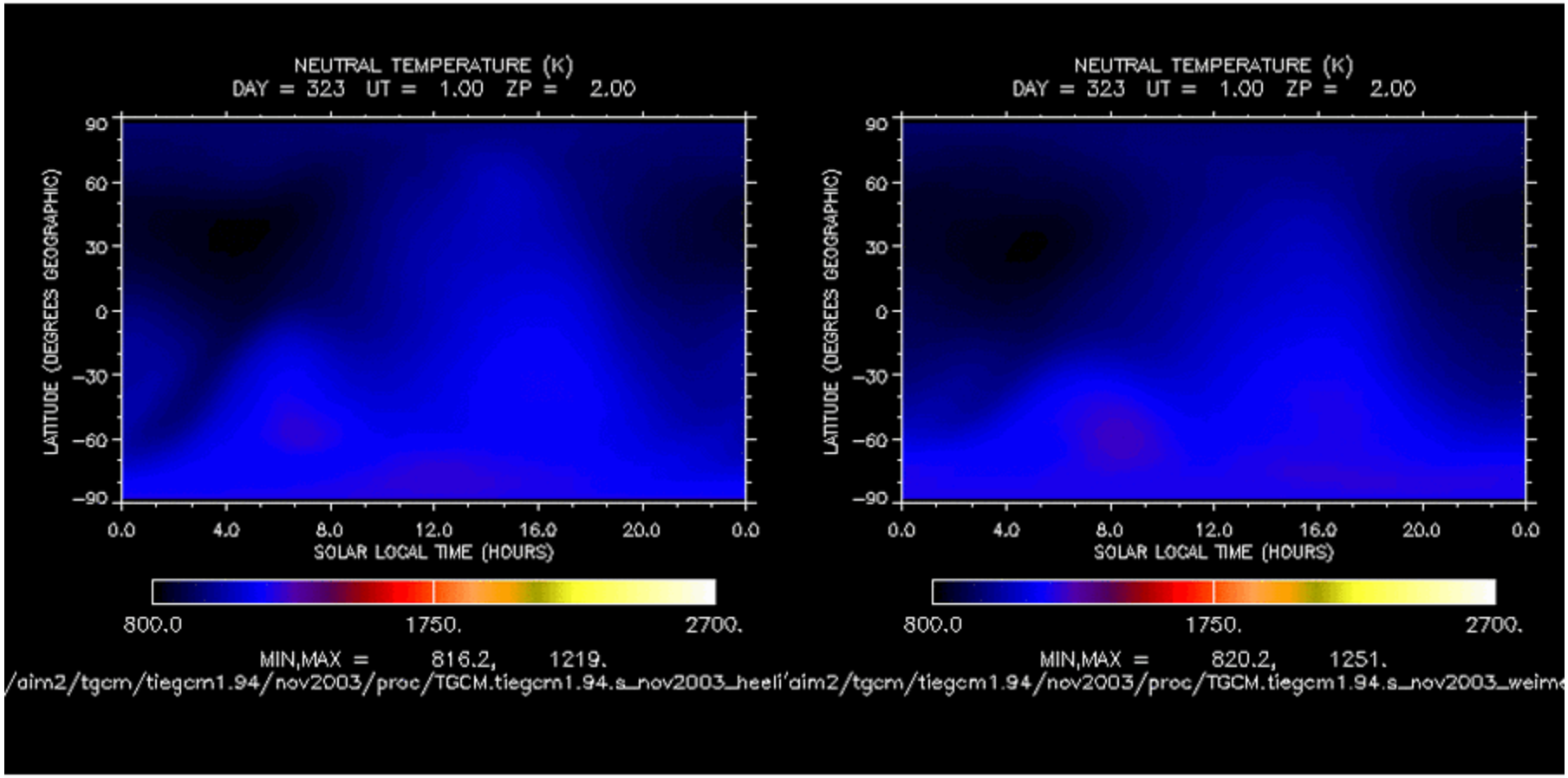


Min,Max = 828, 2274 Interval=100

Global TN at Zp +2 (~350-450 km) Nov 19-24, 2003 (hourly frames)

Heelis/GPI

Weimer/IMF



Future Development (software)

- Near-Term:
  - Validation and tuning of the 2.5 degree “double resolution” model
  - Performance and scaling improvements (FFT, memory structure, etc.)
- Mid-Term:
  - Parallel dynamo solver
  - NetCDF 4.0 with parallel i/o
- Ongoing and Long-Term:
  - Post-processing, visualization and analysis
  - Continued Community Support (CCMC, University users)
  - Further improvements to the User’s Guide and Model Description
  - More frequent minor and intermediate releases of the source code?