GMI Status

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GODDARD SPACE FLIGHT CENTER

GMI Science Meeting

June 13-15, 2007

Greenbelt, MD

Software Integration and Visualization Office

Outline

- SIVO GMI personnel
- SIVO support to GMI Community
- New GMI directory structure
- New GMI naming convention
- New GMI code features
- Automating/streamlining GMI runs
- Completed model runs
- Upcoming tasks

Personnel

- **Jules Kouatchou**
  - **AMTI, Programmer/developer**
- **Megan Damon**
  - **Northrop Grumman, Programmer/developer**
- **Tasks**
  - **Implement and document code changes**
  - **Manage the GMI CVS repository**
  - **Assist GMI community with building and running the code**
  - **Perform requested runs**
  - **Process, archive, and distribute data**

SIVO Support to GMI Community

- Bldg 33 GMI Scientists
- Georgia Tech
- Boeing
- AER
- GMAO
- University of Michigan
- NASA-Langley
- PNL

GMI Directory Structure

- Added new directory and directory structure on dirac
  - /g8/anon/pub/gmidata2/input/
    output/
    …/output/gmic/aura2/2004/diagnostics
    docs/
    progs/
    users/
- /g8/anon/pub/gmidata still exists, untouched
- Input data also available on *discover*
  - /discover/nobackup/projects/gmi/gmidata2
  - Met fields are on-line

GMI File Naming Convention

- For input files
  - /g8/anon/pub/gmidata2/input/emissions/trop/

    emisX_yyyy_Z_Res_Descriptor.nc

    emist_2004_m_2x2.5_auraharvardwship.nc
- For output files
  - /g8/anon/pub/gmidata2/output/gmic/aura2/2004/

    problemname.datatype.filetype

    gmic_aura2_2004_jul.amonthly.nc

New GMI Inputs

- **Emissions**
  - **Added capability to use daily emissions**
  - **Emissions inputs now can include ship emissions**
- **Chemistry**
  - **Photolysis**
    - **Monthly rates can be used (GOCART aerosols)**
    - **Aerosol interaction with photolysis (fastjx53c) added**
  - **JPL06-2 mechanism is currently used**
  - **Default mechanisms**
    - **124 species for Combo Model**
    - **85 species for Troposphere Model**

New GMI Outputs

- **Variables added to all output files**
  - **Grid box height**
  - **Grid box area (mcor)**
  - **Grid info (ai, bi, am, bm)**
- **New outputs to some files**
  - **File description that is placed in header**
  - **Potential vorticity**
  - **Tropopause pressure**
  - **Relative humidity**
  - **Cloud optical depth**
  - **Overhead column O_3**
  - **Surface emissions for aerosols**
  - **Grid box mass**

New GMI Outputs

- **New output files**
  - **Set with freq settings**
    - **Column ozone (.columnoz.nc)**
    - **Hourly data (.hourly.nc; can select species/levels to output)**
    - **Instantaneous daily mixing ratios (.idaily.nc)**
  - **Four overpass times (formerly “noon_species”; .overpass1.nc, etc.)**
- **Output file name changes**
  - **.const.nc is now .amonthly.nc**
  - **Station .column.nc is now .profile.nc**

Namelist File Changes

- Namelist sections reorganized and restructured
- Input/output species changed from indices to names
  - From:
    - flux_species(1:124) = 1, 1, 1, 0, 0, 1, 0…
  - To:
    - fluxSpeciesNames = 'CH2O, CO, H2O2, HNO3,…'

Namelist File Changes

- **Profile stations selection simplified**
  - **From:**
    - col_diag_site(1:201) = 'SPO', 'MCM', 'HBA',…
    - col_diag_lat_lon(:,1) = -89.98, 335.20,
    - col_diag_lat_lon(:,2) = -77.83, 166.60,
    - col_diag_lat_lon(:,3) = -75.56, 333.50,
  - **To:**
    - stationsInputFileName
      - Master list with station names, locations, and descriptions
      - File name set in namelist file
    - colDiagStationsNames = 'SPO, MCM, HBA,…'
      - User-selected list of stations to study

Other Code Changes/Issues

- New tropopause definition
- New lightning algorithm
- Tagged CO/age of air capability
- Species names replace species indices
- Added flux diagnostic version to trunk
- Componentization of the code
- Assisting GMAO with integration of GEOS-5 and the Combo Model chemistry

Other Code Changes/Issues

- Disclaimer/Notice of Release added
- Open-source process has begun
- Version numbering system established
  - Three digit system: X.Y.Z
  - Current version: 2.0.0
- Made GMI simulation date Y2K compliant
- New gmi-users mailing list
- Model runs transitioned to *discover*

Unintended GMI "Features" Addressed

- Soil NOx
- Truncated vertical ozone profile
- Mixing ratio blow-up due to convection
- Divide by zero potential in convection
- Advection code array bounds
- H_2 level not set properly
- Stratospheric chemistry divide by zero potential
- HO_2 heterogeneous chemistry reaction

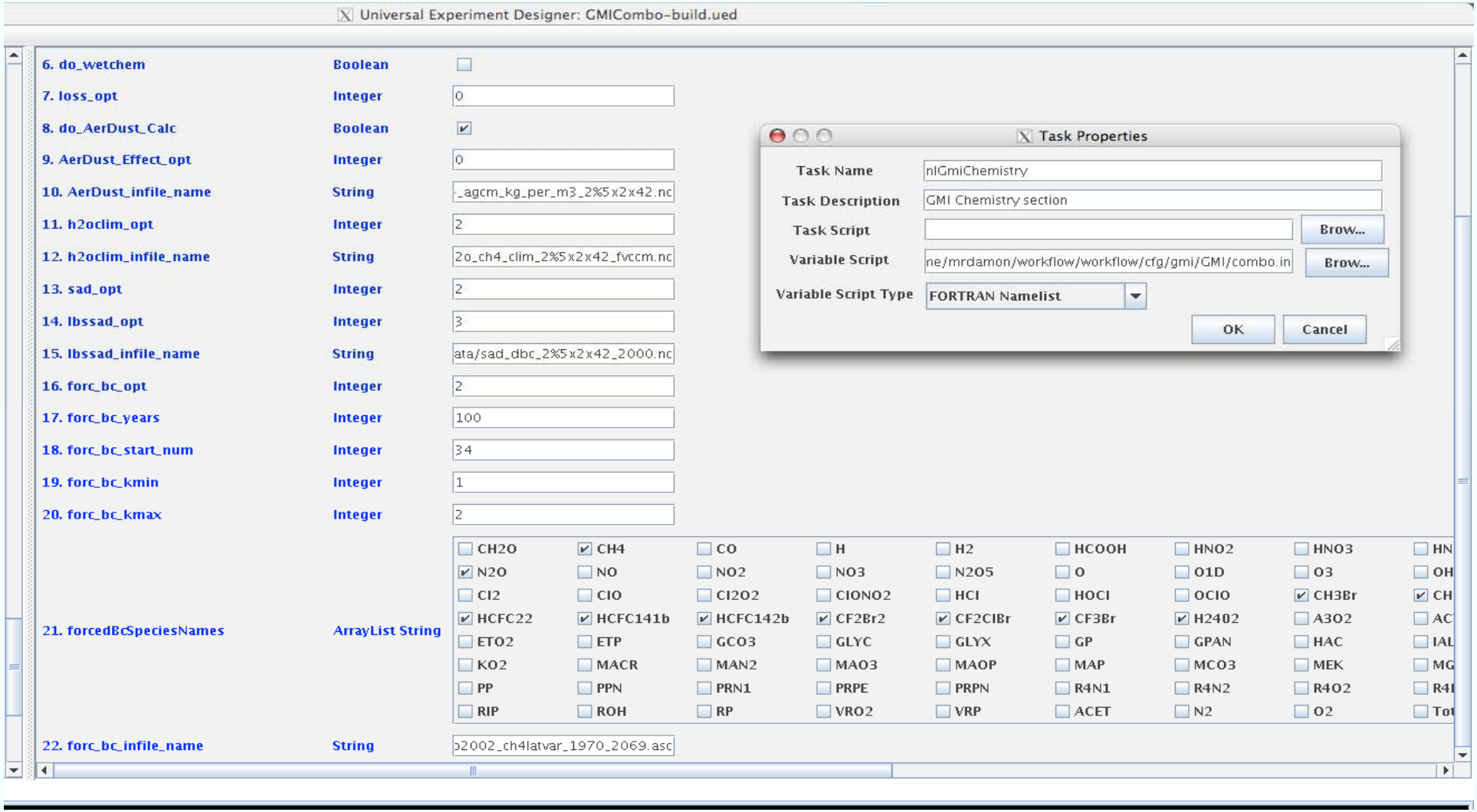
Automating/Streamlining GMI Runs

- **Met field processing/regridding scripts**
  - **Scripts automatically begin processing when GMAO releases new files**
- **Model run submission/monitoring scripts**
  - **Submits a series of model runs**
  - **Emails user when each phase is complete**
- **Namelist/met file list generation scripts**

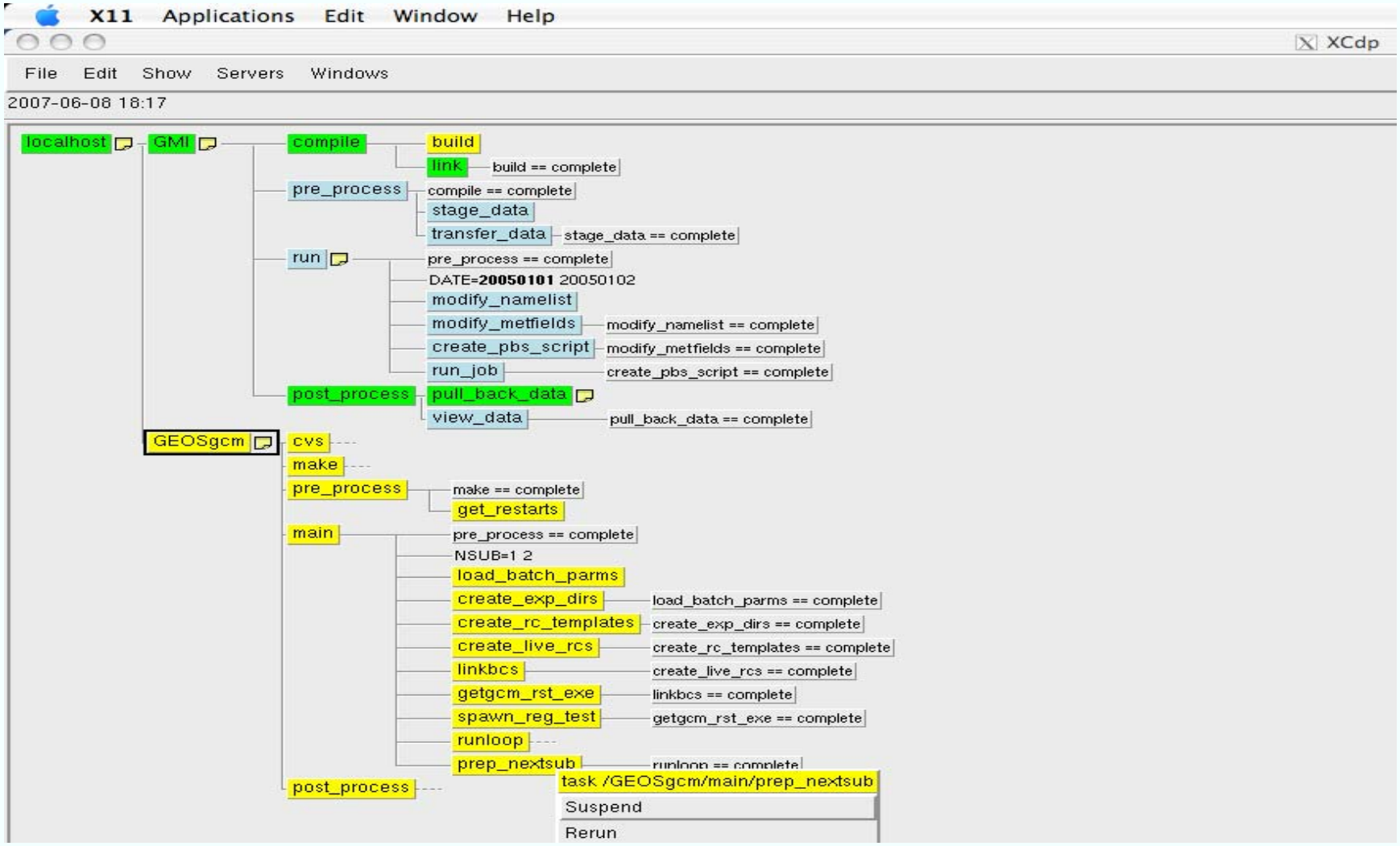
Automating/Streamlining GMI Runs

- **GMI Workflow tool**
  - **GUI with “behind the scenes” scripts to do model runs “end to end”**
    - **Set up namelist file**
    - **Submit job**
    - **Graphically display run progress**
    - **View output data graphically**

GMI Workflow Namelist GUI



GMI Workflow Run Monitoring



Completed GMI Runs

- **Aura Runs**
  - **GEOS4-DAS met fields 2004-2006**
  - **Forecast met fields Jul 2004-Jun 2005**
    - **12 h met field forecasts**
    - **24 h met field forecasts**
- **Incremental Tests**
  - **Tropopause definition**
  - **124 species**
  - **JPL06-2**
  - **H_2 fix**
  - **HO_2 heterogeneous chemistry**

Completed GMI Runs

- **HTAP runs (with some post-processing)**
  - SR1 full chemistry and aerosol
  - SR6 aerosol
  - SR6 AEROCOM aerosol
- **Aerosol runs**
  - Present day (2000)
  - Pre-industrial (1750)
  - DAO, GISS, and FVGCM met fields
- **Boreal wildfire emissions runs**
  - Jun-Sep 2004
  - Forecast and GEOS4-DAS met fields

Upcoming Tasks

- Resolution doubling experiments
- Coupled aerosol/gas-phase chemistry
- Lightning experiments
- Support the integration of GEOS-5 with Combo chemistry
- Implement new TP Core
- GMI User's Guide
- HTAP runs/post-processing
- Evaluating fastjx53c and fastjx61
- Processing of GEOS5 met fields