GSI

Code Management, testing and support

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Fundamental Purpose of DTC

To serve as a bridge between research and operations to facilitate the activities of both halves of the NWP Community

- Research: functionally equivalent operational environment to test and evaluate new NWP methods over extended retrospective periods
- Operational: benefits from DTC T & E of strengths and weaknesses of new NWP advances prior to consideration for operational implementation

DTC Webpage at http://www.dtcenter.org/
Goals of Community GSI Efforts

- Provide current operational GSI capabilities to the research community (O2R)
- Provide a framework for distributed development of new capabilities & advances in data assimilation
- Provide a pathway for data assimilation research to operations process (R2O)
- Provide rational basis to operational centers and research community for enhancement of data assimilation systems
Outline

- GSI code repository
- Community support
- Code management
- Testing and evaluation (T&E)
## Dual GSI Code Repository

<table>
<thead>
<tr>
<th>subtasks</th>
<th>Status</th>
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| EMC-Boulder GSI repository syncing | • All new development and other code changes are committed to the EMC GSI repository  
• The community (Boulder) GSI repository trunk mirrors the GSI core of the EMC GSI repository trunk  
• Difference of the EMC and community GSI repositories includes  
  • Different branches for local development  
  • Community utilities and tools |
| Develop community utilities and tools | • Sample run script  
• PrepBUFR converter sample code  
• DTC Diagnostic utilities (Fortran codes reading diagnostic files and NCL graphic tools...)  
• ARW Background Error generation code (GEN_BE) (NCAR/MMM and DTC)  
• EMC diagnostic plotting tools need to be merged with DTC’s utilities (documentation and public release) |
| Multiple platform test | • IBM: xlf  
• LINUX: pgi  
• LINUX: Intel  
• Mac OSX: PGI |
# Community Support

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| First GSI workshop and Second GSI community tutorial | • Workshop: NCAR, FL lab, Boulder, CO, June 28, 2011<br>• Tutorial<br>  
  • NCAR, FL lab, Boulder, CO, June 29- July 1, 2011<br>• Updated lectures (new lectures added) and practical cases/instructions |
| GSI Helpdesk and documentation                | • Over 360 registered GSI users.<br>• Updated GSI User’s Guide<br>• Updated GSI webpage<br>• Enhance BUFR/PrepBUFR support |
Community GSI - User’s Page

- Mainly support through User’s Page and help desk:
GSI Outreach and Support

- Community GSI Workshop
- Annual Community GSI Tutorial
- GSI webpage
  - Download
  - Documentation
  - Online tutorial
- GSI helpdesk
  gsi_help@ucar.edu
- GSI email list
  gsi_users@ucar.edu
Source code and fixed files were based on:
the GSI EMC trunk r12534 (25 Feb 2011)
the community GSI trunk r593

Source code was based on the NCEP Global Implementation:
Q1FY09

Source code was based on the NCEP Global Implementation:
Q1FY10

With each official release code is a GSI User’s Guide and on-line tutorial cases
Community GSI – Tutorial

- 2010 summer tutorial:
  - 14 lectures
  - 8-h practical sessions

- 2011 summer tutorial:
  - 28-30 June
  - 13 Lectures
  - 4-h basic practical sessions
  - Optional advanced practical session
    - Full day on 30 June

- GSI Workshop on 27 June
## Code Management

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| EMC-DTC direct interaction      | • DTC Maryland staff  
• EMC<->DTC onsite visit |
| GSI Review Committee (GRC)      | • Planning meeting was held on June 28, Boulder, CO.  
• The first committee meeting (coordination) was held on Sept 30, 2010, Camp Springs, MD: Concept of operations  
• Started trial of code review procedure as part of R2O infrastructure in Nov, 2010  
• Review R2O procedure in the review committee meeting. And finalize the procedure and provide public access to the document in early August. |
| GSI community developer meetings | • Monthly Boulder GSI developer meetings  
• Bi-weekly EMC GSI developer meetings  
• Working group email lists |
## GSI Review Committee (2011)

### Members

- **DTC:** Xiang-yu (Hans) Huang
- **EMC:** John Derber
- **GMAO:** Ron Gelaro / Ricardo Todling
- **ESRL:** Stan Benjamin
- **NCAR:** Thomas Auligne
- **AFWA:** Steve Rugg / Jason Martinelli

### Meetings

1. **Coordination and Advisory (First meeting on Sept 30, 2010)**
   - Propose and shepherd new development
   - Coordinate on-going and new development
   - Process management
   - Community support recommendation

2. **GSI Code Review (First trial on Nov 10, 2010)**
   - Establish and manage a unified GSI coding standard
   - Establish and manage a process for proposal and commitment of new developments to the GSI repository.
   - Review proposed modifications to the code trunk.
   - Make a decision on whether code change proposals are accepted or denied.

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**GSI Review Committee Meeting TODAY after the workshop!**

Please pass your questions and suggestions to the committee members.
GSI R2O Transition Procedure (2011)

1. GSI Review Committee scientific review
2. Development, testing and merging
3. GSI Review Committee code and commitment review

Since Nov., 2010, 6 out of 21 review tickets were from non-EMC developers.

If you are interested in getting new development back to the GSI trunk, please contact GSI helpdesk (gsi_help@ucar.edu).
# Testing and evaluation

<table>
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<tr>
<th>Subtasks</th>
<th>Status</th>
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<tbody>
<tr>
<td>Setup FY2011 end-to-end system</td>
<td>• Including pre-processing (WPS), data assimilation (GSI), forecast (ARW), post-processing (WPP) and verification (MET)</td>
</tr>
<tr>
<td>Baseline experiment</td>
<td>• Testing Version v3.0 GSI in FY2010 testbed</td>
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<tr>
<td></td>
<td>• Month-long ARW runs initialized with GFS analyses</td>
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<tr>
<td>Impact studies</td>
<td>• Month-long GSI+ARW cycling/cold-start runs</td>
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<tr>
<td>QC procedure check</td>
<td>• Conventional obs.</td>
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<td></td>
<td>• GPS RO (refractivity)</td>
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<tr>
<td></td>
<td>• Surface obs.</td>
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<td></td>
<td>• Satellite radiance</td>
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<tr>
<td>Ensemble /Hybrid DA</td>
<td>• 3-week visitor</td>
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<td></td>
<td>• Investigate and test ensemble/hybrid DA techniques</td>
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<tr>
<td>Utilities</td>
<td>• End-to-end running script suite</td>
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<td>• Read and display outputs from GSI, WRF, and MET</td>
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GSI Testbed

- Test GSI in an end-to-end system
- World-wide regional applications
- Mostly coupled with WRF-ARW
- Test and evaluate
  - GSI system update
  - Observation impact
  - New techniques
  - Running schemes
  - Background errors
  - Observation errors
  - Others
GPS RO Assimilation Diagnostics

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<tr>
<th></th>
<th>Ob Rejection</th>
<th>RMS</th>
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<tbody>
<tr>
<td>GSI v1.0</td>
<td>~100%</td>
<td>-</td>
</tr>
<tr>
<td>GSI v1.0 w/ ‘2.0’ QC</td>
<td>61.2%</td>
<td>1.16</td>
</tr>
<tr>
<td>GSI v2.0</td>
<td>59.1%</td>
<td>0.97</td>
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*Results for 2007081512*
Surface Observation Impacts

- Verification against ADPUPA (sonde only, top), ADPSFC (bottom)
- Impact of surface data apparent at analysis time near surface (SFC), little/no SS impact for upper levels (UL)
- SS positive impact near SFC from assimilating surface data propagates to UL during fcst times
Regional BE statistics were calculated using ARW forecasts for the testing period and domain.

(Courtesy of Syed Rizvi)
Future Plans and Challenges

• Maintain and enhance current efforts:
  ▫ Helpdesk, tutorial and workshop, utilities development, webpage, documentation, ...

• Additional work:
  ▫ New/additional documentation (BUFR/PrepBUFR, radiance data assimilation, hybrid capability, Bundle...)
  ▫ Testing and evaluation advanced techniques (hybrid, ...)
  ▫ New/enhanced community support:
    • BUFR/PrepBUFR (one day tutorial, documentation, webpage, helpdesk)
    • Hybrid (need work with partners and community)

• R2O
  ▫ Connection and communication with community research groups
  ▫ Implementation of R2O procedure

➤ Limited resources
➤ Feedback from community
➤ Objective evaluation tools and utilities under construction
## DTC Data Assimilation Team

<table>
<thead>
<tr>
<th>Tasks</th>
<th>Staff Category</th>
<th>FTE (FY2010)</th>
<th>FTE (current)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code management and community support</td>
<td>Scientists</td>
<td>1.5</td>
<td>~1.3</td>
</tr>
<tr>
<td></td>
<td>Software Engineers</td>
<td>0.5</td>
<td>0.5</td>
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<tr>
<td>Testing and evaluation</td>
<td>Scientists</td>
<td>1.2-1.7</td>
<td>~0.6</td>
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<tr>
<td>Total</td>
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<td>3.5-3.7</td>
<td>~2.4</td>
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