9th NOAA TBPG Workshop
Kansas City, MO
April 10-11, 2018

Space Weather Prediction Testbed
Rodney Viereck

Status and Updates
SWPC/SWPT Models

Sun:
- ADAPT (USAF)
- WSA (NASA)
- Flare Prediction (SBIR)
- Fareside Imaging (SBIR)
- EUV Irradiance (GOES)

Solar Wind:
- Enlil (George Mason U.)
- L1-Earth Transit (U. Colorado)
- Chen CME Model (NRL)

Magnetosphere:
- Space Weather Modeling Framework (U. Mich.)
- GOES Magnetopause Model (U. Colorado)

Ionsphere:
- IPE (U. Colorado)
- US-TEC
- NA-TEC
- Global TEC
- GPS/ROTI (SBIR)
- Equatorial Scintillation

Aurora:
- 30 Minute Forecast (JHU/APL)
- 3 Day Forecast

Thermosphere:
- WAM (U. Colorado)
- CTIPe

Ground:
- E-Field
### SWPC/SWPT Models

**Under Development**
- Sun:
  - ADAPT (USAF)
  - WSA (NASA)
  - Flare Prediction (SBIR)
  - Fareside Imaging (SBIR)
  - EUV Irradiance (GOES)
- Solar Wind:
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  - Chen CME Model (NRL)
- Magnetosphere:
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**In Test and Transition**
- Ionosphere:
  - IPE (U. Colorado)
  - US-TEC
  - NA-TEC
  - Global TEC
  - GPS/ROTI (SBIR)
  - Equatorial Scintillation

**Operational**
- Aurora:
  - 30 Minute Forecast (JHU/APL)
  - 3 Day Forecast
- Thermosphere:
  - WAM (U. Colorado)
  - CTIP
- Ground:
  - E-Field
- Under Development
- In Test and Transition
- Operational
FY17 Q4: Whole Atmosphere Model (WAM) coupled with the Ionosphere Plasmasphere Electrodynamics (IPE) model with WAM Data Assimilation System (WDAS) running on WCOSS-Dev

Whole Atmosphere Model:
- Extended GFS (up to 600 km)
- Drives ionosphere model (one way coupling)
- Imparts terrestrial weather structures onto the ionosphere.
  - planetary, tidal, gravity waves

Forecasts of Ionospheric/Thermosphere conditions support users of GPS/GNSS, HF Radio, Satellite Com. Satellite Drag,…
FY 17 Highlights:
GloTEC Model and COSMIC 2 Data
Assimilative model of the ionosphere

- **Global Total Electron Content (GloTEC):**
  - Combines ground-based and space-base (COSMIC) GPS/GNSS observations to create a 3D assimilative map of the ionosphere.
  - Proves specification of parameters relevant to a number of users.
    - GPS/GNSS, HF Communication, Satellite Communication.
**GloTEC:** Will use COSMIC-2 data to create a real-time 3D specification maps of the ionosphere and TEC

**WAM-IPE:** Will provide multi-day forecasts of ionosphere and TEC.

- Phase 1: COSMIC-2 and GloTEC will be used to validate WAM-IPE forecasts (FY19)
- Phase 2: COSMIC-2 data will be assimilated into WAM-IPE to improve forecasts (FY20)
## FY17(18) Transition Metrics

### Space Weather Prediction Testbed

<table>
<thead>
<tr>
<th>Major Tests Conducted</th>
<th>Transitioned to Operations</th>
<th>Recommended for Transition to Operations</th>
<th>Advanced To Experimental Testing</th>
<th>Further Demonstration / Development</th>
<th>Rejected For Further Testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>WAM-IPE: Real-time, One way coupled.</td>
<td>(RL9)</td>
<td>FY19 Q4</td>
<td>FY17 Q4</td>
<td></td>
<td></td>
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<tr>
<td>GloTEC Assimilative Model with COSMIC 2 data</td>
<td></td>
<td>FY19 Q2</td>
<td>FY18 Q4</td>
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<td></td>
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<tr>
<td>WSA-Enlil Model Upgrade</td>
<td></td>
<td>FY18 Q3</td>
<td>FY18 Q1</td>
<td></td>
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<tr>
<td>NSO GONG Data Processing on IDP</td>
<td></td>
<td>FY18 Q3</td>
<td>FY17 Q4</td>
<td></td>
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<tr>
<td>Goespace Model Upgrade (V2)</td>
<td>(V2) FY17 Q4</td>
<td>(V3) FY19 Q3</td>
<td>(V3) FY18 Q3</td>
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<td></td>
</tr>
<tr>
<td>E-Field Product</td>
<td>FY19 Q2</td>
<td>FY 18 Q4</td>
<td>FY17 Q4</td>
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</tbody>
</table>
FY18 Highlights:

Updates and Plans

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- **WAM-IPE**
  - 2-way coupling implemented on WCOSS-Dev (NESSI)
  - Derived products developed (in conjunction with customers and user)
  - FV3 Dynamical Core implementation and testing begins

- **GloTEC**
  - Ready to receive COSMIC 2 data
  - Ready to test GPS/GNSS RO data from the Commercial Data-Buy Pilot Product (high latitude GPS RO)
FY18 Highlights:

Space Weather Action Plan

Space Weather Prediction Testbed

- **Space Weather Action Plan:** Initiative to enhance National Readiness and Resilience against Space Weather
  - Multi-Agency Announcement of Funding Opportunity: R2O2R
    - FY18 AO: Using existing funds a tri-agency announcement (NASA, NOAA, NSF) was released to support transition of model to operations and the upgrade and improvement to existing operational models.
    - FY19 AO: New money (~$10M from OMB) has been allocated to enhance space weather R2O2R
  - NASA-NOAA MOU Annex 2 developed for the next set of tasks
    - Aviation Radiation
    - Data assimilation
  - Expansion of Space Weather Testbed Center
    - (multi-agency, academia, commercial partners).
Questions
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● **Summary:**
  ● A number of models are in development
  ● Several models are being upgraded
  ● New resources are being used to address the R2O2R processes and applied research for space weather

● **Questions?**

Rodney Viereck, Director
Space Weather Prediction Testbed
NOAA/NWS/NCEP/SWPC
325 Broadway
Boulder, CO
80305
rodney.viereck@noaa.gov