Air Force Weather

Integrity - Service - Excellence

Air Force Weather View of CCMC

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Space Weather Modeling Needs

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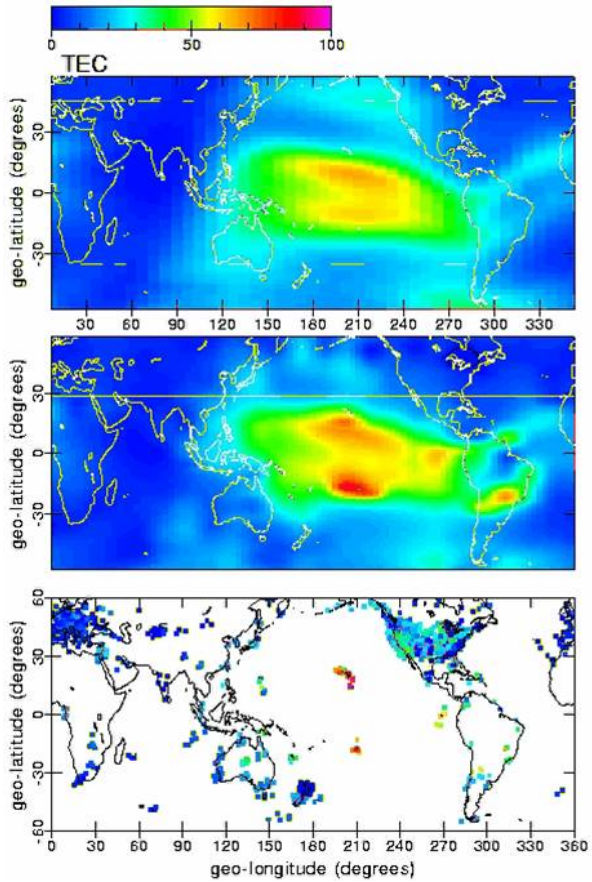
- Forecast Models are required for the following:
  - Solar Surface/Solar Atmosphere
    - Forecasting effects on communications, radars, and space systems; input to forecasting solar wind
  - Solar Wind
    - Input to forecasting of the magnetosphere and ionosphere
  - Magnetosphere
    - Forecasting storm effects and magnetospheric effects on space systems
  - Ionosphere (Ionospheric Parameters & Scintillation)
    - Forecasting effects on electromagnetic propagation
  - Thermosphere/Stratosphere/Mesosphere
    - Orbital prediction, forecasting high-altitude winds, input to forecasting ionosphere
- Forecast requirement is 0-120 hours!

AFW/Community Modeling Challenges

- Model portability, optimization, and robustness
- Model output formats
- Model visualization and effects modeling
- Model validation
- Data quality/error estimates required by advanced data assimilation systems
- Technology Transition Process



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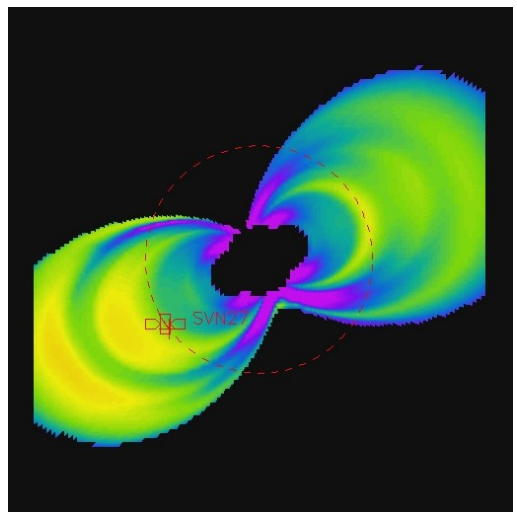
Importance of CCMC as a Technology Transition Partner

Brig Gen Thomas E. Stickford, USAF Director of Weather:
"CCMC is fertile ground for technology exploitation—a distinct advantage for the Air Force and our Nation!"

- **Model validation**
- **Making models more easily transitionable**
- **Testing model robustness**
- **Testing in real-time mode**
- **Model visualizations / applications**



Back-up Slides

Technology Transition Process

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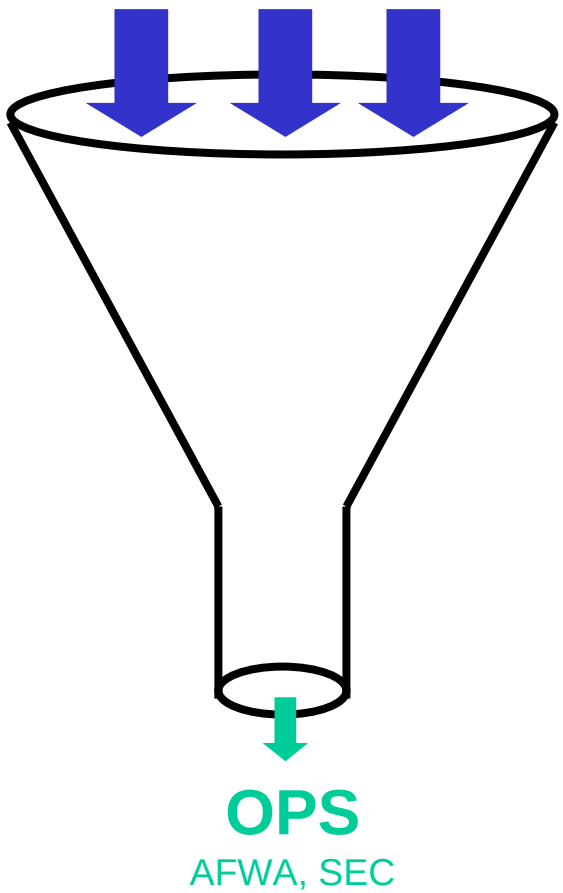

Technology Transition is more than handing-off a model

- **Integrated into infrastructure**
- **Documented**
- **Maintainable**
- **<u>Automated</u> database interaction, model execution, post-processing, product generation**

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Space Weather Modeling Requirements

- **Solar Surface/Atmosphere Forecasting (0-120 hours)**
  - **Flare time, location, and intensity**
  - **Particle and electromagnetic emissions**
  - **Solar atmosphere parameters**
  - **Backside activity**

- **Necessary for:**
  - **Forecasting interference on communications and radar systems**
  - **Forecasting radiation effects on satellite systems, astronauts, and aircrews**
  - **Providing input drivers for solar wind forecasts**

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Space Weather Modeling Requirements

- **Solar Wind Forecasting (0-120 hours)**
  - **Plasma and magnetic field parameters**
  - **Integrate ambient and transient characteristics**

- **Necessary for:**
  - **Input drivers for magnetosphere & ionosphere**
  - **Forecasting magnetic storm onset**

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Space Weather Modeling Requirements

- **Magnetospheric Forecasting (0-72 hours)**
  - **Stand-off distance of magnetopause / bow-shock**
  - **Particle and magnetic field characteristics**
  - **South Atlantic Anomaly characteristics**
  - **Geomagnetic storm currents**

- **Necessary for:**
  - **Forecasting geomagnetic storm effects**
    - **Satellite drag / orbit changes**
    - **Power outages**
  - **Forecasting satellite damage**
  - **Input driver for ionosphere**

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Space Weather Modeling Requirements

- **Ionospheric Forecasting (0-120 hours)**
  - **Great-circle route vertical cross sections**
  - **Auroral strength & boundary location**
  - **Electron Density Profiles**
  - **Total Electron Content**

- **Necessary for:**
  - **Forecasting effects on communications, radars, and navigation systems**

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Space Weather Modeling Requirements

- **Ionospheric Scintillation Forecasting (0-120 hours)**
  - **Equatorial scintillation**
  - **Auroral scintillation**

- **Necessary for forecasting:**
  - **Communication outages**
  - **GPS errors & outages**
  - **Missile defense & satellite tracking radar errors**

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Space Weather Modeling Requirements

- **Upper Atmosphere Forecasting (0-120 hours) (Stratosphere / Mesosphere / Thermosphere)**
  - **Densities**
  - **Temperatures**
  - **Winds**

- **Necessary for:**
  - **Forecasting orbital changes / space object re-entry**
  - **Input driver for ionosphere**
  - **Stratospheric turbulence**
  - **High-altitude dispersion**