Air Force Weather Agency

Integrity - Service - Excellence

U.S. AIR FORCE

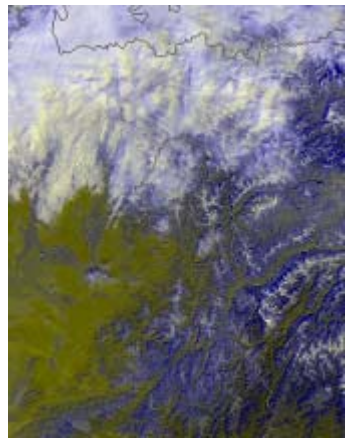
AFWA Metrics and V&V Needs

Lt Col Trey Cade
Chief, Applied Technology Division
Air Force Weather Agency

Air Force Weather Agency Mission:

Maximize our Nation's aerospace and ground combat effectiveness by providing:

- **Accurate, relevant and timely air and space weather information to DoD, coalition, and national users.**



Definitions

Validation: **A determination, based on analyzing model performance, that a model is considered valid for operational use.**

- **Used to decide whether to implement a model into operations.**

Verification: **The continuous process of measuring the performance of an operational model to determine how well its performing.**

- **Used for forecaster awareness and to identify areas for model improvement.**

Sometimes qualitative verification is OK

AFWA Needs

- **AFWA requires a robust V&V and metric program across all phases of space weather support including Acquisition, Operations and Advocacy**
- **Acquisition: V&V studies aimed at assisting in selection of models for operations**
  - **Model-to-model 'fly-offs'**
  - **Model evaluations against a range of conditions document strengths, weaknesses, and biases**
  - **Metrics should also include important information such as processing requirements, software efficiency, input/output storage needs**

Is the model ready for operational forecasting?

- **Realistic inputs, automated runs, no tweaking**

AFWA Needs – Cont.

- **Operations: Day-to-day, real-time metrics to track longer term biases and daily variations in performance**
  - **Daily performance statistics critical to model confidence**
  - **Identify and prioritize model improvements**

- **Advocacy: AFWA requires 'single number' metrics that can be used to advocate the value of space weather modeling to the non-space weather community**

Operations Index

Mesoscale Meteorological Modeling

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Overview

- Parameters selected based on customer importance
- Calculates a value that represents forecasting skill of the model vs. persistence
- Skill scores calculated for each parameter on a monthly basis by normalizing the forecast root mean square (RMS) error against the persistence RMS error
- Skill scores for each parameter combined to form a single value using a weighting system determined by mission needs
- High and low range calculated by applying a confidence interval (CI) to the Ops Index
- CI is calculated based on the high and low range of the RMS data

Weighting Scheme

Parameter								Cycles
	6hr		18hr		30hr		42hr	06/18Z
	12hr		24hr		36hr		48hr	00/12Z
250WS	2		2		1		0.5	
850WS	2		2		1		0.5	
700RH	2		2		1		0.5	
500RH	2		2		1		0.5	
500TT	2		2		1		0.5	
500HT	2		2		1		0.5	
SFCRH	6		3		2		1.5	
SLP	6		3		2		1.5	
SFCTT	6		3		2		1.5	
850RH	2		2		1		0.5	
SFCTD	6		2		2		1.5	
SFCWS	6		3		2		1.5	100

Science Index

Mesoscale Meteorological Modeling

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Overview

- The “Science Index” uses 42 parameters and weights them evenly based on the number of skill scores used.

Parameters

250WS*	500RH*	925TT	50TD*
850WS*	925HT	850TT	925WS
SFCWS*	850HT	250TT	500WS
500HT *	250HT	100TT	100WS
SLP*	100HT	50TT*	50WS*
SFCTT*	50HT*	925TD	SFCWD
500TT*	925RH	850TD	925WD
SFCTD*	250RH	500TD	850WD
SFCRH*	100RH	250TD	500WD
850RH*	50RH*	100TD	250WD
			100WD
			50WD*

*** Denotes 11 “Operations Index” parameters common to “Science Index”**

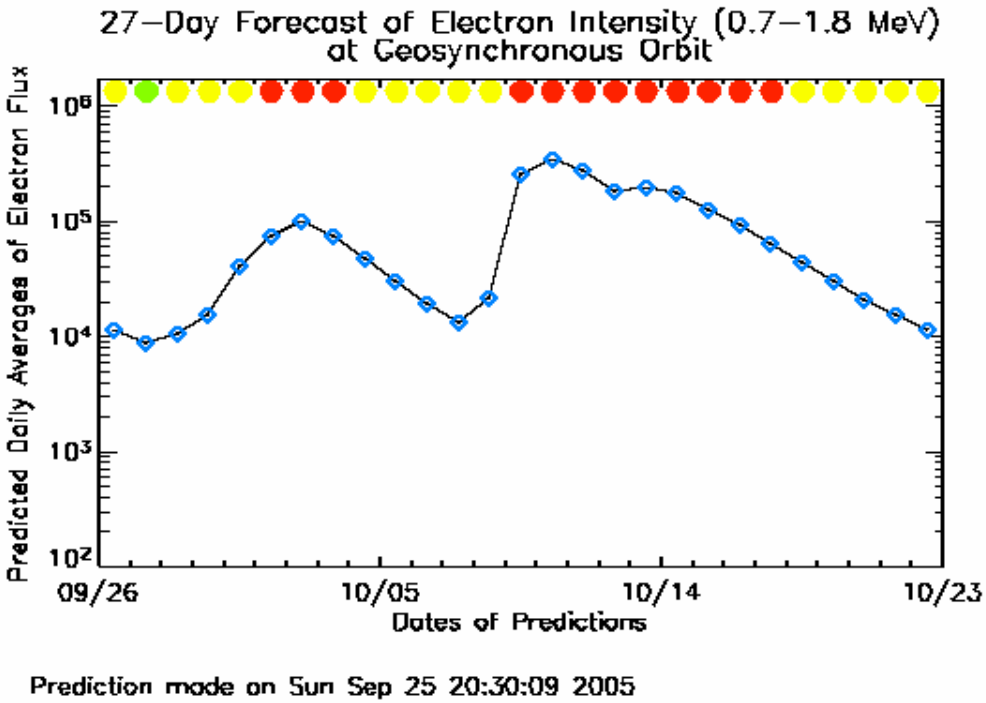
*** Denotes additional 6 parameters to be used in generating Science Index**

AFWA - CCMC Partnership

- **AFWA should utilize CCMC for all phases of its V&V and metric needs**
  - **Acquisition: CCMC could play a key role in helping AFWA decide between models (i.e., fly-offs)**
  - **Operations:**
    - **CCMC could document model performance and tendencies providing forecasters valuable bias information on which to base daily forecast confidence**
    - **CCMC efforts and partnerships with model developers could help target upgrade opportunities and ensure improvement**
  - **Advocacy: CCMC experience with metric development could assist AFWA in the development of 'one-number' metrics**

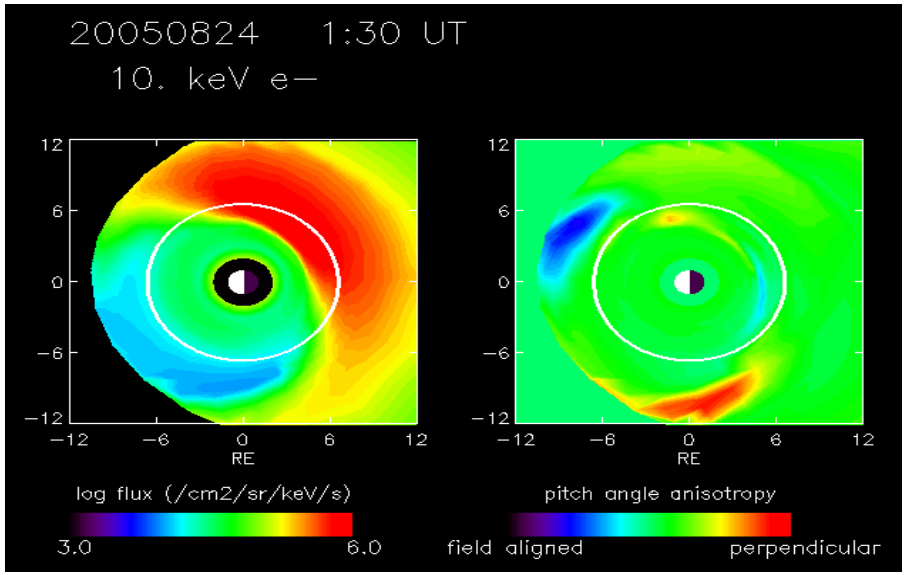
AFWA - CCMC Partnership

- **August 05: CCMC acquired the UPOS-developed Relativistic Electron Prediction (REP) model for our first formal V&V effort**
  - **Details of the V&V are still being worked**
  - **Goal: Learn model tendencies and value vs a standard**



AFWA - CCMC Partnership

- AFWA would also like to have the CCMC V&V the UPOS Radiation Belt Environment (RBE) model



- Near term efforts could involve a V&V of the the USC and USU version of the GAIM models
- Other efforts could include assisting in the search for solar surface and thermospheric models for operational transition

Summary

- AFWA has a need for V&V partners
- CCMC is a natural choice for V&V and metric development partnership
- First formal effort is underway… AFWA looks forward to a lot more!