



AFRL

THE AIR FORCE RESEARCH LABORATORY
LEAD | DISCOVER | DEVELOP | DELIVER



AFRL – CCMC Collaboration



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AFRL-CCMC Collaborations Outline



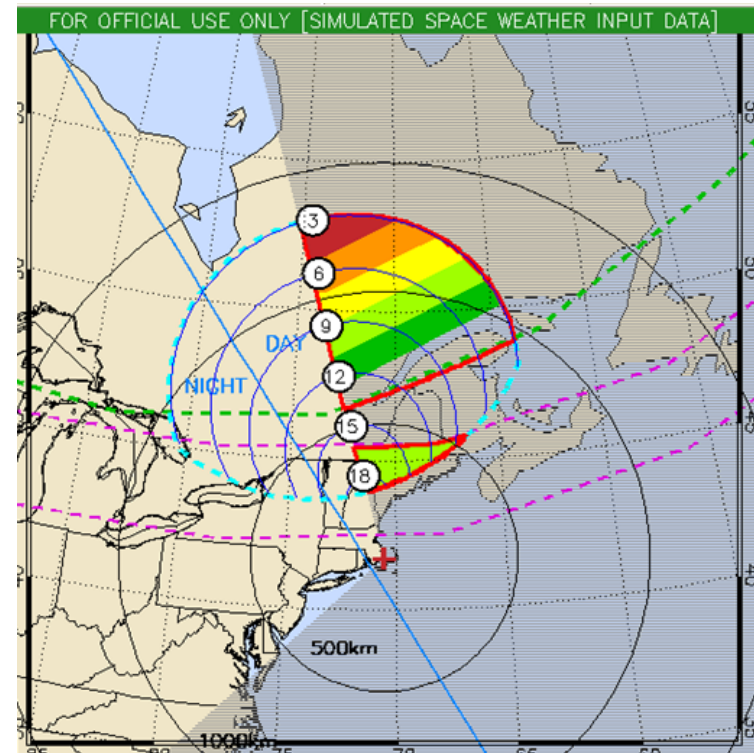
- Collaborations
 - Past
 - Present
 - Future
- Additional Notes
 - High-Level Call-Outs



AFRL-CCMC Collaboration

Past - 1

- WSA: model use, upgrades and couplings
- Radar Auroral Clutter (RAC) model remote run proj:
 - Current RAC run at AFWA with coupled env & system-impact models
 - Uses Kp from DMSP, ground mag, or ACE
 - Drives Hardy auroral & Foster SAPS models
 - Combined w radar specs
 - Output nowcast & forcast env false target zones
 - Quick-turn proj to prove CCMC output potential for ops & net-centric remote feed of env inputs to drive ops SIPs in rt
 - Replaced Hardy auroral models w ACE-driven SWMF & Fok RC polar & auroral boundaries
 - Env models run in one place (CCMC = AFWA)
 - Eng effects apps at another (AFRL = JSPOC)
 - Process worked, but dead sun provided no boundary variations





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Past - 2



- CCMC Operations Working Group (OWG)
 - AFRL led
 - OWG accomplished: members, metrics, validations requested, HW/SW reqs, notes & recommendations
 - CCMC obtained several OWG-recommended/desired models
 - CCMC performed /documented several OWG-requested validations
- CCMC-hosted models used (or planned to be) by SWFL
 - Current SWFL focus on validation of “baseline” models
 - current operational versions (directly from AFWA) are being acquired
 - Most other acquisitions are being worked directly with model developers
- R2O Valley of Death



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Present - 1

- Beginning of the end of R2O Valley of Death
 - Getting slowly filled-in since 2000
 - OpSEND 2000 – first set of system-impact products
 - » RAC, HFI, SatScint, GPS SFE (all primarily ionospheric)
 - Substantial CCMC work
 - Proofs of value, robustness, runability and real-time apps
 - Direct work assisting with operational use/modifications
 - Applied to SWFL plans for R2O models acq/exec/VnV/test-beds
 - Applied to AFWA plans for model acq and operational uses
 - SEEFS 2009 – second set of SIPs
 - » RAC, SatScint, RadScint, SoRBE, Char/D (+ solar & magnetos!)
 - Fortuitous mess of AF R2O issues & collaborations
- Current status = Pit of Despair



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Present - 2



- Nick Arge: more WSA and couplings
- Dan Ober (AFRL/RVBXP)
 - AFRL FY2010 seed \$ for physics-based models validation at CCMC
 - Magnetospheric: LFM, GGCM, BATSRUS, GUMICS
 - Thermosphere-Ionosphere-Plasmosphere: CTIP
 - Masha & Lutz assisting with special run requests
 - Plan to include work on coupling GGCM with CTIP
 - New proposal for additional/continued work in 2011-2014



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Future - 1



- PBMOD at CCMC: **Present John Retterer Slides**
- Documentation of CCMC validations performed
 - WE NEED TO READ THEM!
- Potential for SWFL-directed model runs for new validations
- Collaboration to know/get/use CCMC models at SWFL
 - Huge potential for future generation of AF-required SIPs
 - MetE, SoRBE, SEUPE, SpROuts, CharD, SaLAD, ToDo, SODA, GELo, ISE, CoFIE
 - Potential for direct deliveries of models from CCMC to SWFL?
- SWFL use of CCMC model runs for forecast & anom assmts



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Future - 2

- Proof for use of “new” type of rt data for ops
 - SuperDARN, PolarDARN, AMPERE, COSMIC, etc
- Need for error bars on model inputs & outputs
 - for SIPs confidence level use
 - for ensemble model running uses
- CCMC as additional NASA contact for AFRL & ops
 - CCMC/ Marlo Maddox operational support to NASA
 - John Allen contact for cross-NASA applications of SIPs
 - Aside: note recent exchange with MSFC (Minow) regarding desire for charge/discharge product support for LEO EVAs (Char/D!)
- Resume OWG as more nationally-focused R2O effort



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Future – 3 (OWG)

- Substantial OWG inputs to CCMC up to 2007
 - not much done since
- Definite push for increased collaboration between ops orgs
- Plan to reinvigorate as a National Space Wx R2O WG
 - Need for new R2O and ops organizations membership
 - **AFWA:** Jeff Cox / Joe Reich
 - **NASA SRAG:** Dan Fry / Neal Zapp
 - **JSpOC:** Maj Aaron Williams /other?
 - **SMC:** Steve Higley / Kevin Scro
 - **NOAA:** Doug Biesecker / Howard Singer
 - **CCMC:** Marlo Maddox / Yi Jua Zang
 - **AFRL:** Stephen Quigley / Dave Cooke
 - **NRL:** ??
 - **NASA OTHER:** ??
 - Plan to post community-wide info on CCMC Website
- Turn “Pit of Despair” into a “Puddle of Anticipation”



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Additional Notes



- High-Level Call-Out
 - Hesse: $0 \times 3 = 12$?
 - Hayes: “Desirements”?
 - Allen: RATSURUS

The End





Extra Slides

- **BACKUP SLIDES**
 - **CCMC OWG**



SEEFs



Future Work-2

- Future SEEFs development will include the following subset of AFSPC/A5 env effects product requirements, and others identified by AFRL: (note sensor-to-shooter roadmaps)
 - Satellite Single Event Upsets & Events (SEUPE)
 - GPS Dual-Frequency/Scintillation Errors
 - Meteor Effects (MetE)
 - Radar Correction Factors-Ionospheric Effects (CoFIE)
 - Satellite Total Dose (ToDo)
 - Satellite Orbital Drag Application (SODA)
 - Tropospheric Effects on Radars
 - Tropospheric Effects on Lasers (TroEffeL)

 - Spacecraft Utility Disorientation Status (SPUDS)
 - Spacecraft Reconnaissance Obs & Outage Sensitivities (SpROUtS)
 - Satellite Launch and Deployment (SaLaD)
 - Effects of GPS on Golfing (EGG)



OWG - Members



✓ 1) List of OWG Members:

Membership - Nov 2007			
AFWA	Matt Sattler/Capt Anderson	402-294-3373	Sattlerm@afwa.af.mil
NOAA/SEC	Kent Doggett (co-chair)	303-497-3317	Kent.A.Doggett@noaa.gov
NASA/SRAG	Steve Johnson	281-483-5323	A.S.Johnson1@jsc.nasa.gov
AFRL/VS BX	Stephen Quigley (chair)	719-556-2889	Stephen.Quigley@cisf.af.mil
SMC/WXT	Christopher Cox (Maj)	719-556-8732	Christopher.Cox@cisf.af.mil



OWG - Validations Needed

✓ 3) List of Validations Needed in Ops: **Primary AFSPC & SMC Need of CCMC!**

CCMC OWG - List of Validations Needed in Operations

The following list does not consider whether or not a particular model or models reside currently at the CCMC.

This desire for a validation should be considered a recommendation for that model to be acquired and validated by the CCMC.

This list does not provide information on the types of metrics that would be desired for such a validation, but the OWG is willing to provide assistance in developing such metrics and/or validation processes to the CCMC.

FIRST PRIORITY - 3 or more OWG organizations overlap (no particular order)

Comparative validation of the Hardy Auroral Oval model against the OVATION model

Comparative validation of OpSEND's UHF SATCOM Scintillation product version of SCINDA model w version used in SEEFS' SatScint product

Input data validation of USU GAIM with/without SSUSI/SSULI/COSMIC

Data validation of the JHU/APL Kp & Dst predictions forced by HAF solar wind output instead of ACE

SECOND PRIORITY - 2 OWG organizations overlap (no particular order)

Validation of Foster's Sub-Auroral Polarization Stream (SAPS) Model (best compared to other SAPS mod, MHD mod trough, or combined auroral/SAPS m

Predicted Kp driven Magnetospheric Specification Model vs Magnetospheric Specification and Forecast Model

Validation of the Detman Hybrid Heliospheric Modeling System against ENLIL/WSA system.

Third Priority - 1 OWG organization chose (no particular order)

Data validation of forecast produced by JHU/APL Radiation Belt Environments model forced by HAF solar wind output

Comparative validation of the WSA solar wind model against the HAF solar wind model (Ghee Frye may have done some of this)

Comparative validation of the Smithtro Relativistic Electron Forecast Model against the JHU/APL Rel (reco val of both against ground truth for abs vs relative)

Comparative validation of USU GAIM against USC GAIM

Comparative validation of the ENLIL solar wind model against HAF

Comparative validation of predicted delta B magnitude at ground magnetometers from Weimer Model and same derived from MHD code(s)

Fourth Priority (in no particular order)

Comparative validation of operational versions of WBMod & WBGrid with versions used in SEEFS' RadScint & SatScint products

Comparative validation of the Costello Kp prediction algorithm against the JHU/APL Kp prediction algorithm (done already?)

Comparative validation of the Proton prediction System (PPS) model against the PROTON model

Li/Temerin Dst prediction against the JHU/APL Dst Prediction

Data validation of the JHU/APL Radiation Belt Environments model forced with observed Dst vs forecasted Dst.

Data validation of the JHU/APL Kp & Dst prediction algorithms with and without observed Kp & Dst