Operational Metrics for Geospace Models

- Goal: Validation of Geospace prediction models to determine which model or models should begin transition to operations process beginning about 2012.
- Focus: Models that can predict regional geomagnetic activity
- Timeline: About 12 months
- First Steps: CCMC leads evaluation; Build on GEM Storm Challenge; Establish partnerships; Decide on metrics; Conduct evaluation
- Metric Selection Workshop: Monday April 26, in Boulder, preceding Space Weather Workshop (April 27-30). Discussing and determining the metrics that can be used to select models that can meet operational needs.

Geospace Model Validation Workshop
April 26, 2010 1300 - 1730
Millennium Harvest House Hotel,Boulder, CO

Agenda

1300 – 1310 Welcome and Introduction
Tom Bogdan (Director, SWPC) and Howard Singer (NOAA SWPC)

1310 – 1330 Report on FEMA/European Union Workshop on Transatlantic Geomagnetic Storm Preparedness and the North American Electric Reliability Corporation and DOE Conference on Geomagnetic Storms
Joseph Kunches (NOAA SWPC)
(replacing presentation from guest unable to attend)

1330 – 1350 Metrics for Geospace Models – SWPC Recommendations
Howard Singer (NOAA SWPC)

1350 – 1410 AFRL Geospace Model Validation Plans
Shawn Young (AFRL)

1410 – 1430 CCMC Geospace Model Validation Capabilities
Masha Kuznetsova (NASA CCMC)

1430 – 1450 CCMC GEM Storm Challenge Results--Metrics and Lessons Learned
Antti Pulkkinen (NASA CCMC)

1450 – 1510 Break

1510 – 1530 Space Weather Modeling Framework BATS-R-US MHD Model Overview
Aaron Ridley (U. of Michigan)

1530 – 1550 OpenGGCM MHD Model Overview
Alexander Vapirev (UNH)

1550 – 1610 LFM MHD Model Overview
Michael Wiltberger (NCAR-HAO)

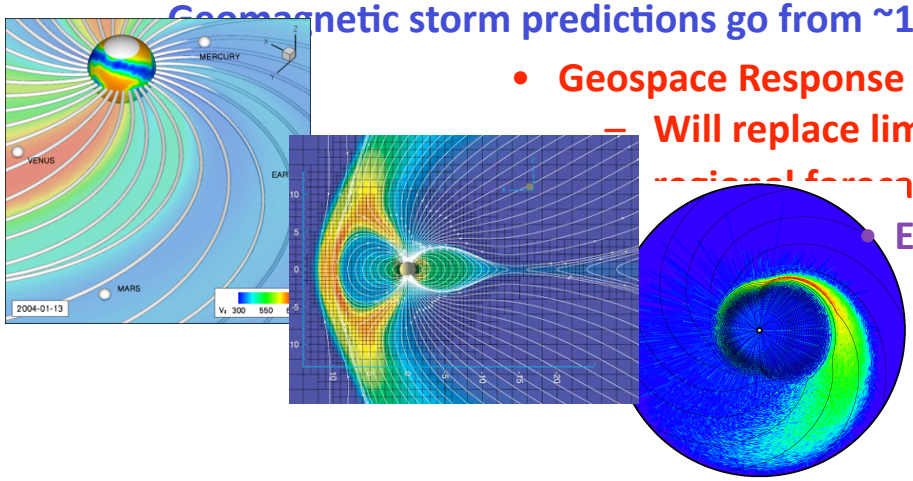
1610 – 1630 GUMICS MHD Model Overview
Howard Singer for (Tuija Pulkkinen and Minna Palmroth, FMI)

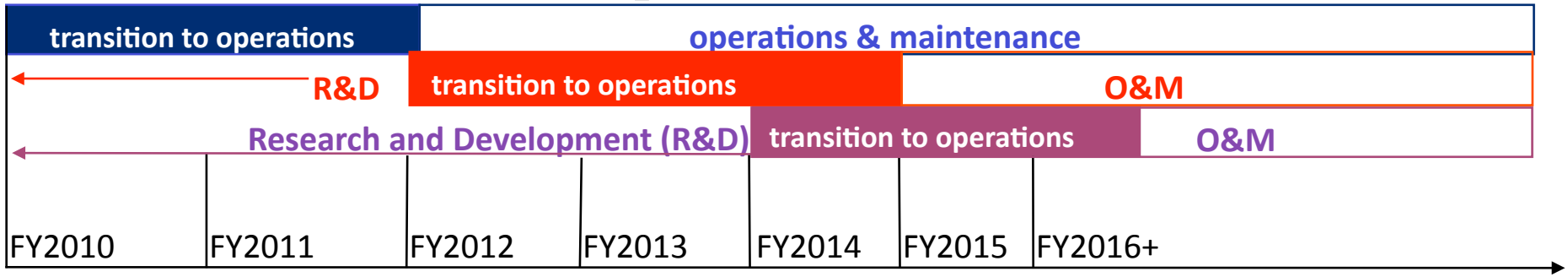
1630 – 1730 Discussion and Metrics Selection

Model Transition to Operations

Partnering with NASA's Community Coordinated Modeling Center, DOD, and the research community to develop improved space weather models to maximize the utility of solar wind and CME data for extended forecast and warnings

- Solar Wind Disturbance Propagation Model
  - Geomagnetic storm predictions go from ~1 hour to 18hr to 4 days
- Geospace Response Model
  - Will replace limited value global predictions with actionable regional forecasts and warnings
- Energetic Particle Transport Model
  - Model to predict radiation storm peak intensity, timing, and spectrum; no models currently exist!





O&M includes Operation to Research (O2R) feedback to continuing R&D

Regional Geomagnetic Activity Prediction

- **Need for both continuous activity prediction and storm prediction (location, onset time, duration, magnitude, probability of exceeding threshold)**
  - Location, or region, can be selected in different ways: e.g. lat-long grid on Earth; noon, dusk, midnight, dawn; high-latitude, mid-latitude, low latitude…
  - Magnitude can be for different parameters: e.g. max deviation, dB/dt, mean deviation, etc. during a selected time interval
  - Time resolution for product is selectable; e.g. Kp is 3-hours, Costello Kp is 15 min

- **Focus on dB/dt and Kp**
  - dB/dt: demonstrated customer need (e.g. power utilities)
  - Regional Kp: to serve customers and demonstrate improvement over current global products

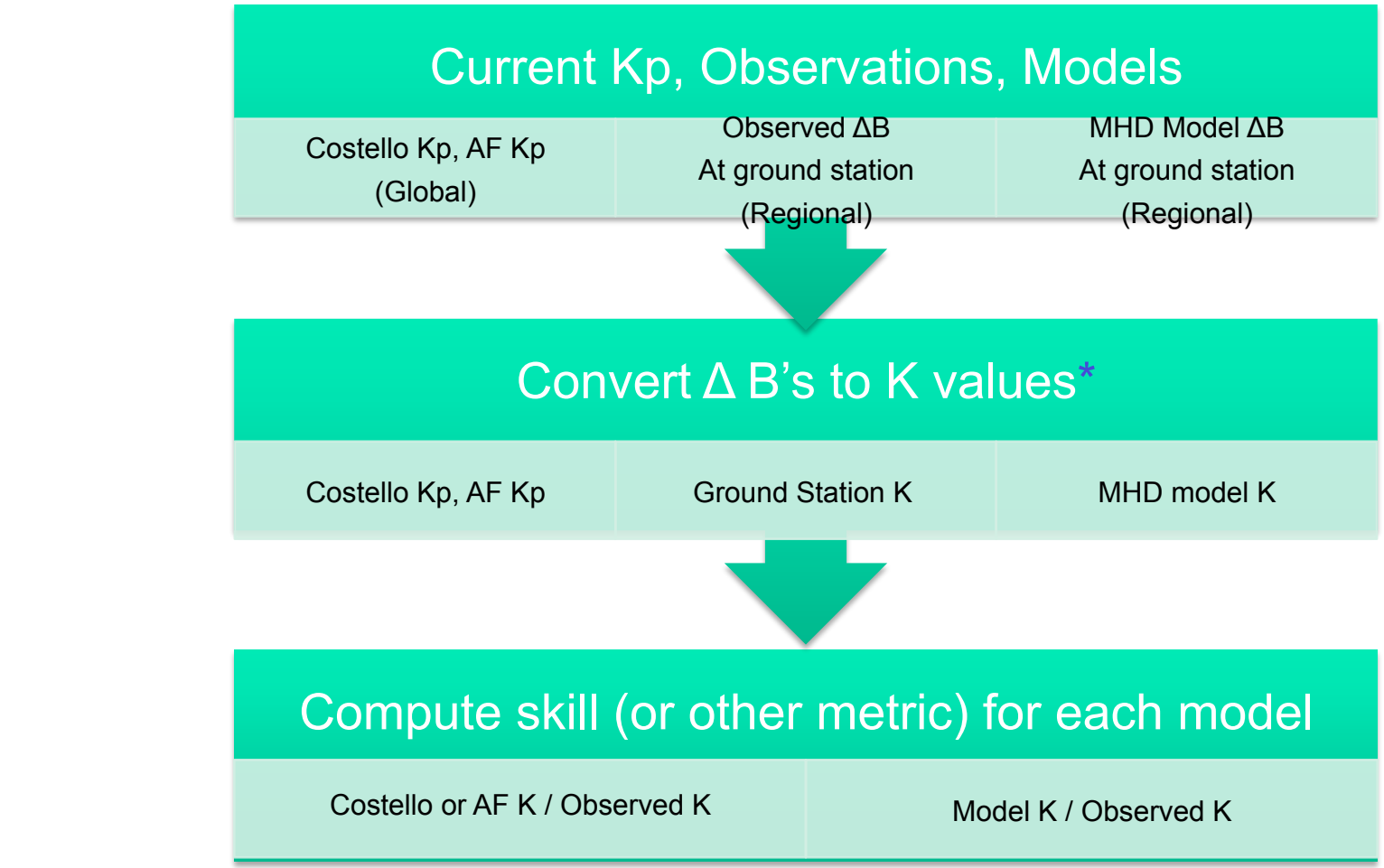
Regional Kp Prediction

Challenge

- Can MHD models predict a regional (TBD) Kp (or K) that better represents a local geomagnetic disturbance than the currently available global Kp over specified time interval (TBD)?

- Currently Available: Costello Kp predicted from solar wind input at 15-min cadence and AF 3-hour near-real time Kp observed index

Regional Kp Prediction



* Alternative: convert Costello and AF Kp's to ΔB' at test station location; also need to consider valid latitude range (~48-62 deg) for K index

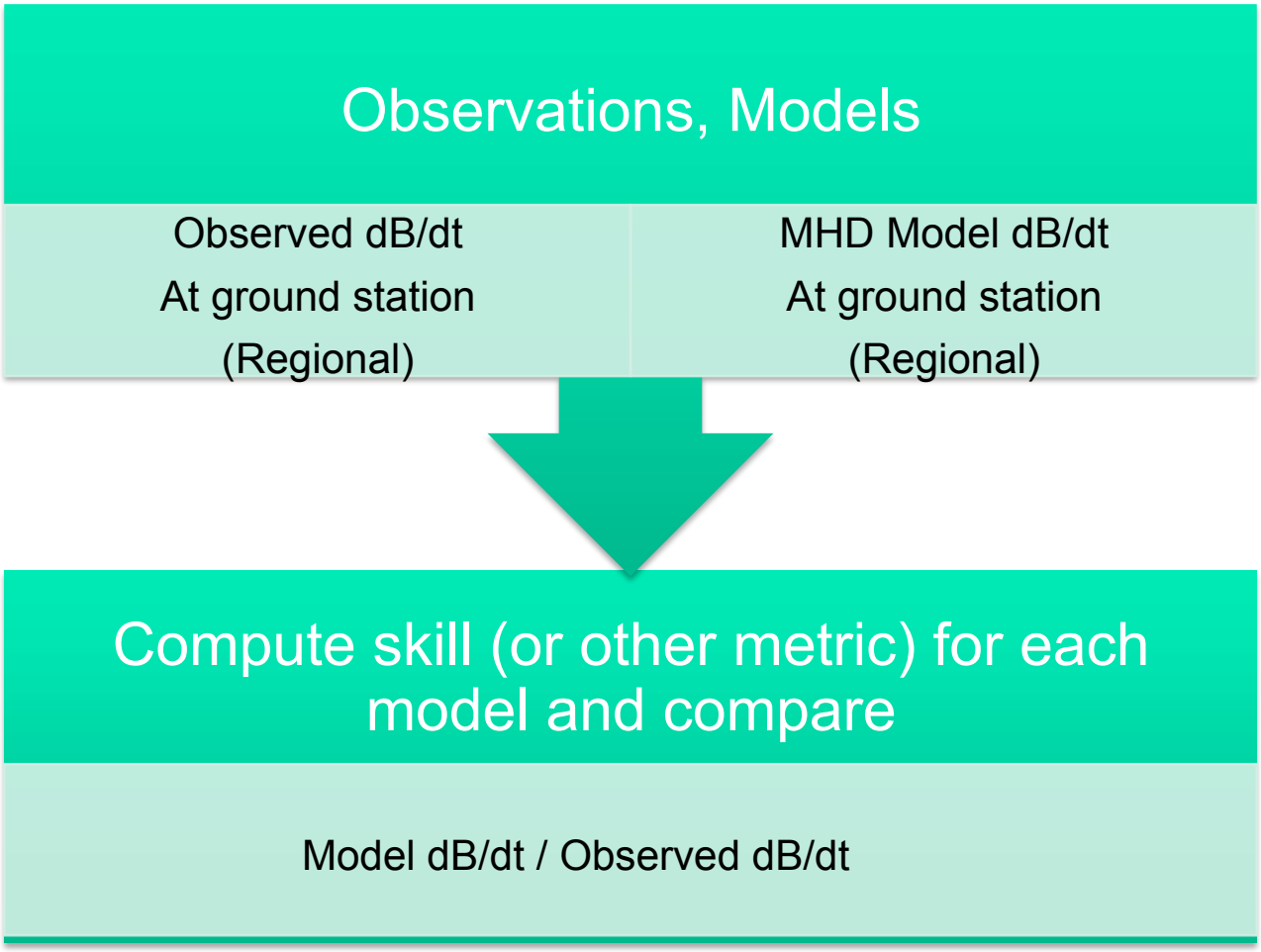
Regional dB/dt Prediction

Challenge

- How well can MHD models predict a regional (TBD) dB/dt (e.g. max disturbance, average disturbance, log-spectral distance) compared to the ground observed value over specified time interval (TBD)

- Currently Available: No product

Regional dB/dt Prediction



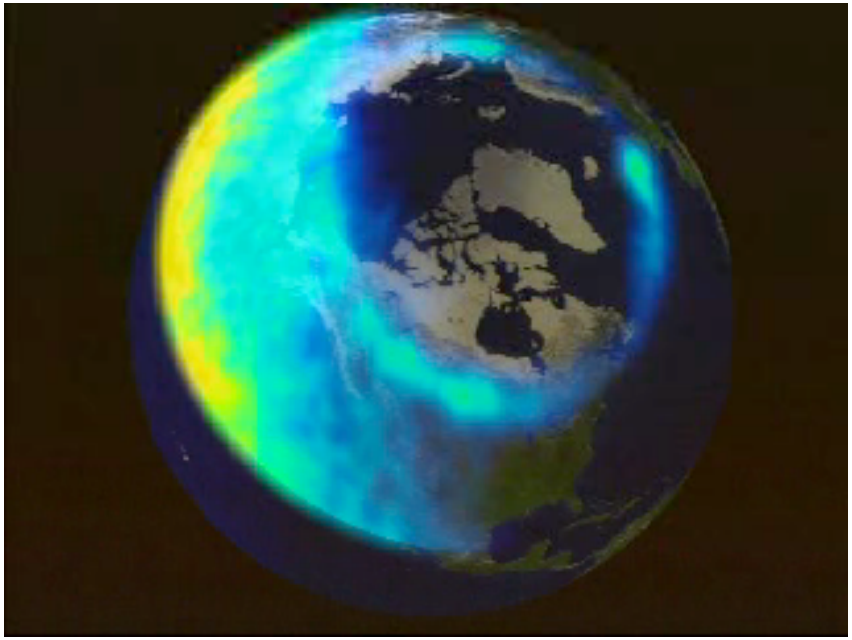
Secondary Geomagnetic Activity Products and Metrics

MHD Model Auroral Products

- Latitude, width, local time, and intensity of the auroral electrojets
- Related to locations of large dB/dt's
- Related to location of HF radio absorption
- Provides location of polar cap where Solar Energetic Particle's have access and can disrupt HF radio communication
- Energetic particle precipitation

Metrics need to be developed

- potential data sources for comparison include: AMPERE, DMSP, POES, ground-based magnetometers



Polar Visible Aurora: High Solar Wind Conditions on April 17, 1999 over the North Pole