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Title: DREAM Integration of Space Weather Forecasts into Space Protection

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DREAM

Integration of Space Weather Forecasts
into Space Protection

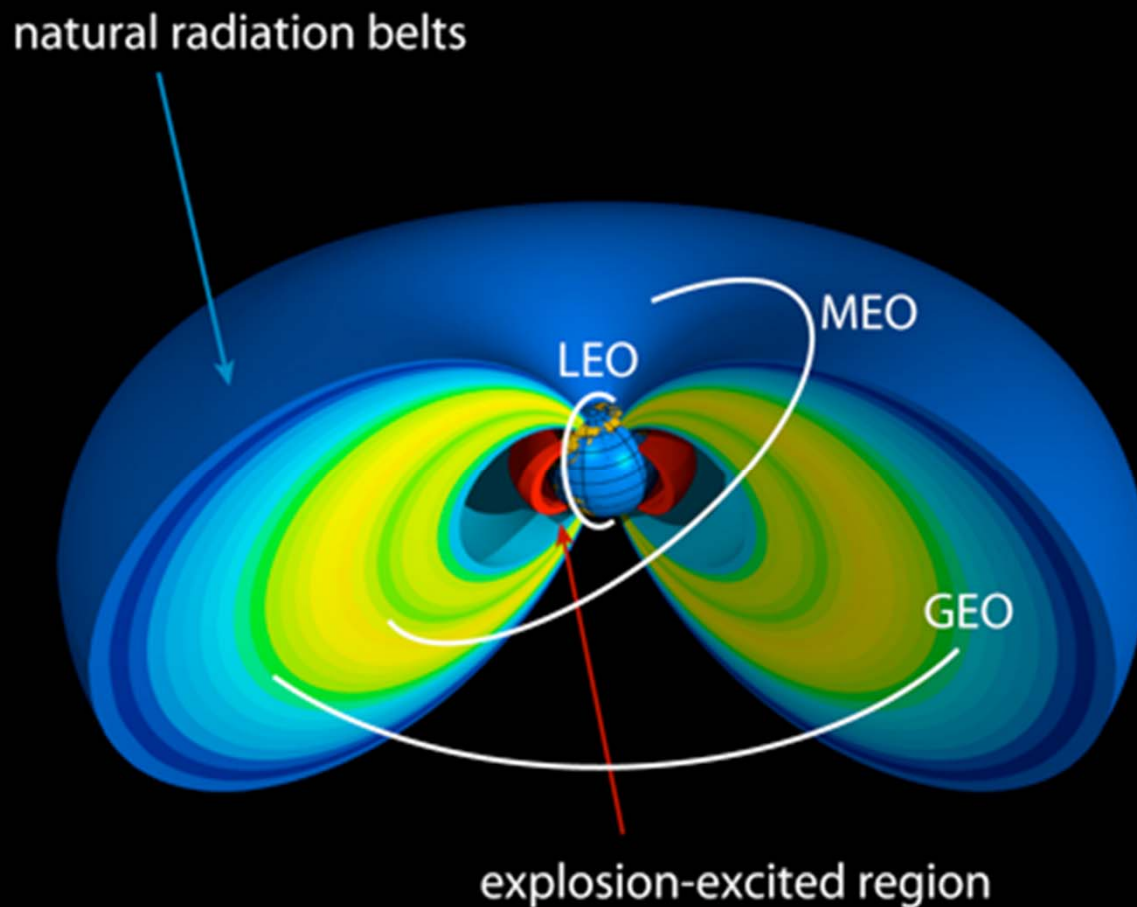
Dr. Geoffrey Reeves

Space Science and Applications Group

AMOS September 14, 2012

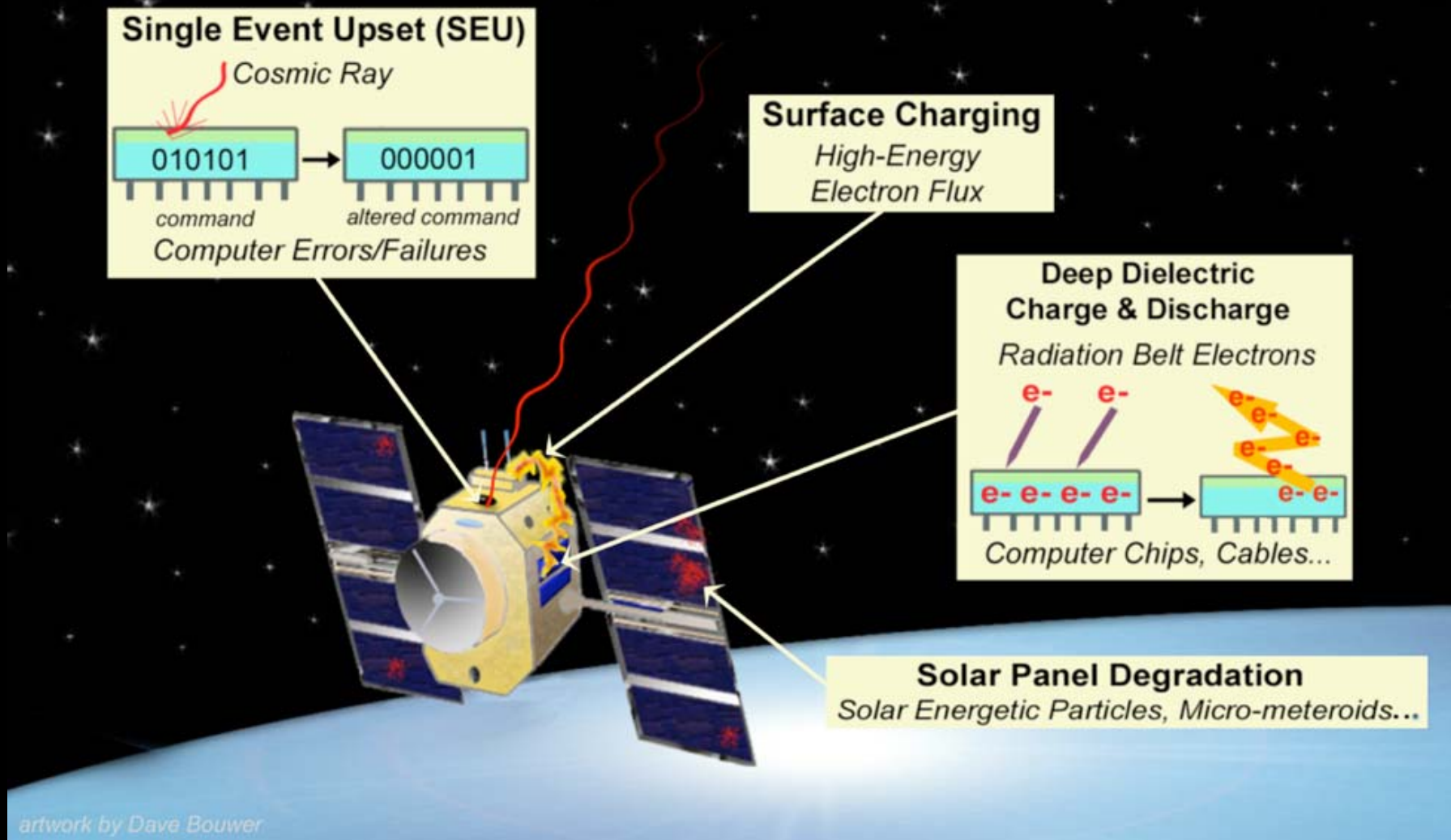


Environment Assimilation Model



Developed by DOE/LANL to quantify risks from natural and nuclear
Data Assimilation with GEO, GPS and other observations
Objective: Provide real-time specification of the radiation environment

Anomaly was or was not caused by Space Weather



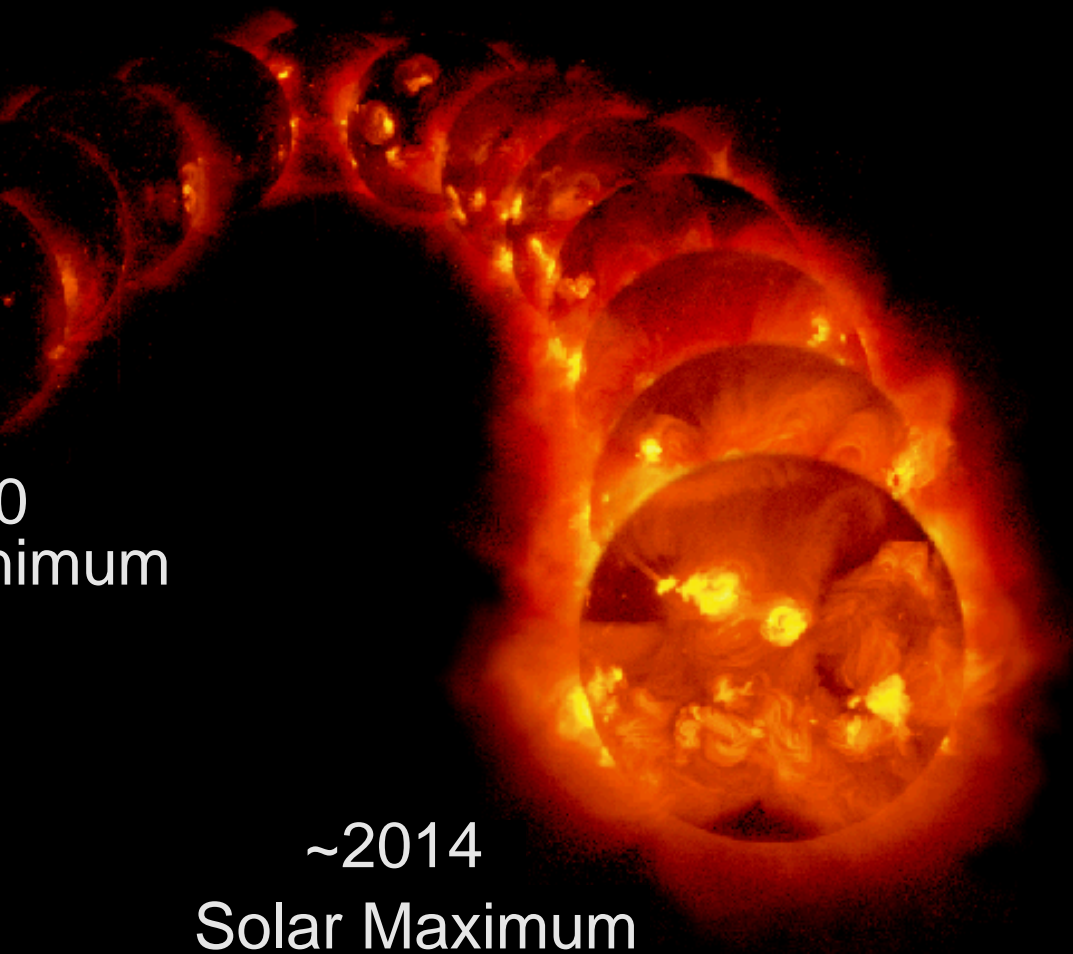
Anomaly Failure →

- Operator Error ?
- Mechanical Failure

→ Attribution Action

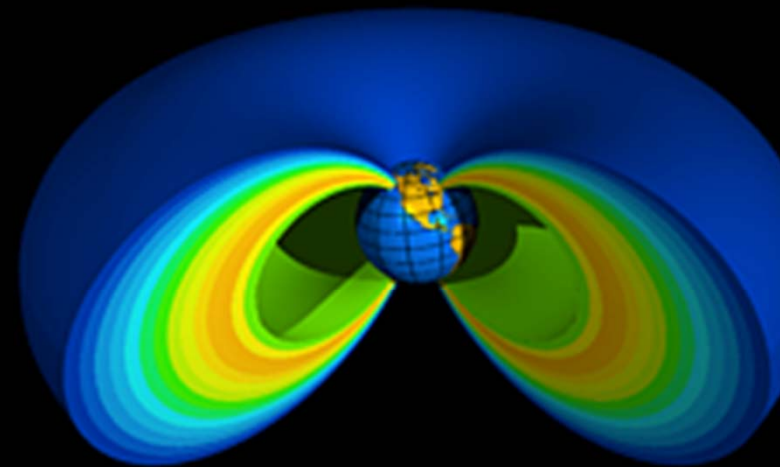
electron radiation belts using data assimilation

1-Year Solar Activity Cycle

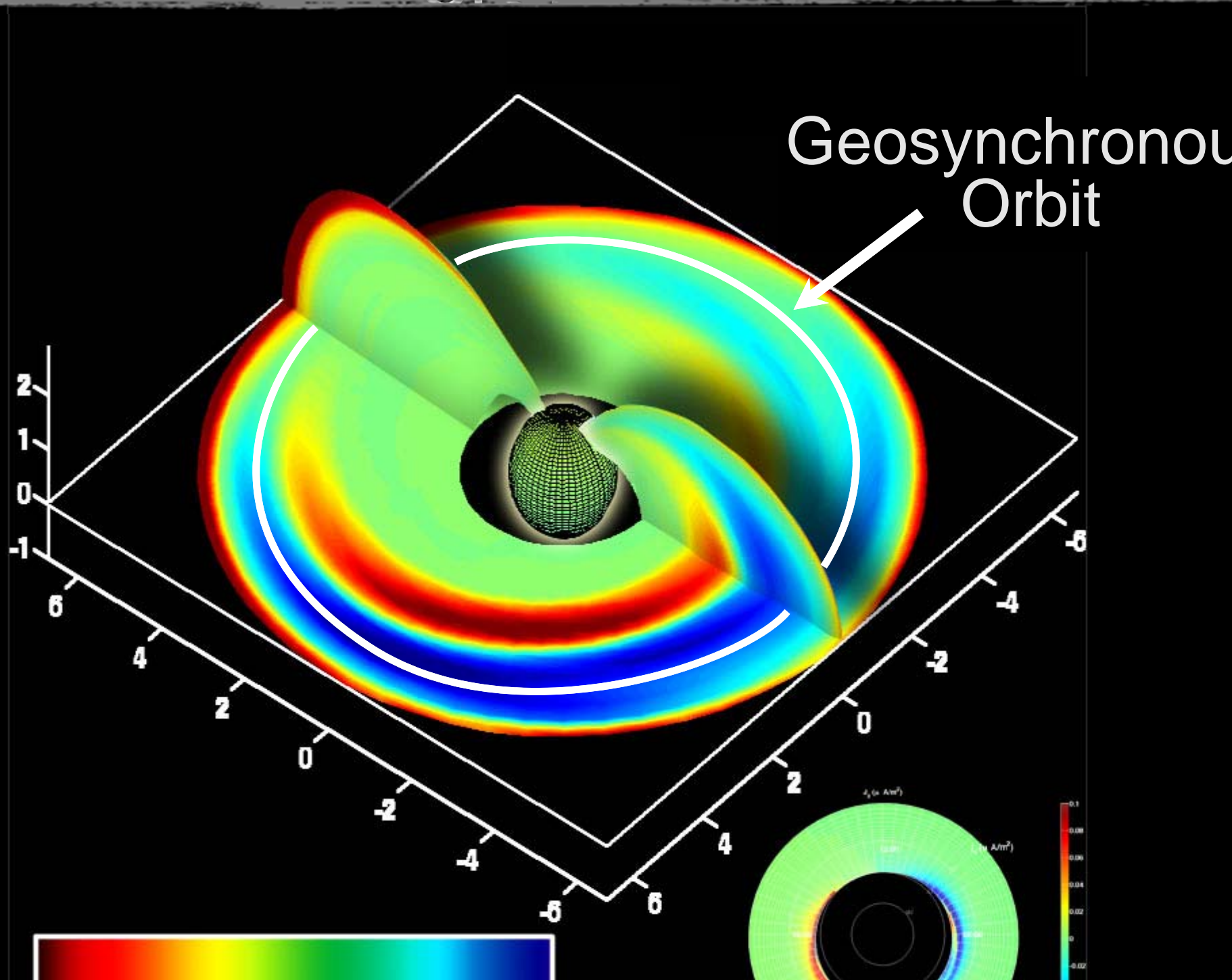


Radiation Belt Changes

1 frame = 18 hours

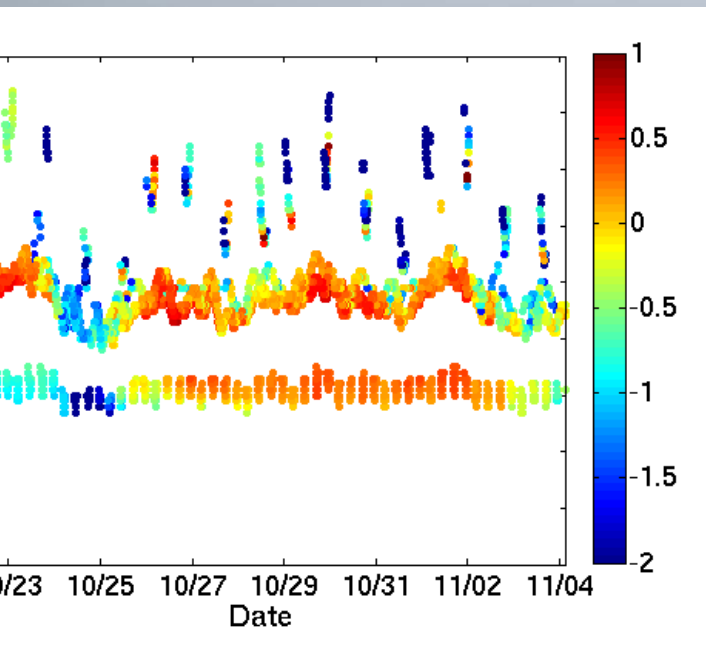


usually wrong - even at geosynchronous orbit

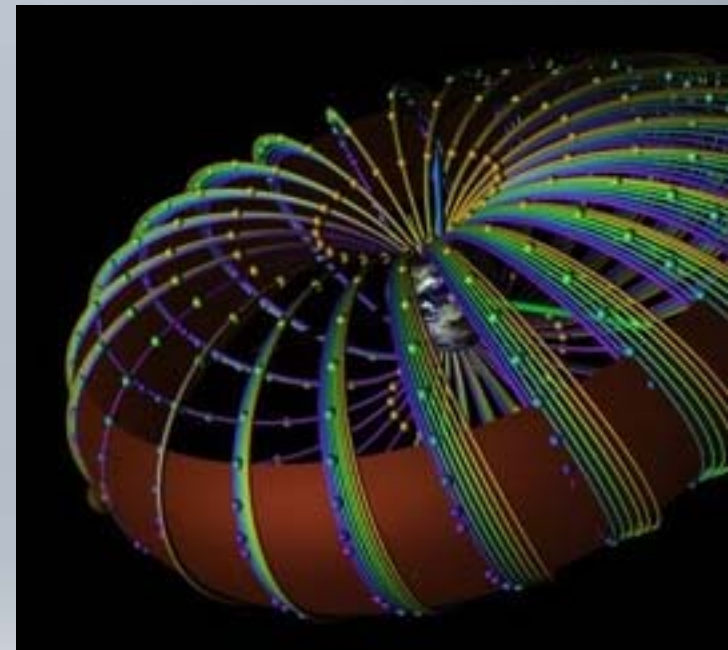


Observations into global, data-driven solutions

Use and/or Heterogeneous Observations



Complex Physical System



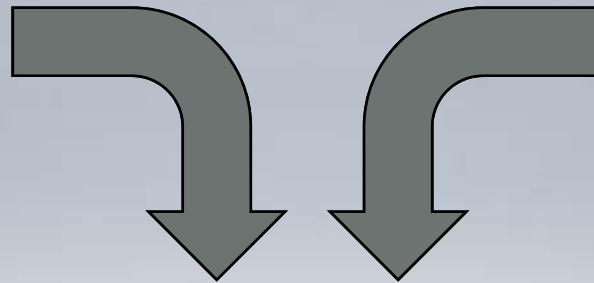
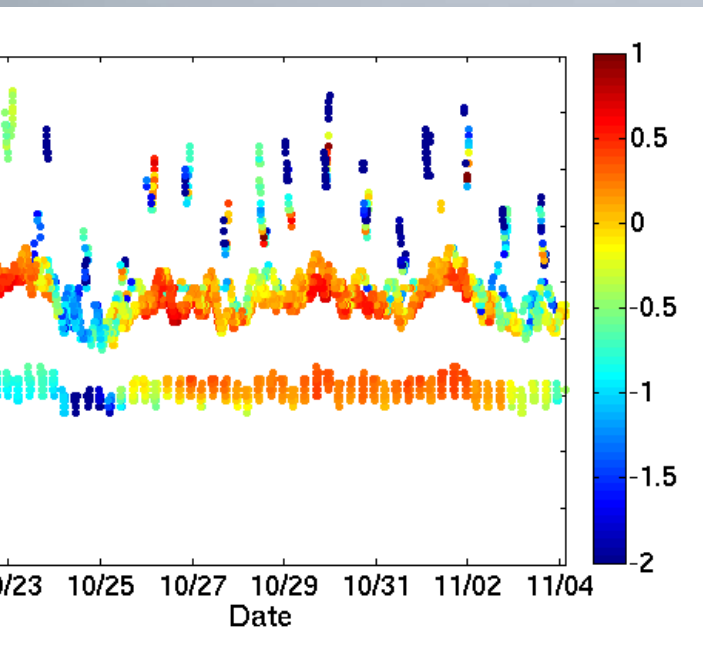
“Pure Physics” space weather models can be complex
or lack real-time observations needed to drive them

Data Assimilation is a method to combine physical models with
sparse or conflicting data to produce optimized global solutions

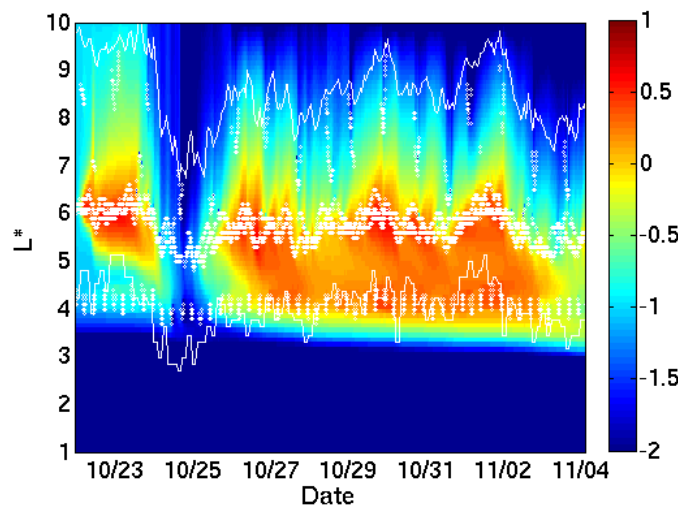
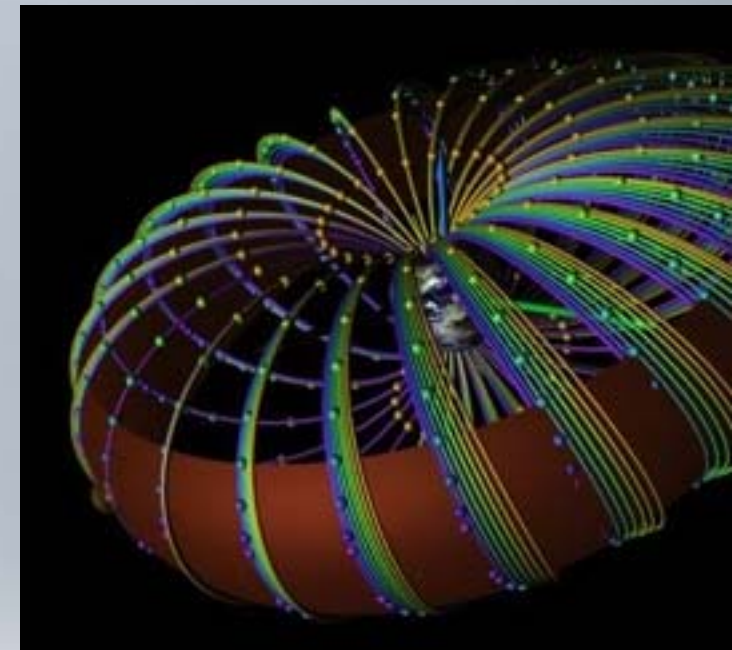
The assimilation, or ‘reanalysis’, gives information not present

Observations into global, data-driven solutions

Use and/or Heterogeneous Observations



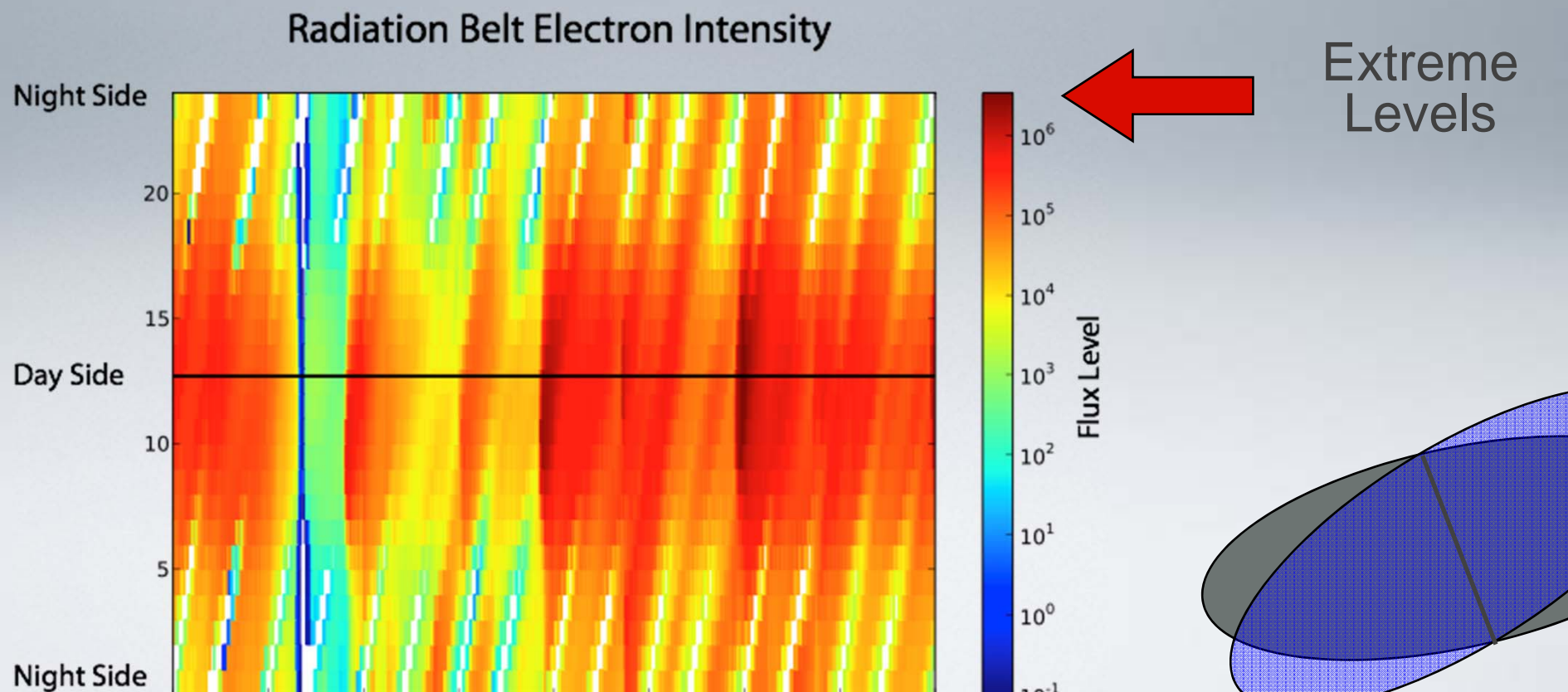
Complex Physical System



Example Application

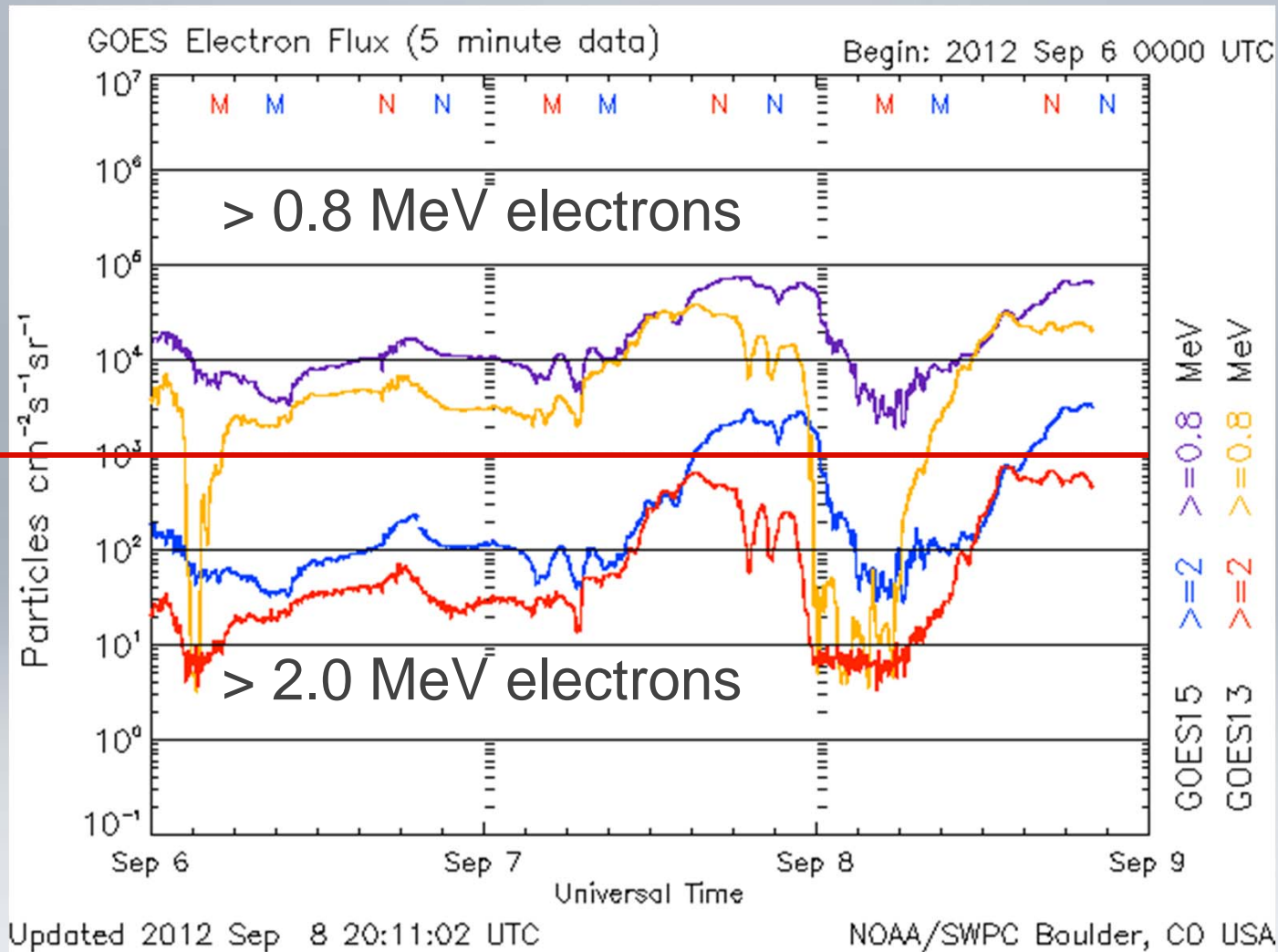
AF Request: Specify current space environment
satellite in geosynchronous orbit
(other orbits are possible but geo was the orbit of interest)

Determine whether the conditions are normal, or
extreme



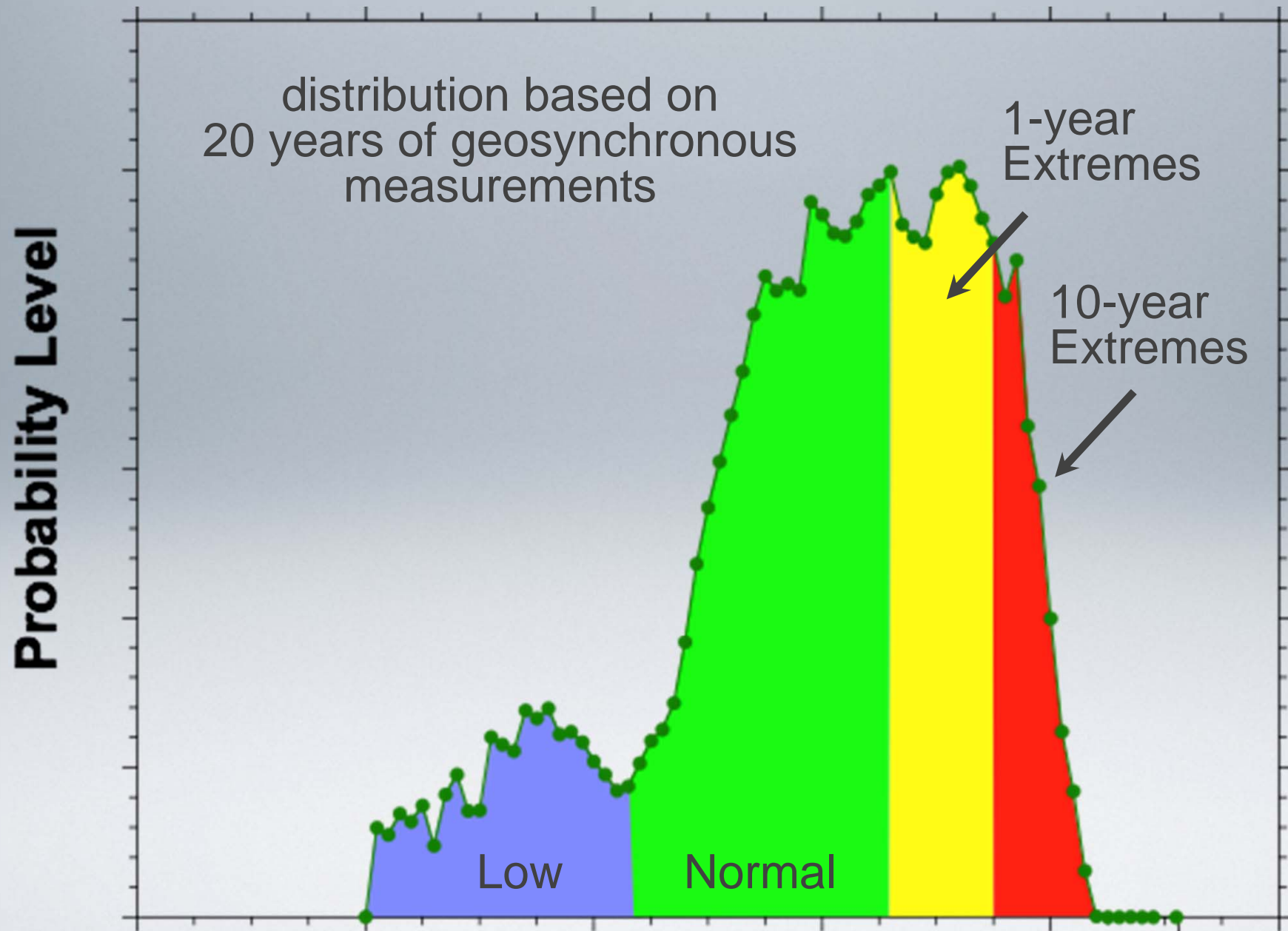
System

electron
level



NOAA issues an electron alert when

System utilizes probability distributions



System

ack real-time raw telemetry stream(s)

eprocess data for assimilation in DREAM

in the DREAM data assimilation model

in the DREAM “Fly-Through” tool to determine t
vironment along the orbit of interest

evaluate conditions relative to historic probability
distributions in that particular orbit

ultimate goal is to determine the likelihood the

plement a new real-time system with
open source data

DAA GOES + NASA RBSP

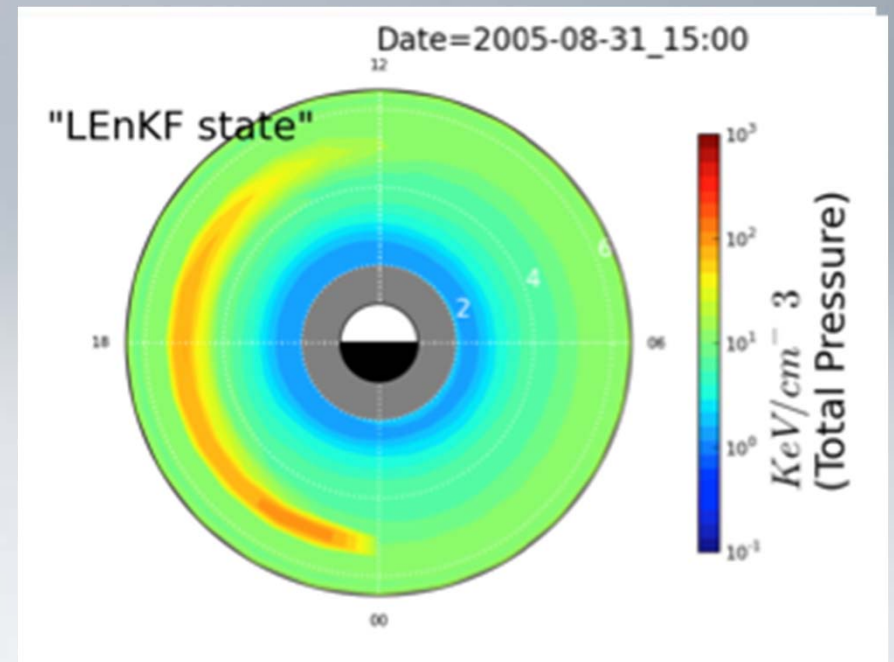
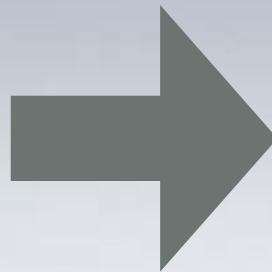
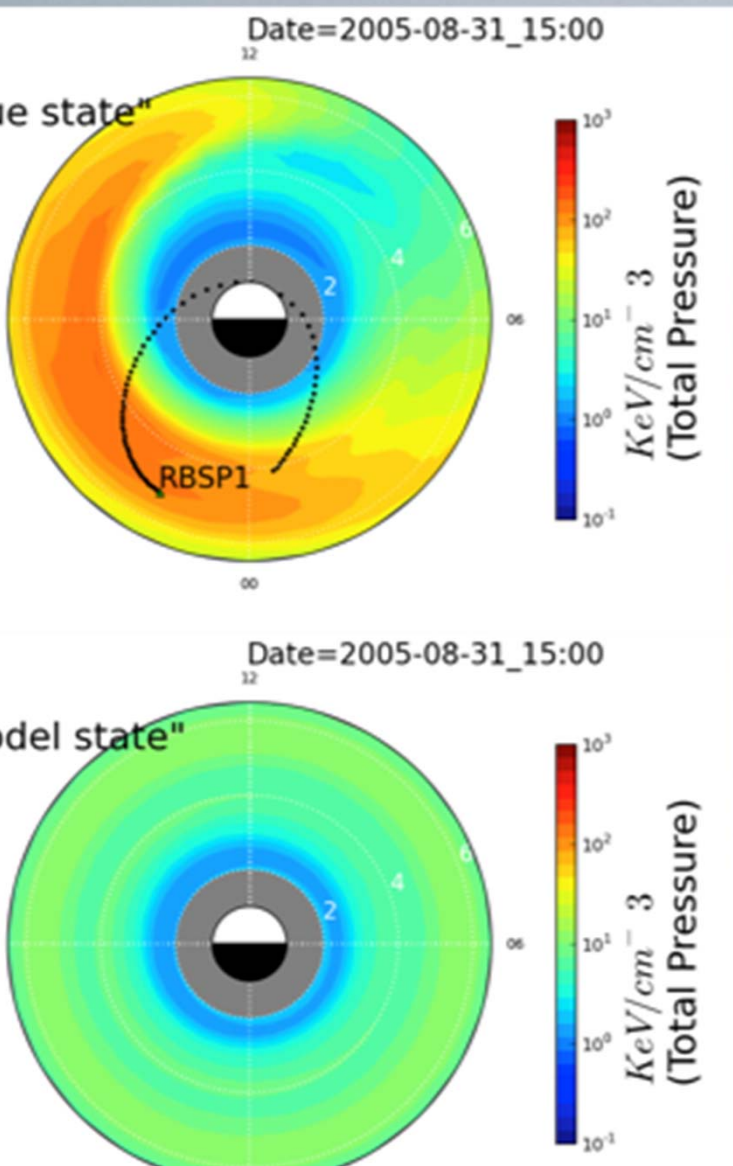
test in operational-like environment (LA

deploy in operational test-bed (Patrick
B)

partners: AFRL, Aerospace

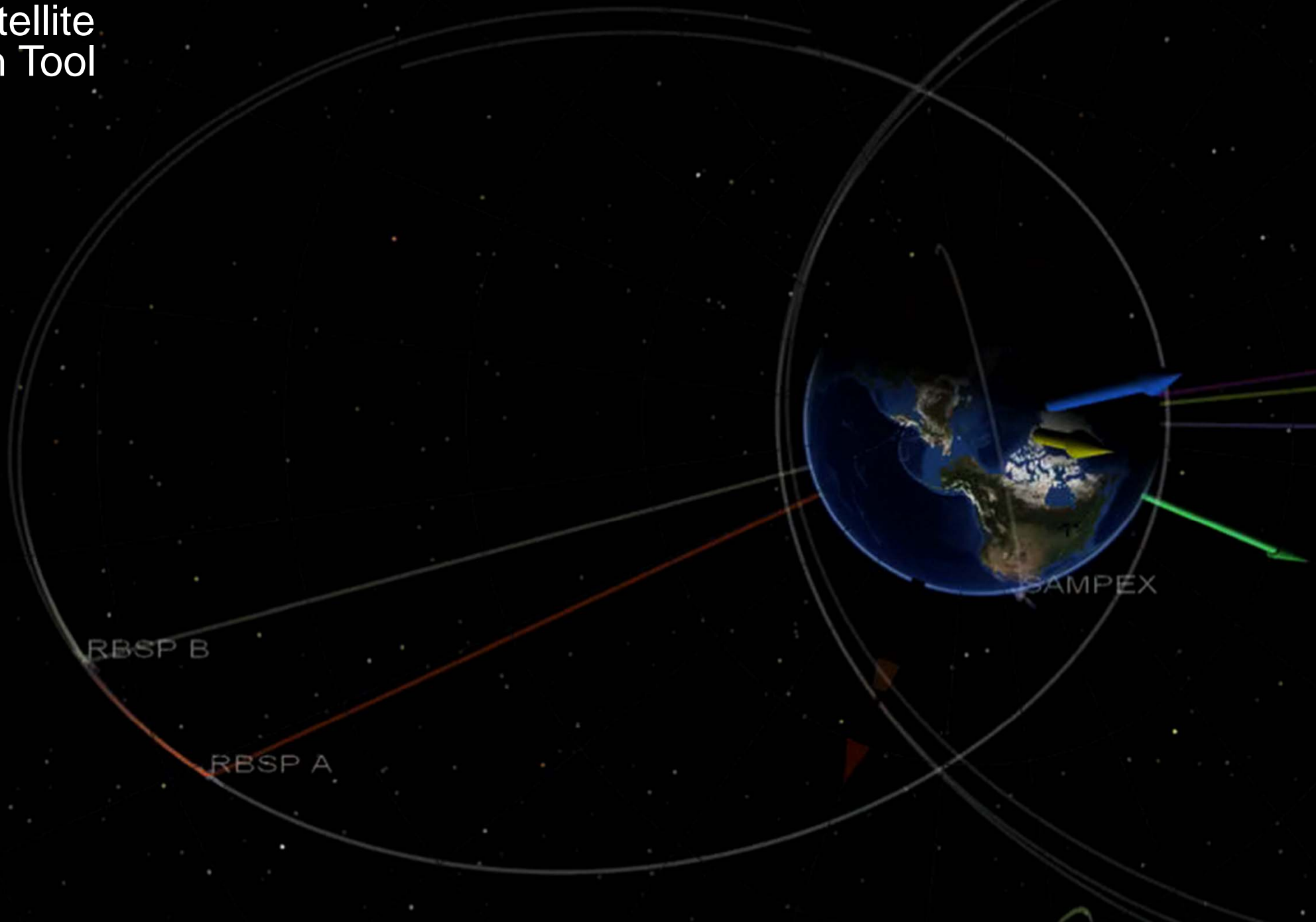
DREAM

Surface Charging data assimilation model



Systems demonstration of SWx for SSA

1/ Satellite
ough Tool



Concluding Comments

Space weather is widely viewed as a critical to effective SSA

AFRL-LANL-Aerospace partnership is trying to bring focus and innovation to new SWx capabilities operations

DREAM is a data-assimilation based radiation belt model

FY13 we are making DREAM operationally-ready both unclassified and classified levels