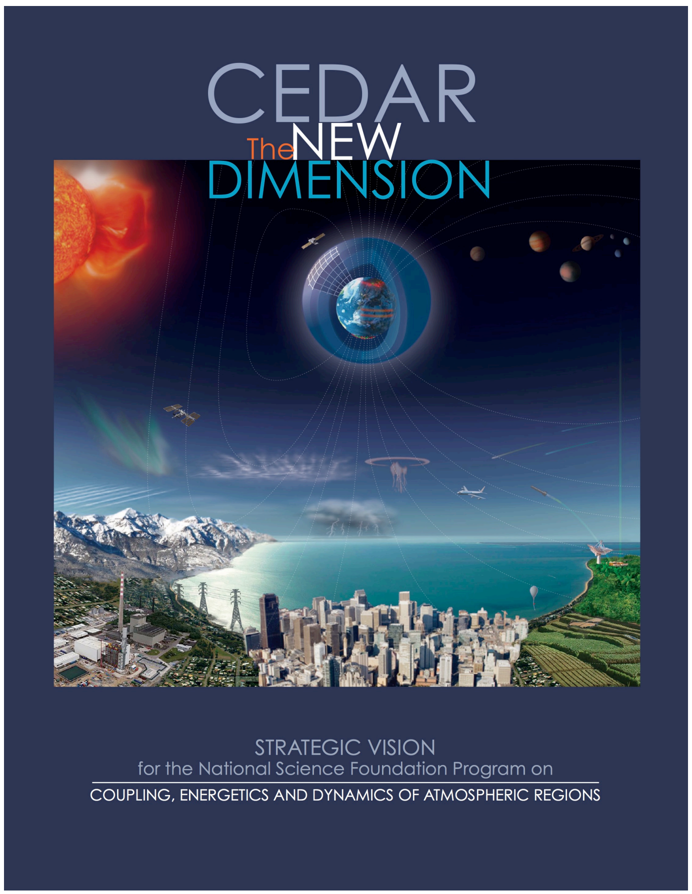
Data Assimilation and Inverse Problems for High-Latitude Electrodynamics



Strategic Thrust 6
Manage, Mine, and Manipulate, Geoscience Data and Models

“Develop advanced analysis techniques needed for effective fusion of observations into sophisticated inference models”

“Optimize information for proper deployment locations of key instruments and measurements to further scientific productivity”

Data Assimilation and Inverse Problems for High-Latitude Electrodynamics

Goals:

Address system-level CEDAR science questions by developing an approach for optimally combining observations obtained from various ground-based sensors as well as space-based sensors.

Identify the challenges of data assimilation and inverse problems for high-latitude electrodynamics and to discuss potential solutions.

High-latitude ionospheric electrodynamics

$$\mathbf{E} = -\nabla\Phi$$

$$\nabla \times \mathbf{B} = \mu_o \mathbf{J}$$

$$\vec{J}_{\parallel} = -\nabla \cdot \vec{J}_{\perp}$$

$$\vec{J}_{\perp} = \underline{\underline{\Sigma}} \cdot \mathbf{E}'$$

Non-conservative electric fields?

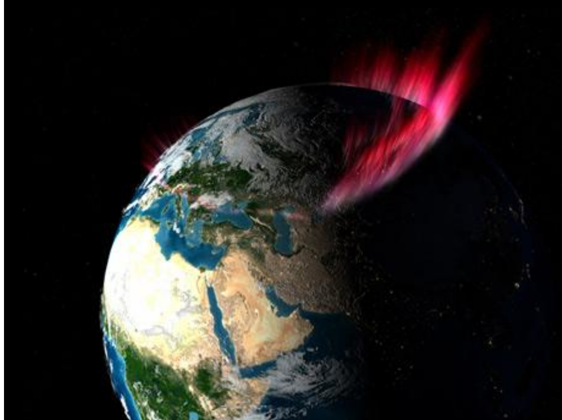
$$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$$

3D Conductivity?

$$\sigma_P(\mathrm{h}, \theta, \phi) \quad \sigma_H(\mathrm{h}, \theta, \phi)$$

Effects of neutral winds?

$$\mathbf{E}' = \mathbf{E} + \mathbf{U} \times \mathbf{B}$$



Credit: NASA