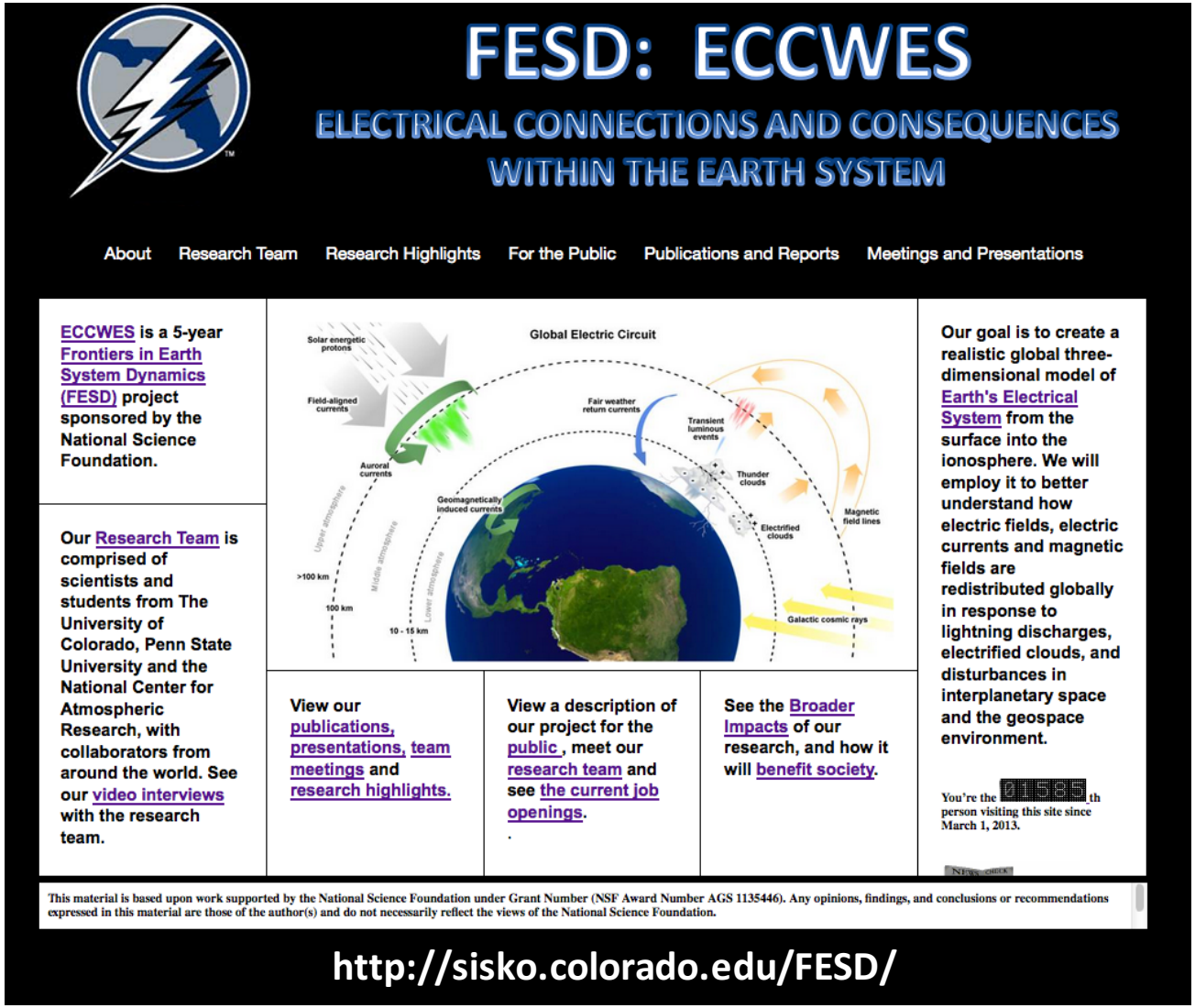
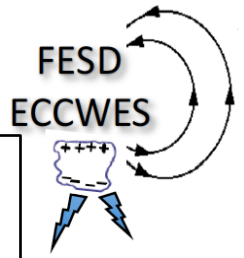
Electrical Connections and Consequences in the Earth System (ECCWES)

ECCWES is a 5-year **Frontiers in Earth System Dynamics (FESD)** project sponsored by the National Science Foundation (Award AGS 1135446, Oct 2011 - Sept 2017).



FESD-ECCWES Team & Other Participants



University of Colorado

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Forbes, Jeffrey, **PI**
Knight, Daniel, Assessment Specialist
Lucas, Greg, graduate student, GEC modeling
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Moudden, Youssef, Research Associate, NLDN Data Analyses
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Thayer, Jeffrey, **Co-PI**
Zhang, Xiaoli, Data Analysis, Global source currents and DEMETER LEP investigation

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Pasko, Victor, Penn State, **Co-PI**
Celestin, Sebastien, post-doc, transient discharge modeling
Jansky, Jaroslav, post-doc, modeling individual thunderstorms

UCAR

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Eastburn, Teresa, Education & Outreach
Edwin, Stanley, **SOARS student**, U. Alaska, Fairbanks
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Haacker-Santos, Rebecca, SOARS liaison
McKoy, Jenine, **SOARS student**, University of Michigan

Collaborators and Other Participants

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Naomi Maruyama, CU-CIRES
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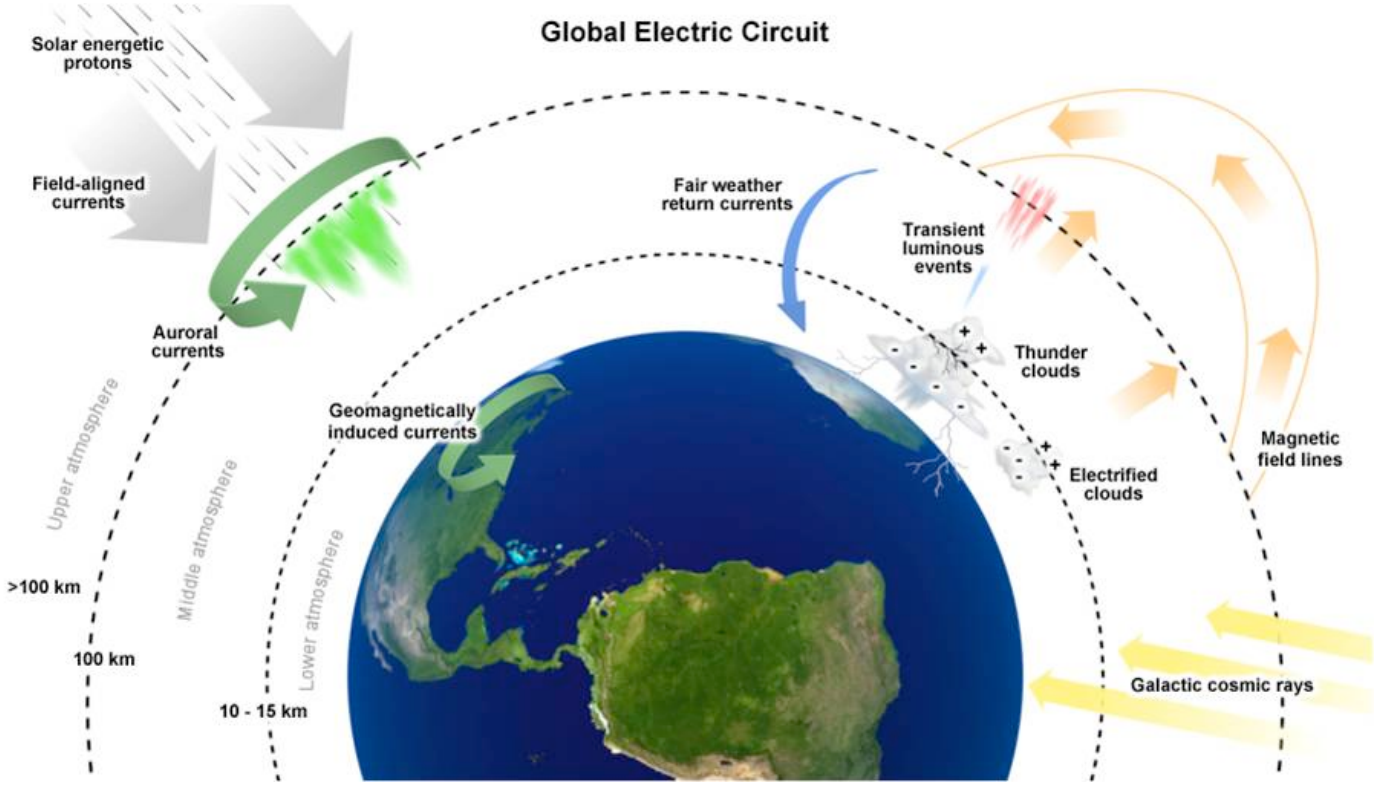
Delores Knipp, CU
Williams, Earle, MIT
Wiltberger, Michael, NCAR-HAO
Zhou, Limin, East China Normal University

What is Earth's Electrical System and what is ECCWES About?

http://www.youtube.com/watch?v=Kn3SkCzMj5g

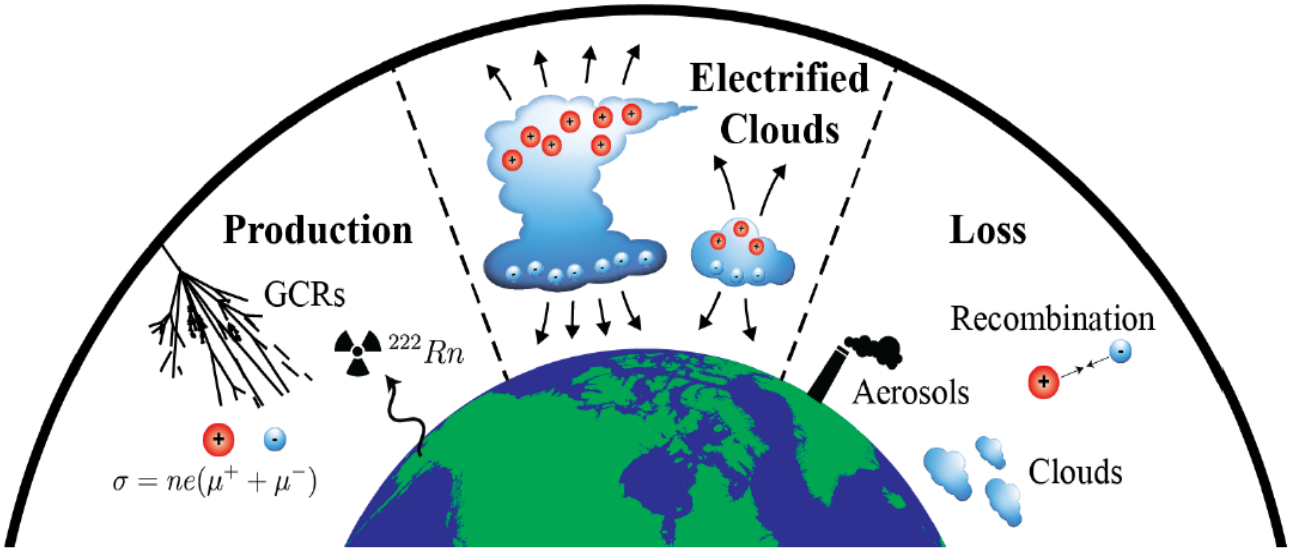
Earth's Electrical System



Challenges

- Highly interdisciplinary
- Bridges a broad range of spatial and temporal scales
- New models to be devloped
- Few observational constraints exist

Processes Defining Atmospheric Conductivity

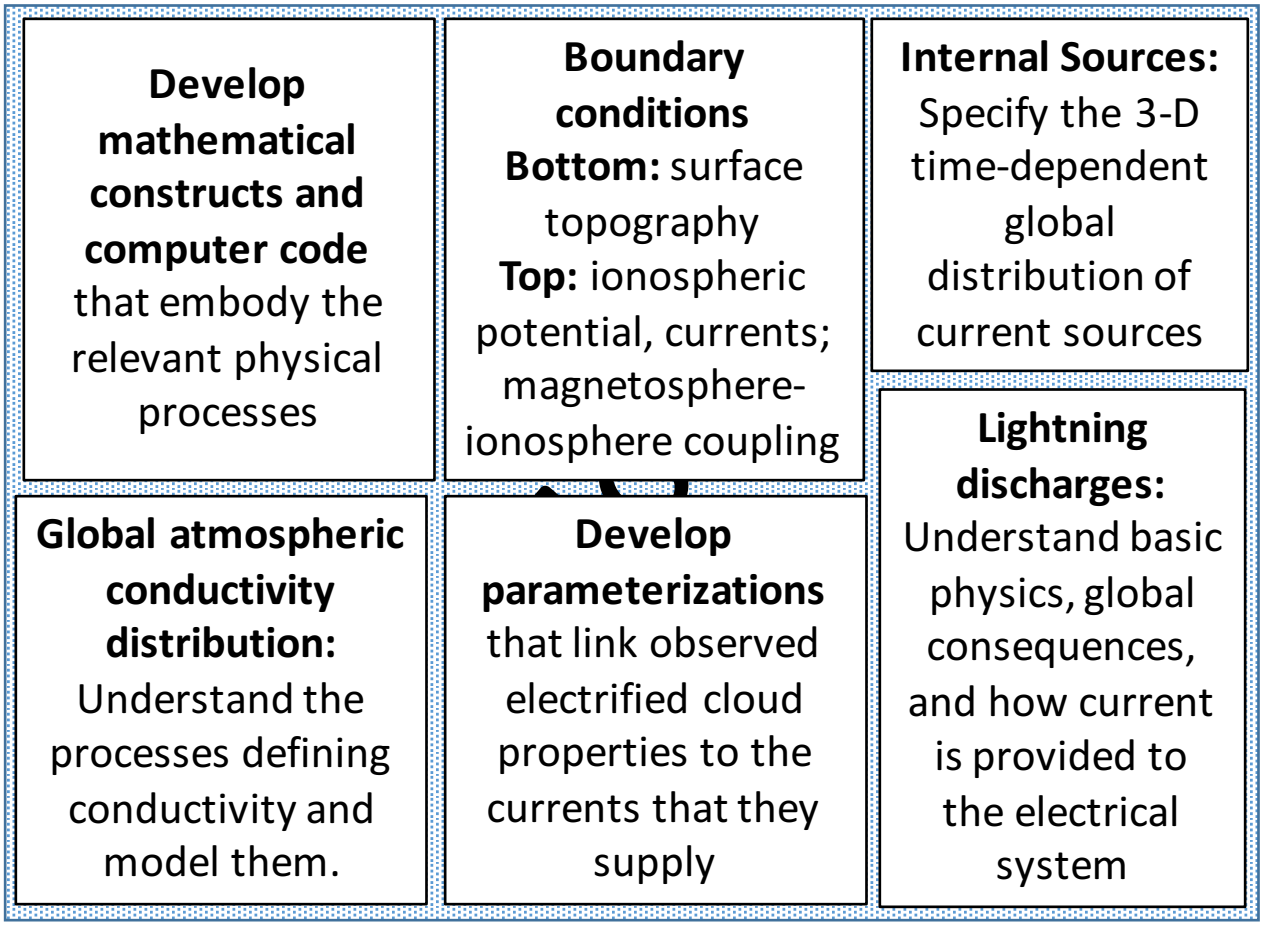


Credit: Greg Lucas, CU-Boulder grad student

- Galactic Cosmic Rays (GCRs)
- Radon (decay product of Radium)
- Aerosols
- Chemical recombination
- Clouds

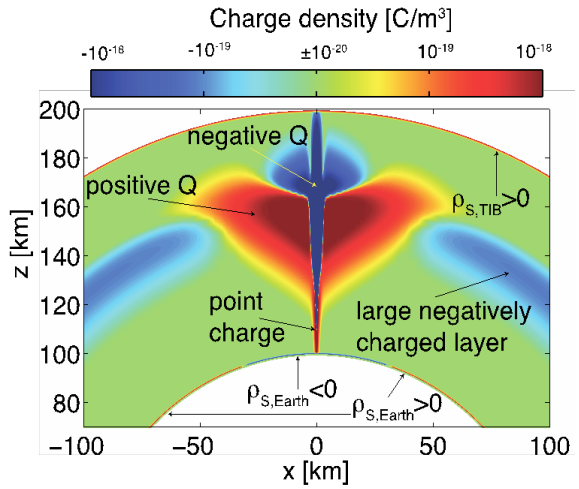
FESD-ECCWES Objectives

- *Develop a realistic 3-dimensional model of Earth's electrical system from the surface into the ionosphere.*
- *Use this model to better understand how electric fields, electric currents and magnetic fields are redistributed globally in response to lightning discharges, electrified clouds, and disturbances in interplanetary space and the geospace environment.*

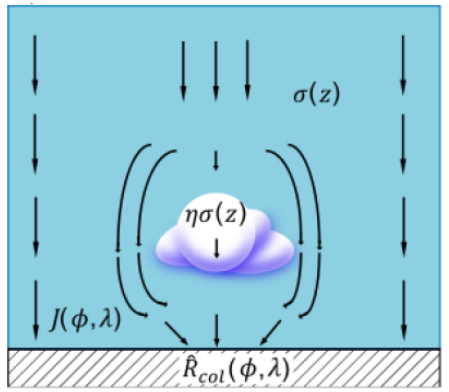


FESD-ECCWES Investigations

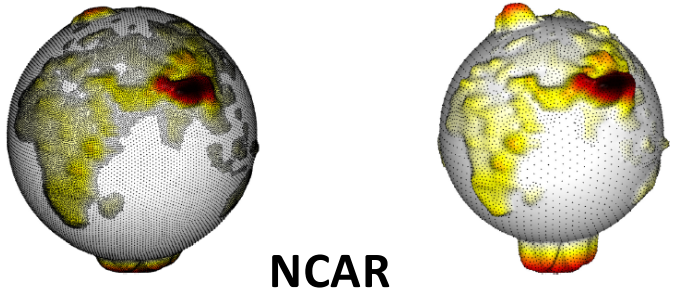
CU-Boulder
Development of Global WACCM-GEC Model
(see following talk by Thayer)



Penn State
Transient modeling of lightning discharges; local and gobal effects
(see Pasko talk on Wednesday)

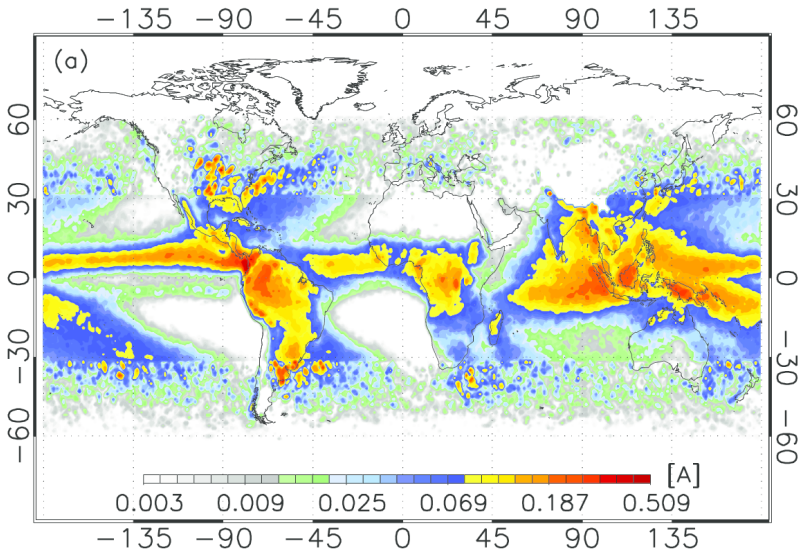


CU-Boulder
Modification of conductivity by clouds



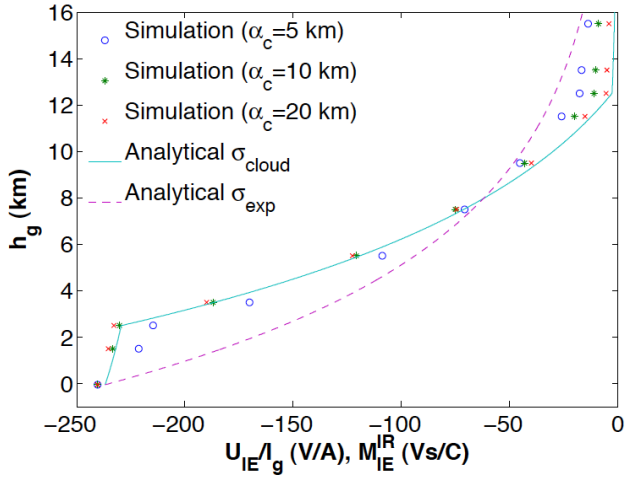
NCAR
Introducing the influences of topography and point current sources: New mathematical representations and modeling approaches

FESD-ECCWES Investigations



NCAR & CU-Boulder

Develop global distributions of source currents for input into global GEC models.



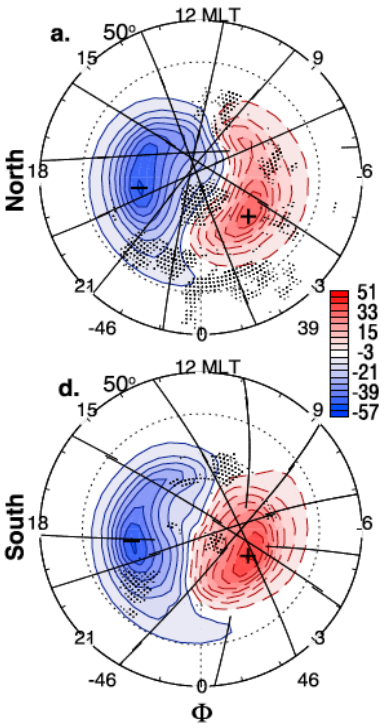
Penn State

Understanding relationships between conductivity and currents around various-scale clouds

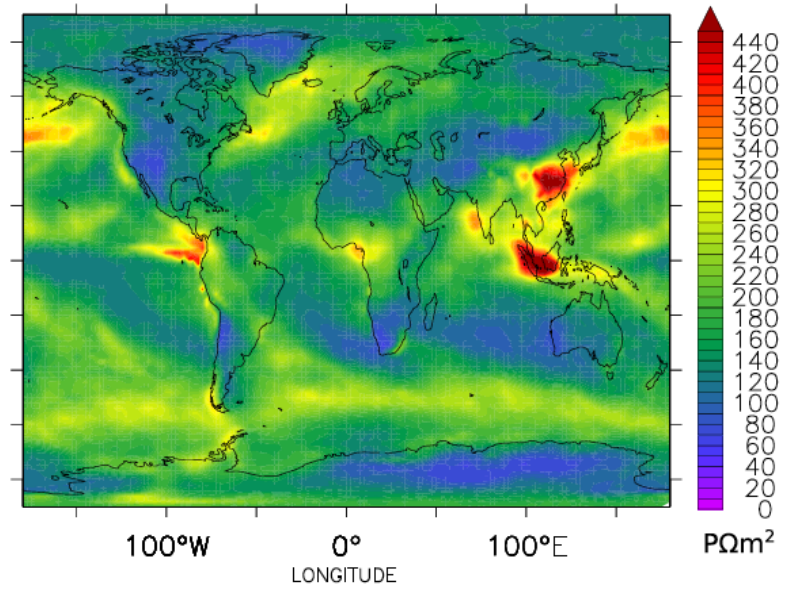
NCAR, Penn State, CU-Boulder

Use measurements from thunderstorm overflights to parameterize relationships between thunderstorm and electrified non-lightning cloud properties and source currents

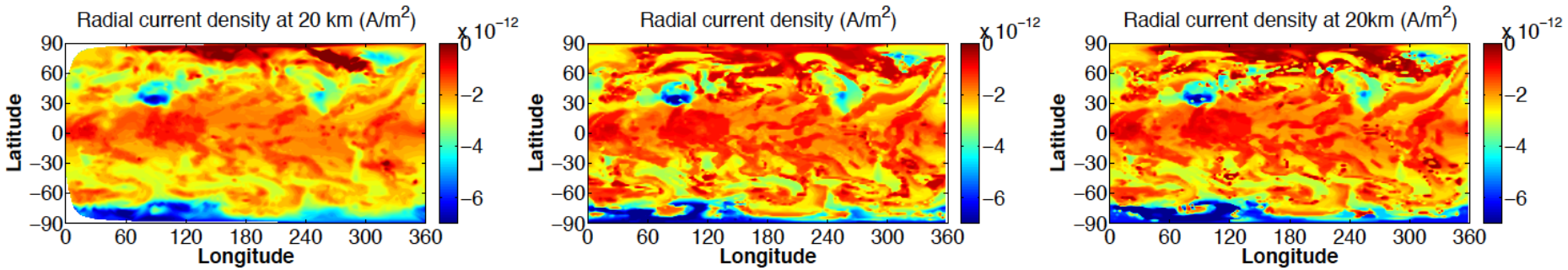
FESD-ECCWES Investigations



NCAR
Ionospheric potential at the upper boundary of the GEC: Mapping electric fields and currents using SuperDARN and AMPERE



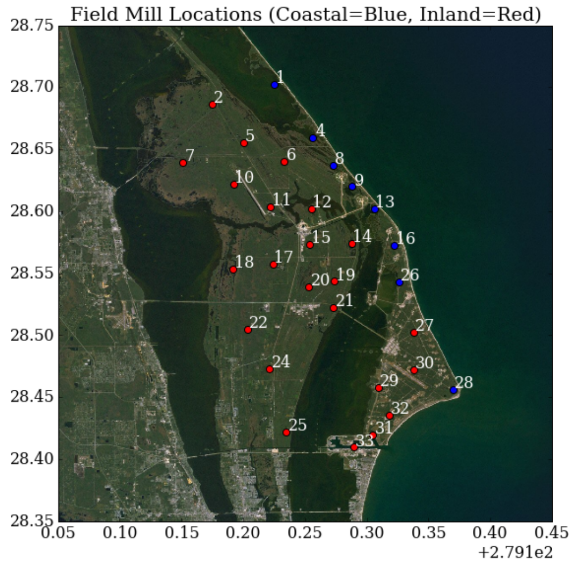
CU-Boulder
Global conductivity model.



Penn State

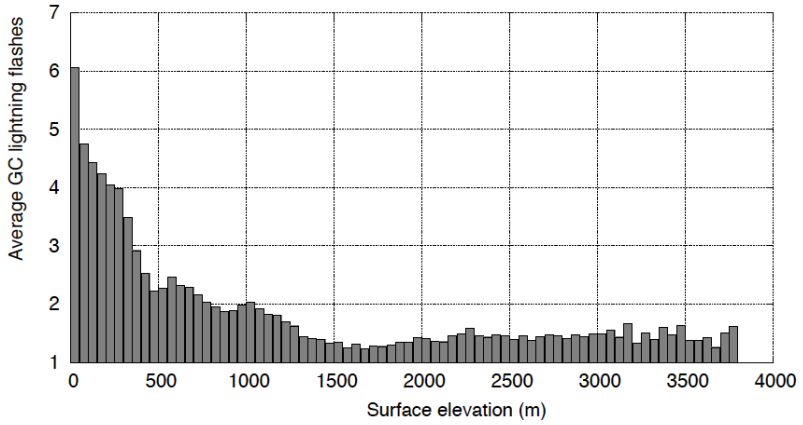
Cross-validations of fair weather currents in CU, NCAR and Penn State Models

FESD-ECCWES Investigations



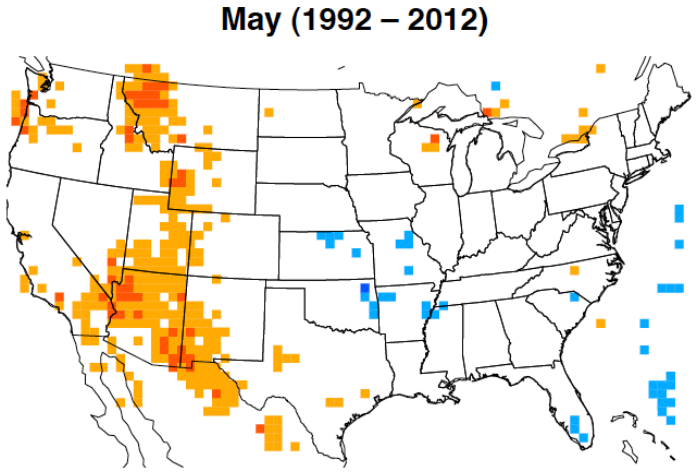
CU-Boulder

Atmospheric electricity on a local scale: Analysis of field-mill electric field measurements around KSFC; Inland vs. coastal effects, diurnal wind patterns, etc.



CU Boulder

CONUS NLDN Lightning correlations with terrain slope & elevation

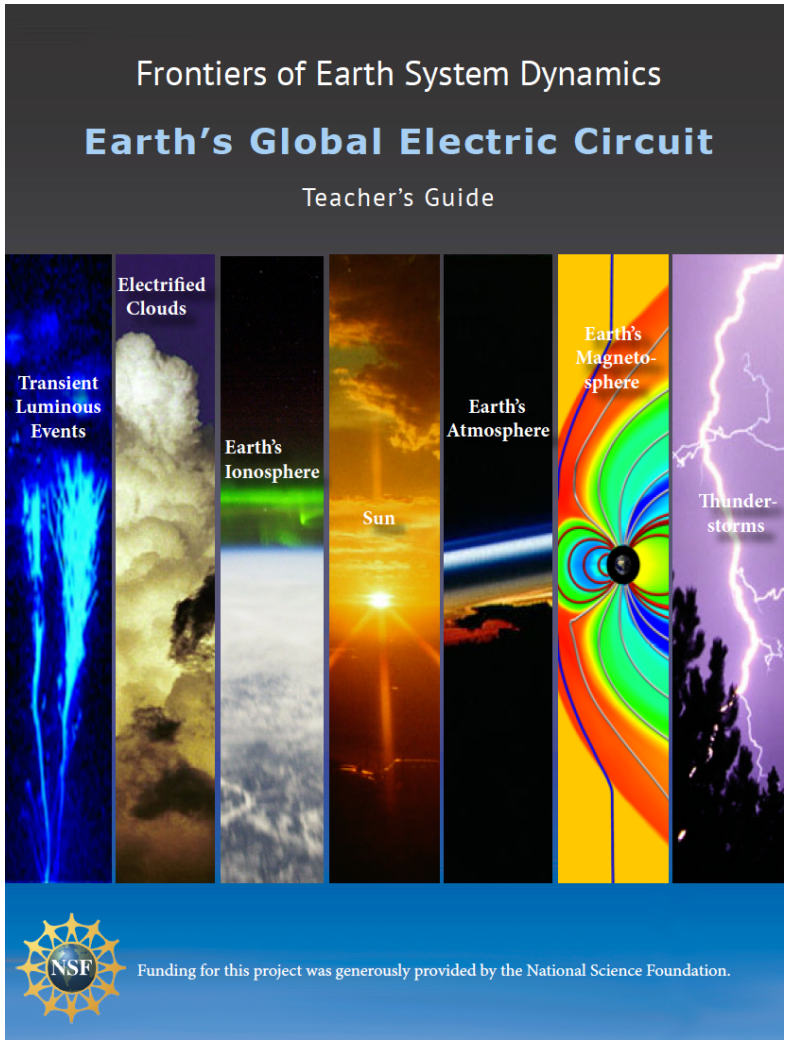


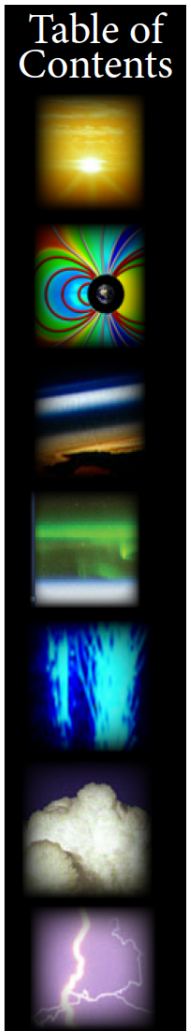
CU Boulder

CONUS NLDN Lightning correlations with ENSO

Education and Public Outreach

Teacher's Guide





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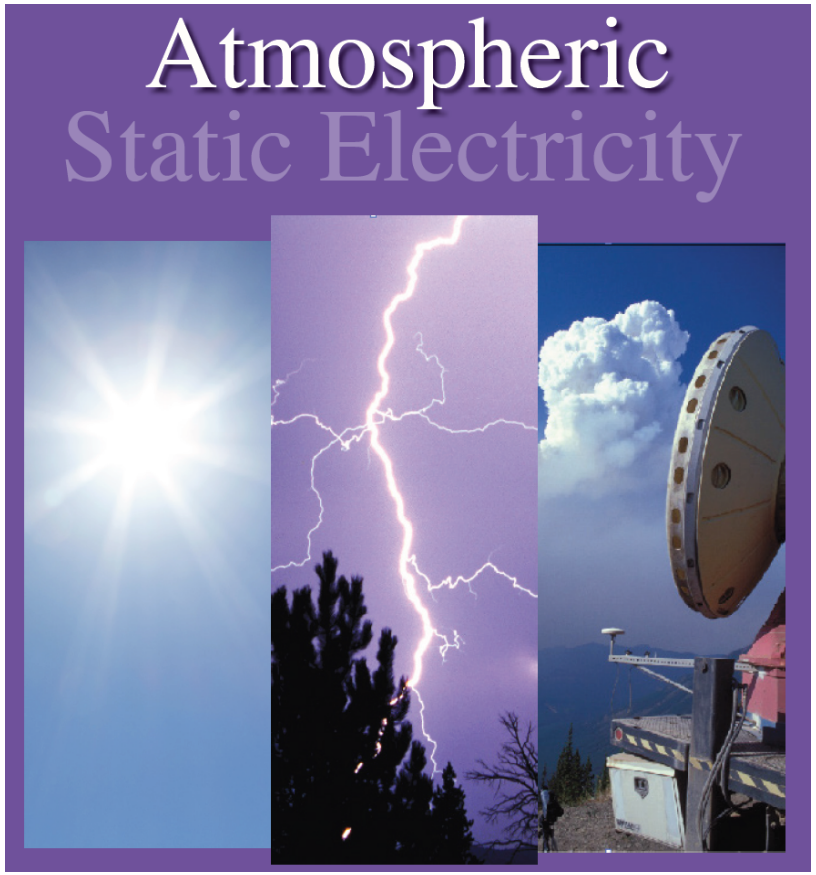

National Center for Atmospheric Research
University Corporation for Atmospheric Research
UCAR Center for Science Education
Boulder, Colorado

scied.ucar.edu

Static Electricity Tubes

How Far is That Storm?

Make Your Own Lightning!