CCMC Resources for Education and Training During Graduate Summer Schools

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Representing the BSWSS and LWS Summer School Organizers

Tale of Two Summer Schools

■ Boulder Space Weather
Summer School (NSF Funded)
- Introduction to Space Weather
- Broad overview at a conceptual level

■ Heliophysics Summer School (LWS)
- Special Topics in Space Physics
- More advanced participants with
research experience

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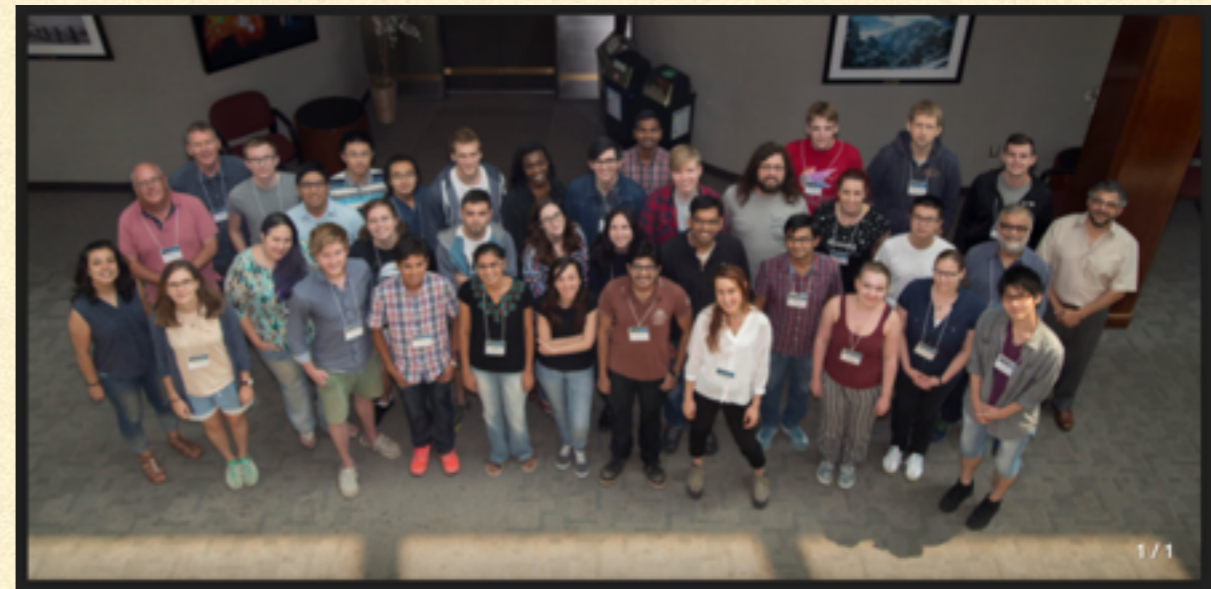
CCMC Tools Suite Used

- CCMC provides the variety of tools to approach a broad range of problems and questions.

- iSWA- access to data and model results

- Models in all domains

- Visualization

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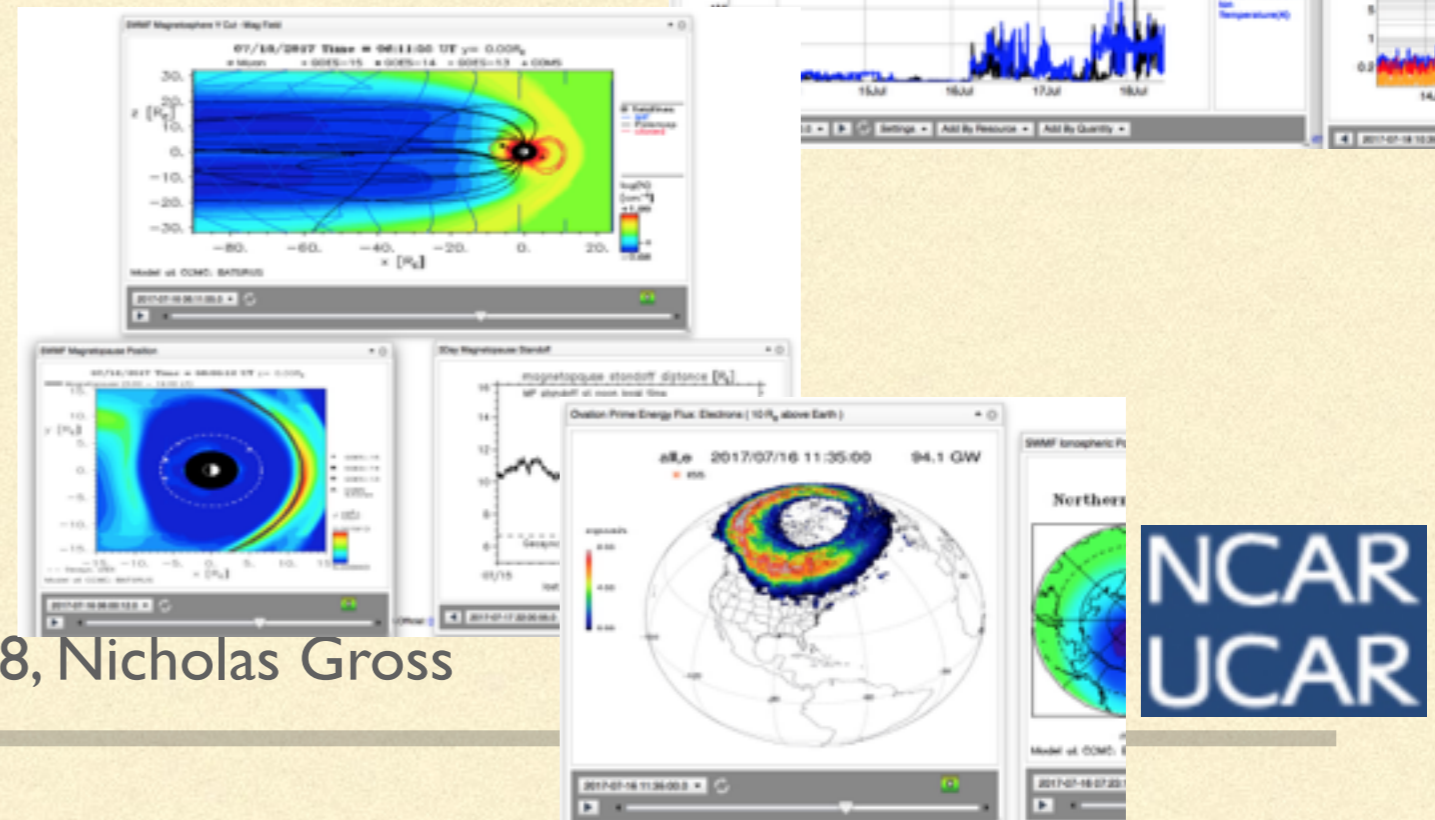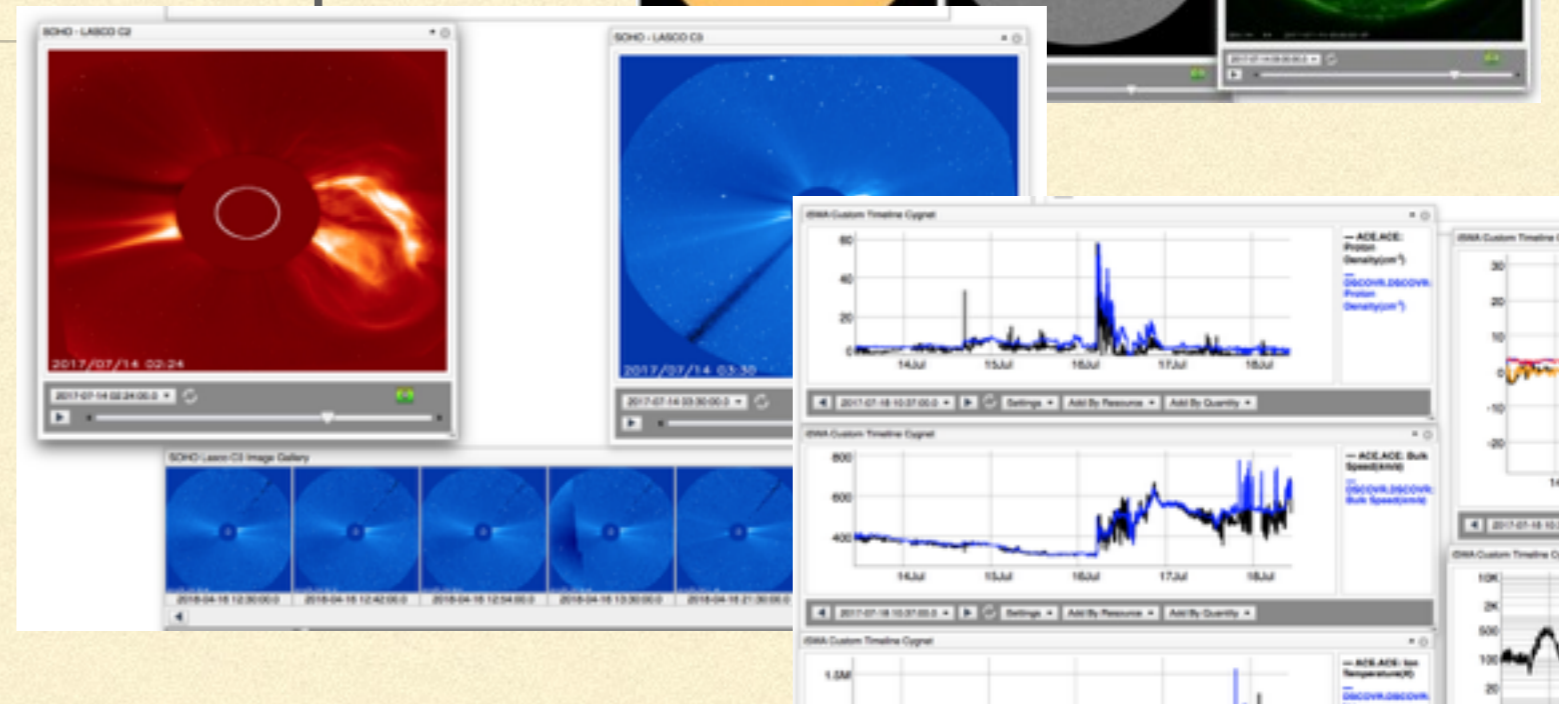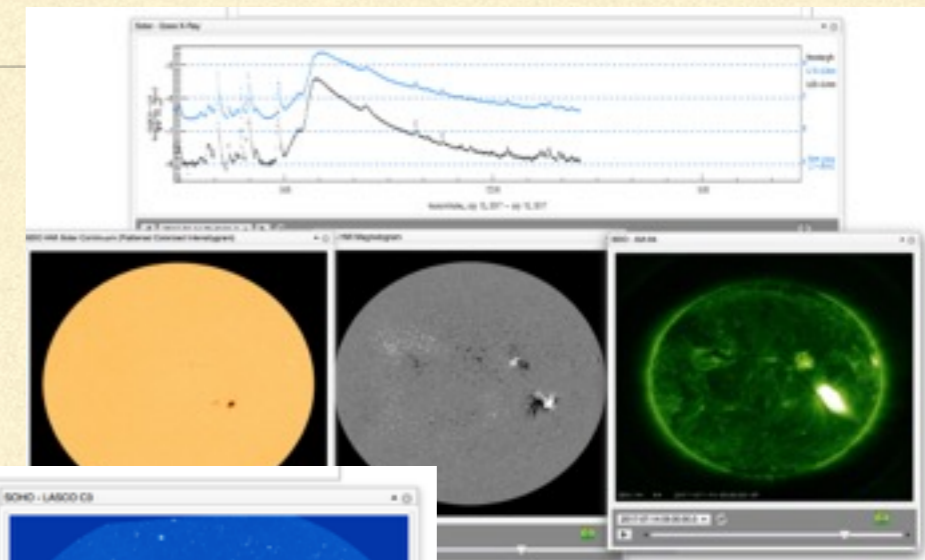# iSWA Layouts for Event Analysis

- **Used either as Capstone or Warm Up**

- Expert/Jigsaw Groups
  - Corona
  - Solar Wind
  - Magnetosphere
  - Ionosphere

- Manuals available for
  - March 5, 2012
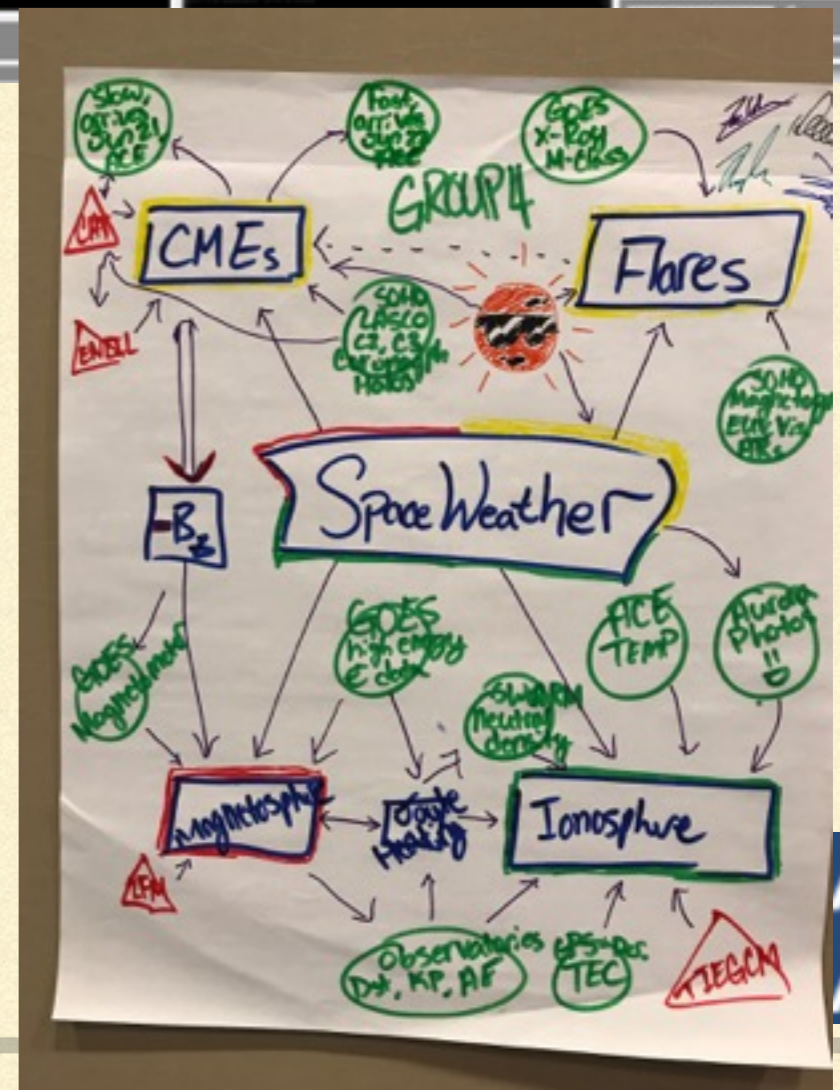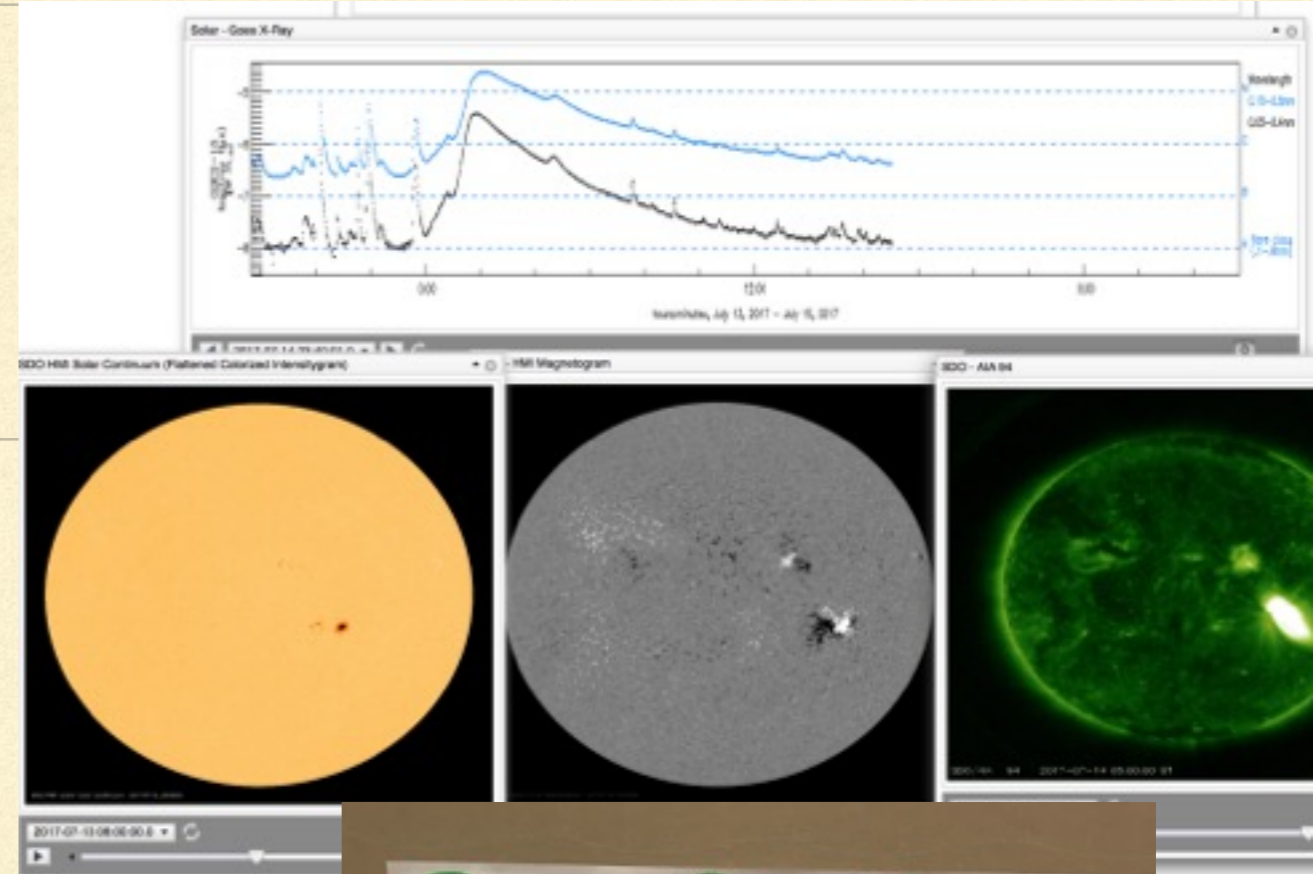 - June 22-23, 2015
  - June 13th-20th, 2017

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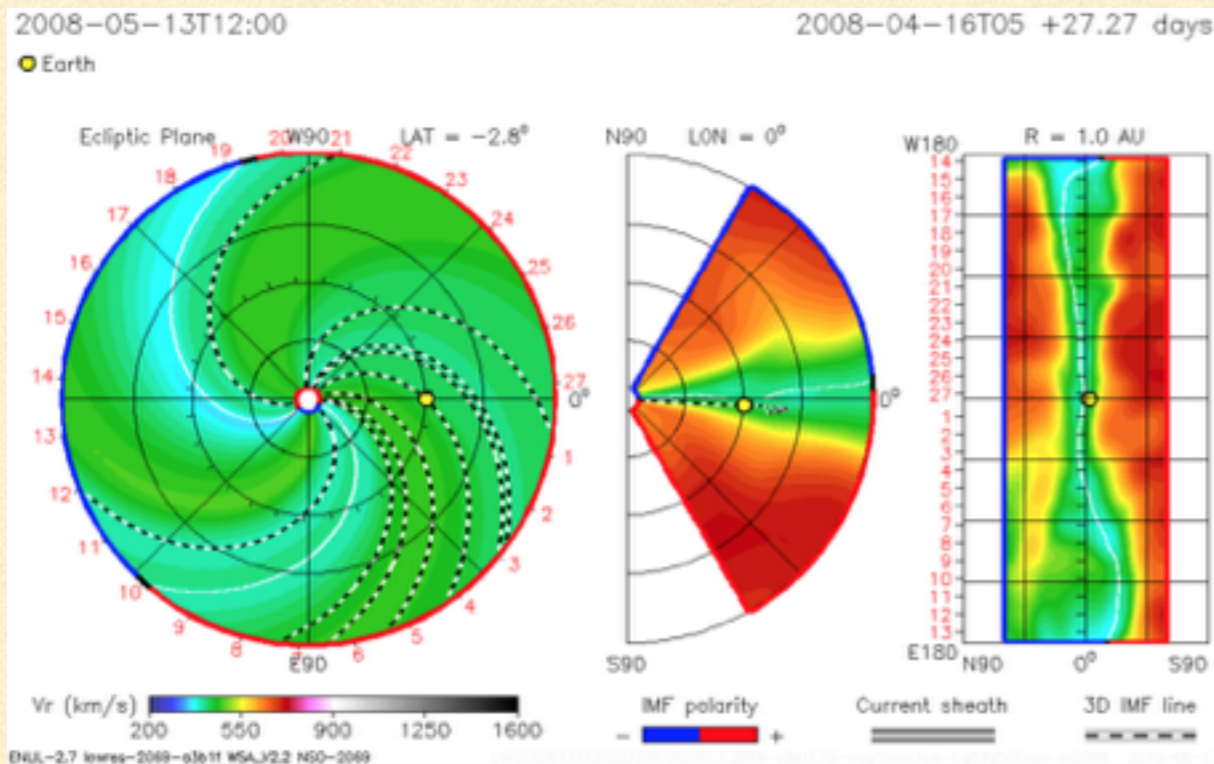
Sequencing and Scaffolding

- Limit Students Cognitive Load

- Introduce just what students need and any give time
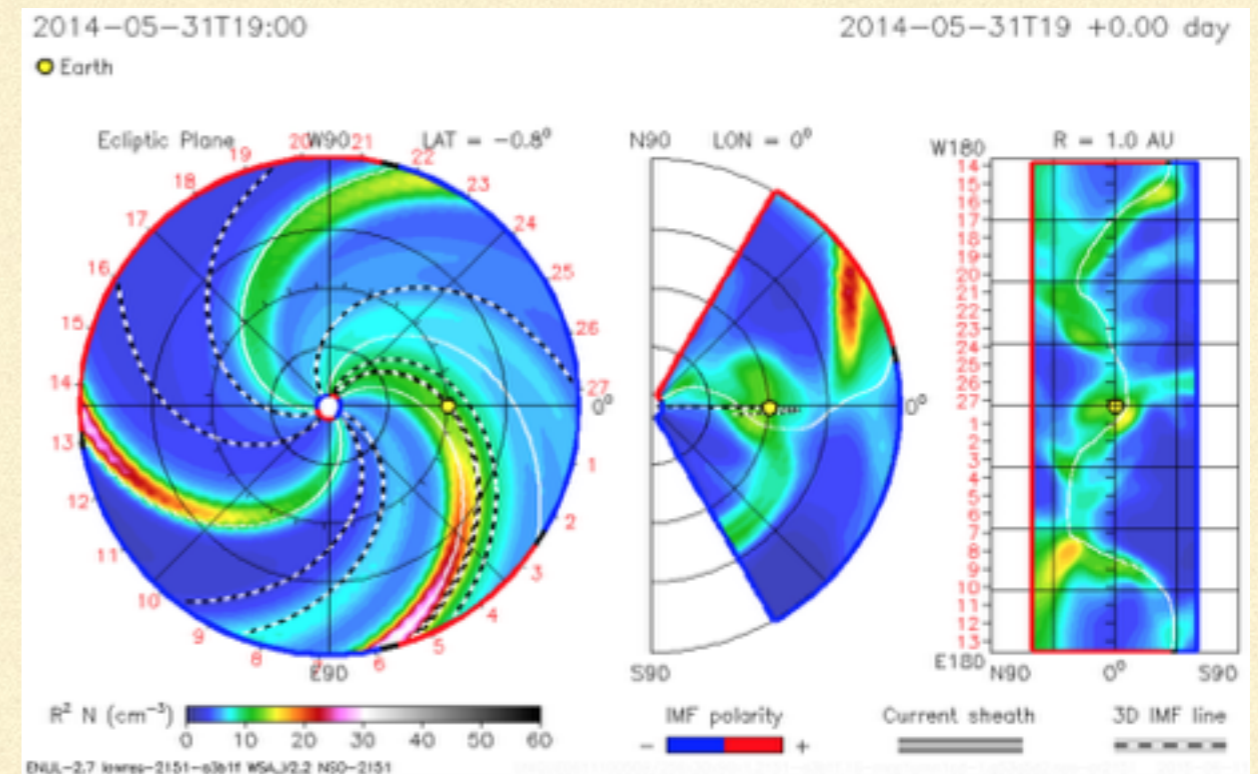
- Build on what came before

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Simulation Compilations: Solar Wind

- **Solar Wind Cases - WSA/Enlil**
  - Carrington Rotations for Solar Min and Solar Max
  - https://ccmc.gsfc.nasa.gov/support/cycles.php

Solar Min: CR 2066- 2070   Solar Max: CR 2148- 2152

Simulations: Magnetosphere Cases

- **Varying Solar Wind Conditions (SWMF)**
  - https://ccmc.gsfc.nasa.gov/support/HSS_2011/results21.php

- **Varying Dipole Moment**
  - http://ccmc.gsfc.nasa.gov/support/HSS_2015/consolidated.php

- **Varying Solar Wind Density**
  (different locations in the heliosphere)
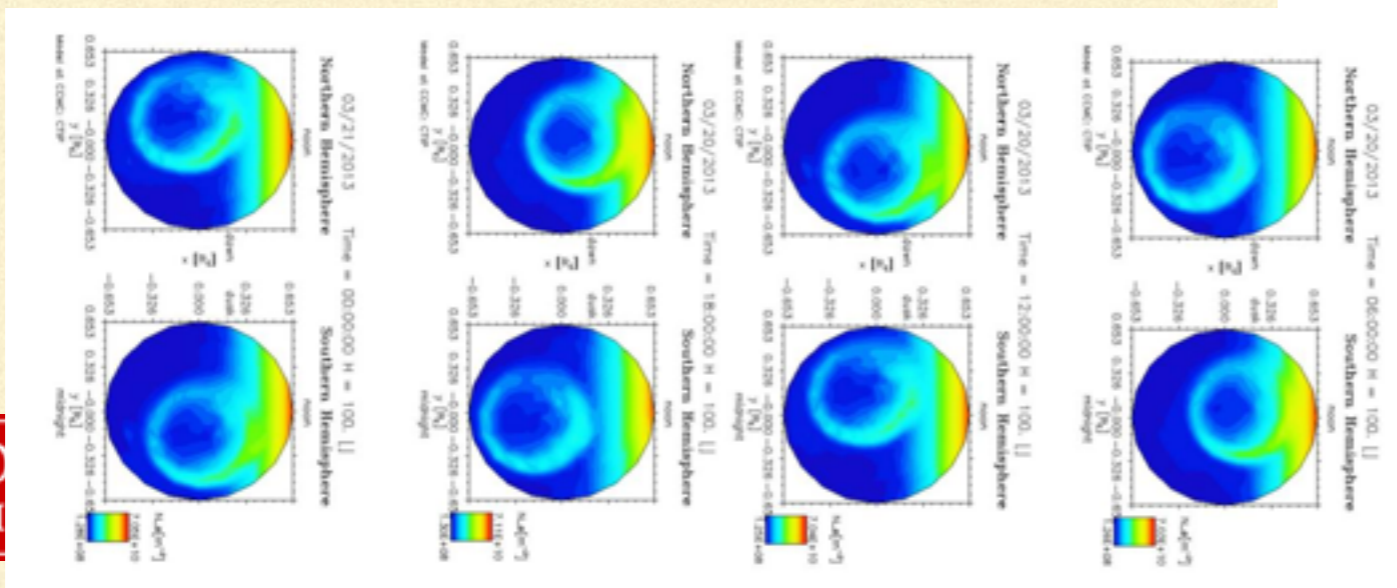
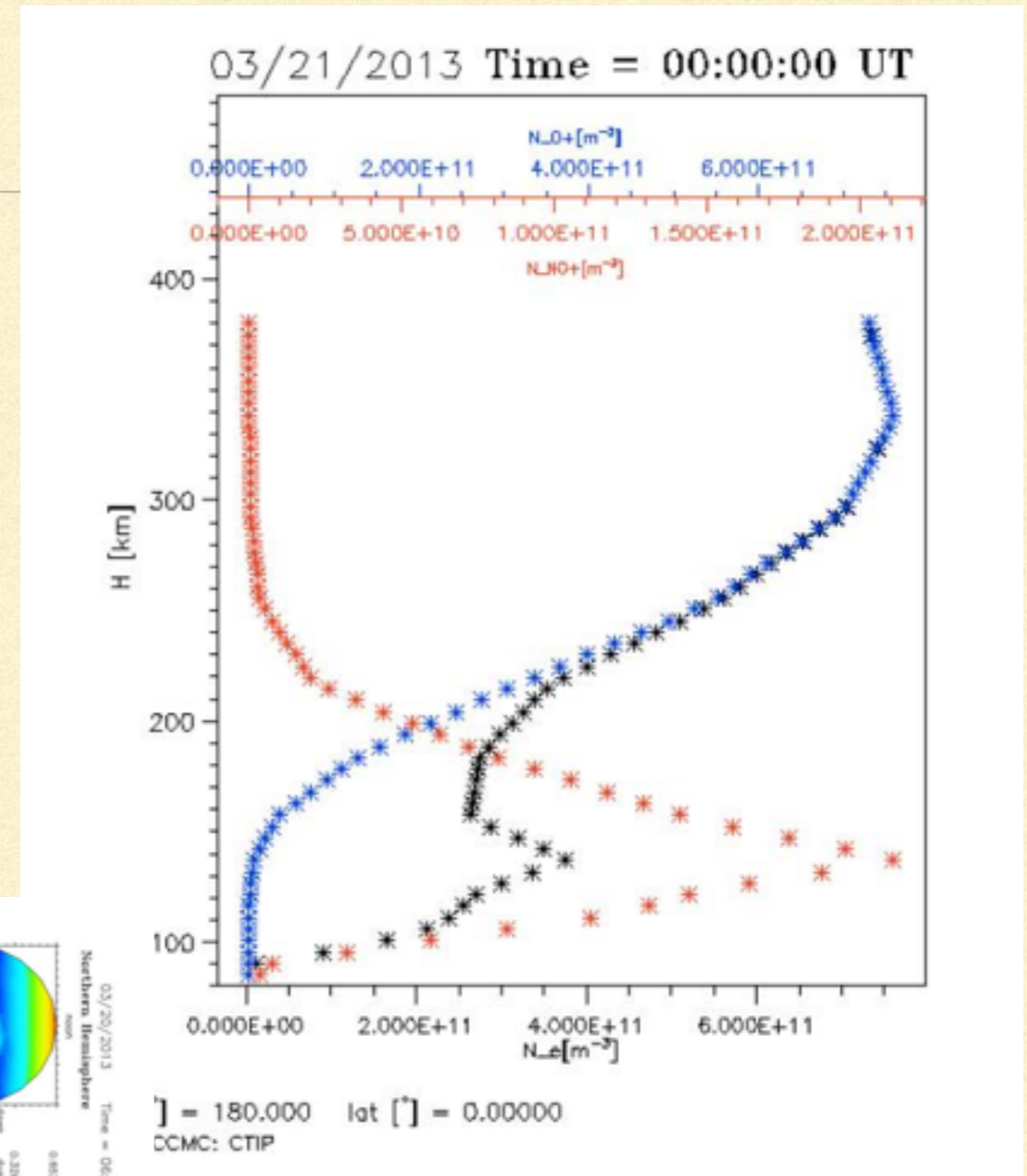- **Varying Dipole Tilt**

- **Dipole Reversal**

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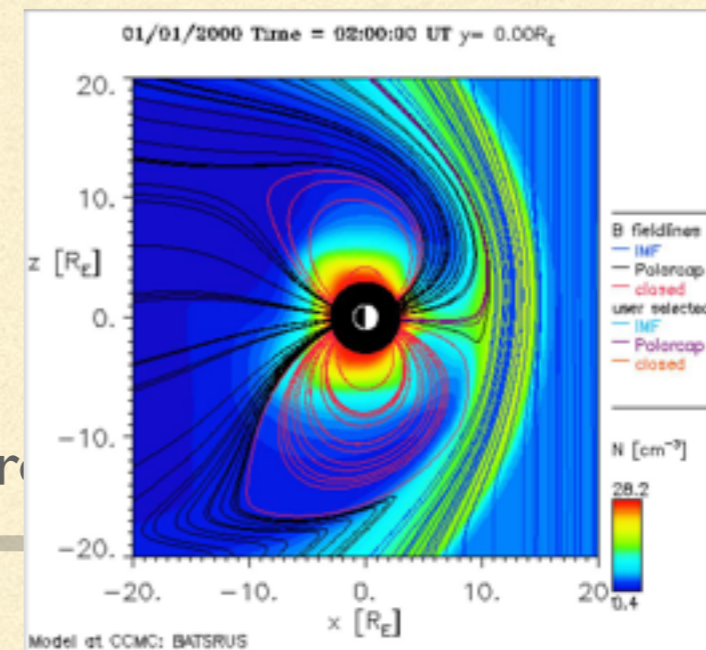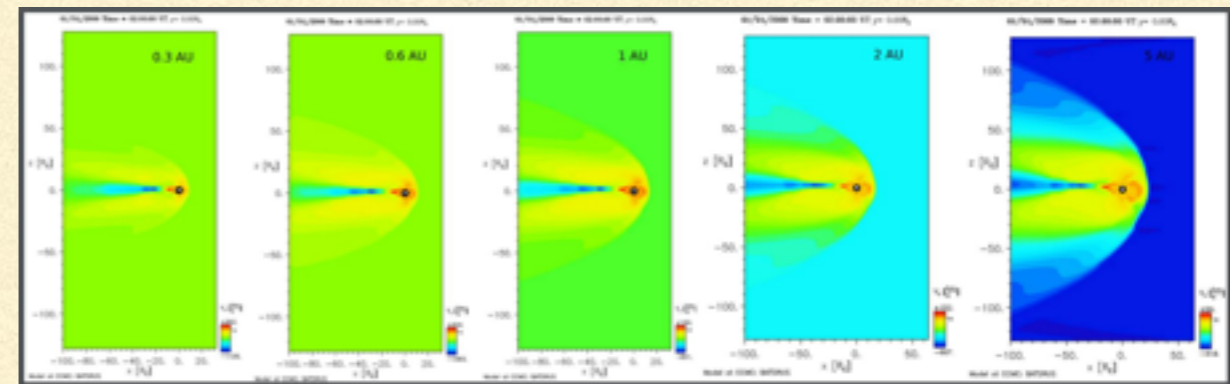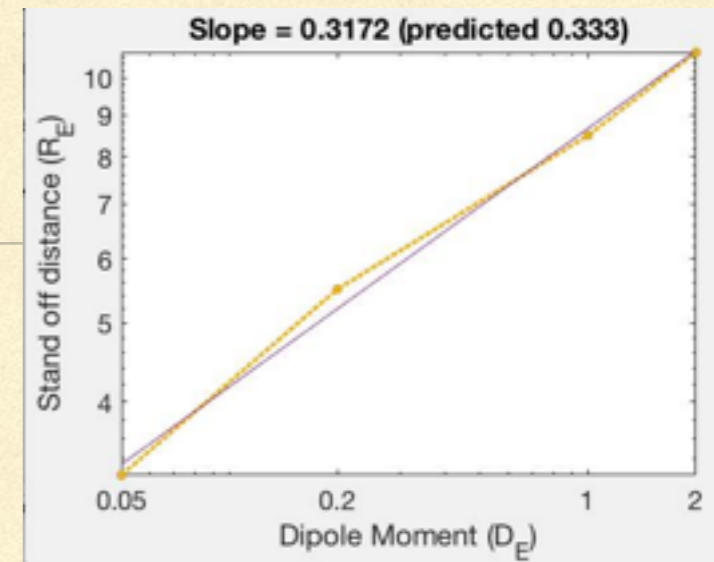
SimulationsIonosphere Model Runs

- **Ionosphere Examples**

- **CTIPe (Fuller-Rowell)**
  - https://ccmc.gsfc.nasa.gov/support/HSS_2010/results31.php

- **Varying Conditions**
  - Quiet Time vs. Storm Time
  - Equinox vs. Solstice

Visualization Tools

- Quick Views

- Kameleon Live-3D Visualization in Development

- These tools allow students to explore data
  - Relationship of plasma variables
  - Global structure of magnetic field

- 3D visualization important to understanding

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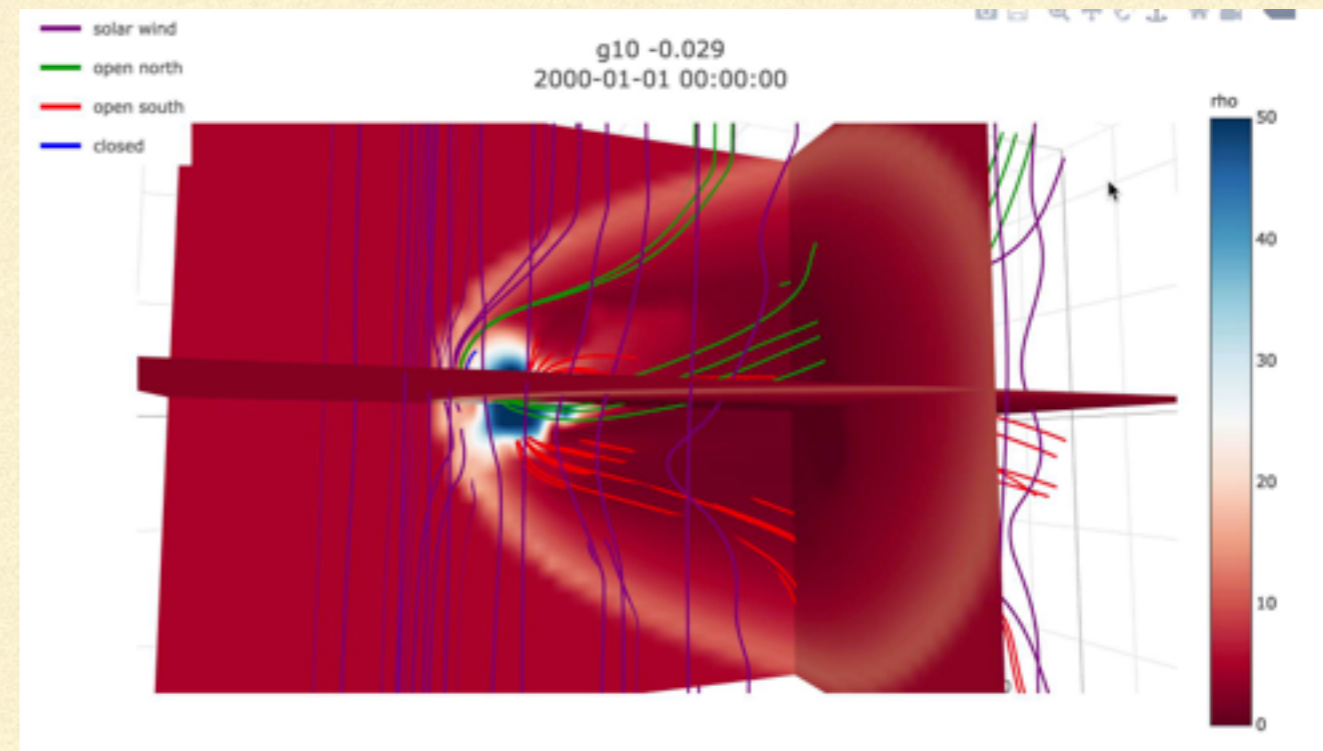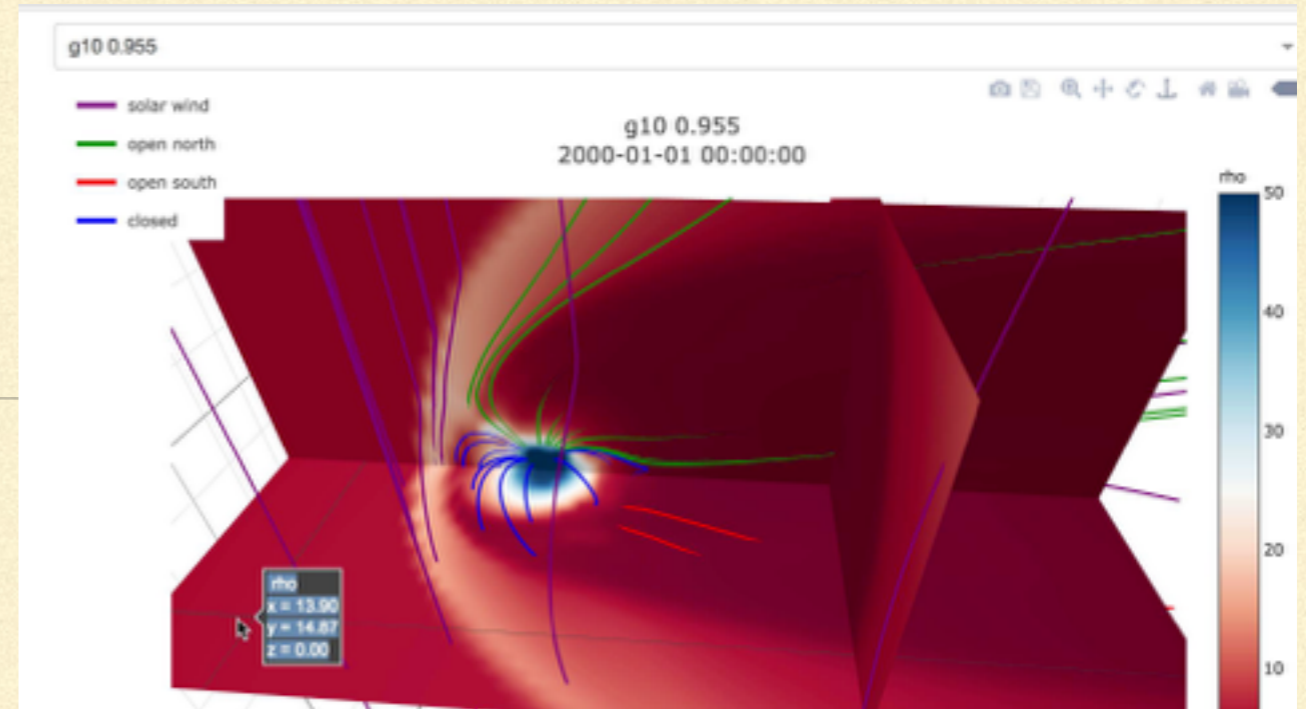
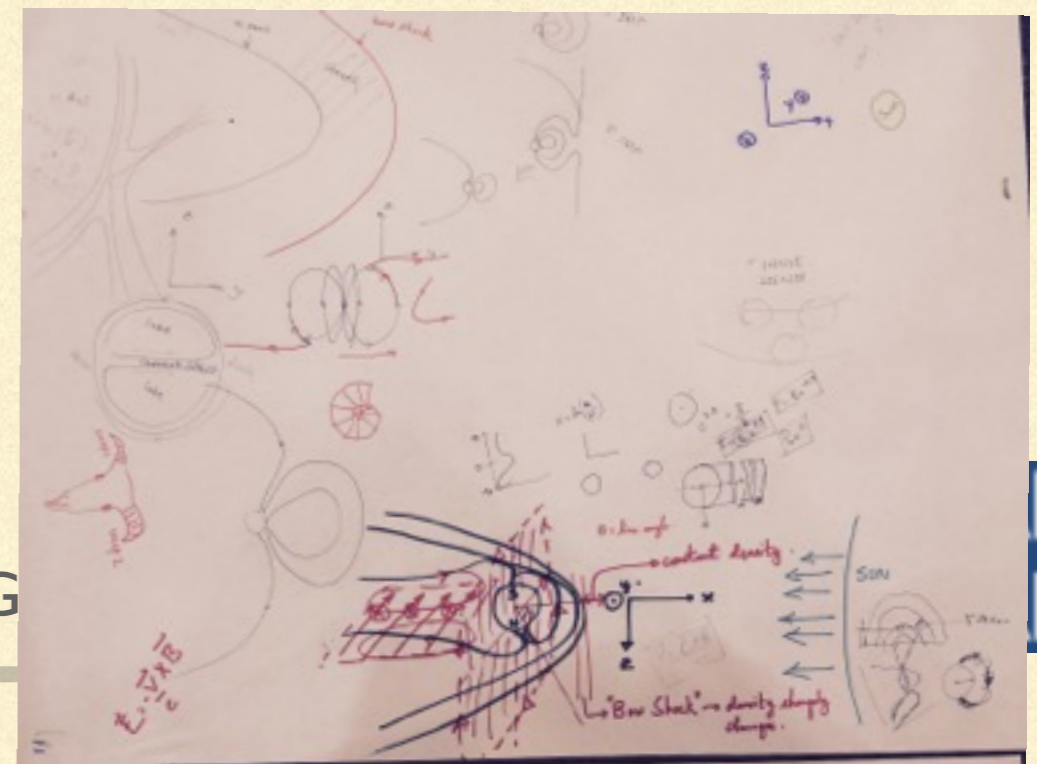# How you use the tools?

- Use the hammer to build a house, or…
  - Demote the Computer - "Computers aren't the thing…"

- Social engineering
  - Roles: leader, facilitator, note taker…etc.
  - Heterogenous vs. Homogenous Groups
  - Expertise and Networking
  - Diversity and Inclusion
  - Communication

"Tangibles" and "Ponderables"

⯈ Provide interesting activities:
  ⯈ Explore Model Output (particularly in 3D and interactive)
  ⯈ Explore data in a self directed way

⯈ Ask a thoughtful questions:
  ⯈ Compare the structure of the solar magnetic field at solar minimum and solar maximum
  ⯈ How do the plasma parameters change at the bow shock?
  ⯈ When does the new Solar Cycle Begin (24-25)? What is your evidence?
  ⯈ NOT, "What is the value of the magnetic field at geosynchronous orbit?"

Shameless Plug

- NSF Boulder Space Weather Summer School - Boulder, July 9 - 20

- NASA/LWS Heliophysics Summer School - Boulder, July 24 - Aug 1

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