Space Weather and HAARP

CEDAR Student Workshop 2016

Bill Bristow
UAF Geophysical Institute

Can HAARP Control Space Weather?

CEDAR Student Workshop 2016

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HAARP.NET

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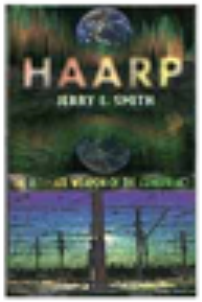
The Military's Pandora's Box

by Dr. Nick Begich and Jeane Manning

In The News

- Planet Earth: The Latest Weapon of War A Critical Study into the Military and the Environment by Rosalie Bertell, Ph.D., GNSH
- Background of the HAARP Project by Rosalie Bertell, Ph.D., GNSH
- The HAARP That Only Angels Should Play by James Hall
- HAARP A Case Study In Ultra-Modern Warfare
- U.S. Air Force Linked To Electronic Warfare Attack In Tennessee
- Could The HAARP Project Be For Mind Control? by Nicholas Jones
- Project HAARP Overview



DVDs

http://www.wanttoknow.info/war/haarp_weather_modification_electromagnetic_warfare_weapons

HAARP: Weather Control

Is the HAARP Project a Weather Control Weapon?

"It isn't just conspiracy theorists who are concerned about HAARP. The European Union called the project a global concern and passed a resolution calling for more information on its health and environmental risks. Despite those concerns, officials at HAARP insist the project is nothing more sinister than a radio science research facility."

-- From documentary on HAARP project's weather control by Canada's CBC

HAARP: What is it?

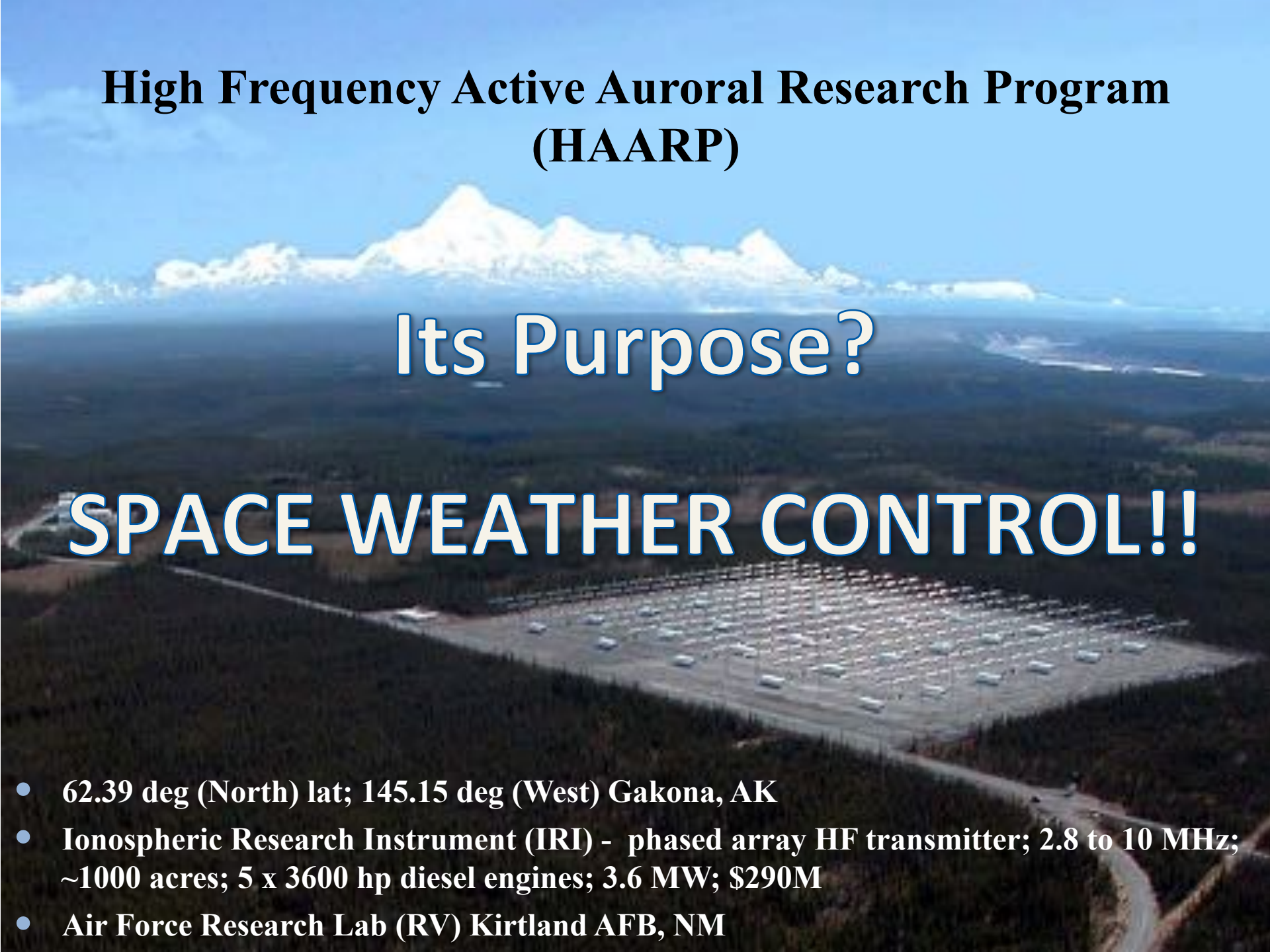
HAARP (High Frequency Active Auroral Research Program) is a little-known, yet critically important U.S. military defense project which has generated quite a bit of controversy over its alleged weather control capabilities and much more.

HAARP array: Gakona, Alaska

Though denied by HAARP project officials, some respected researchers allege that secret electromagnetic warfare capabilities of the project are designed to forward the US military's stated goal of achieving full-spectrum dominance by the year 2020.

Others go so far as to claim that HAARP can and has been used for weather control, to cause earthquakes and tsunamis, to disrupt global communications systems, and more. They point to major aspects of the program which are kept secret for alleged reasons of "national security." The U.S. patent of a key developer of HAARP and other documentary evidence support these claims. And there is no doubt that electromagnetic weapons capable of being used in warfare do exist. The project's $300 million price tag also suggests more is going on than meets the eye.

High Frequency Active Auroral Research Program (HAARP)



Its Purpose?

SPACE WEATHER CONTROL!!

- 62.39 deg (North) lat; 145.15 deg (West) Gakona, AK
- Ionospheric Research Instrument (IRI) - phased array HF transmitter; 2.8 to 10 MHz; ~1000 acres; 5 x 3600 hp diesel engines; 3.6 MW; $290M
- Air Force Research Lab (RV) Kirtland AFB, NM

What is *Space Weather?*

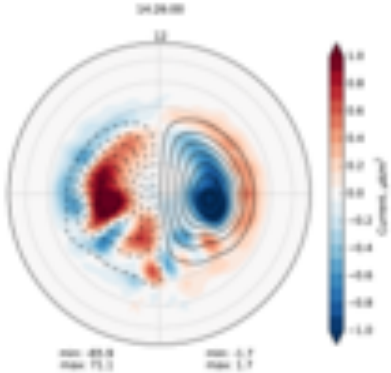
- Terrestrial Weather - Meteorology
  The short-term state of the atmosphere, as distinguished from the long-term conditions of climate; this includes temperature, humidity, precipitation, wind, visibility, and other factors, chiefly considered in terms of their effects on life and human activity.

- Space weather is a relatively new field of science dedicated to the understanding of interactions between the Sun and Earth, and to the forecasting of solar flares, magnetic storms and other space-related phenomena.

Space Weather

AN AGU JOURNAL

Featured in Space Weather



Data assimilation of low-altitude magnetic perturbations into a global magnetosphere model

A snapshot of the baseline LFM-RCM simulation (Σ = 10 S) during the quasi-steady stage of the simulation (time indicated at the top). The Northern Hemisphere FACs including both R1 and R2 currents are shown. Upward current is positive. Solar magnetic coordinates are used such that the pole coincides with the Earth's magnetic axis, and noon is at the top. The distance between the constant latitude circles is 10°. The corresponding ionospheric potential is indicated by black contours (solid = positive and dashed = negative). The contours are spaced by roughly 10 kV. Minimum/maximum

Current Issue

Volume 14
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May 2016

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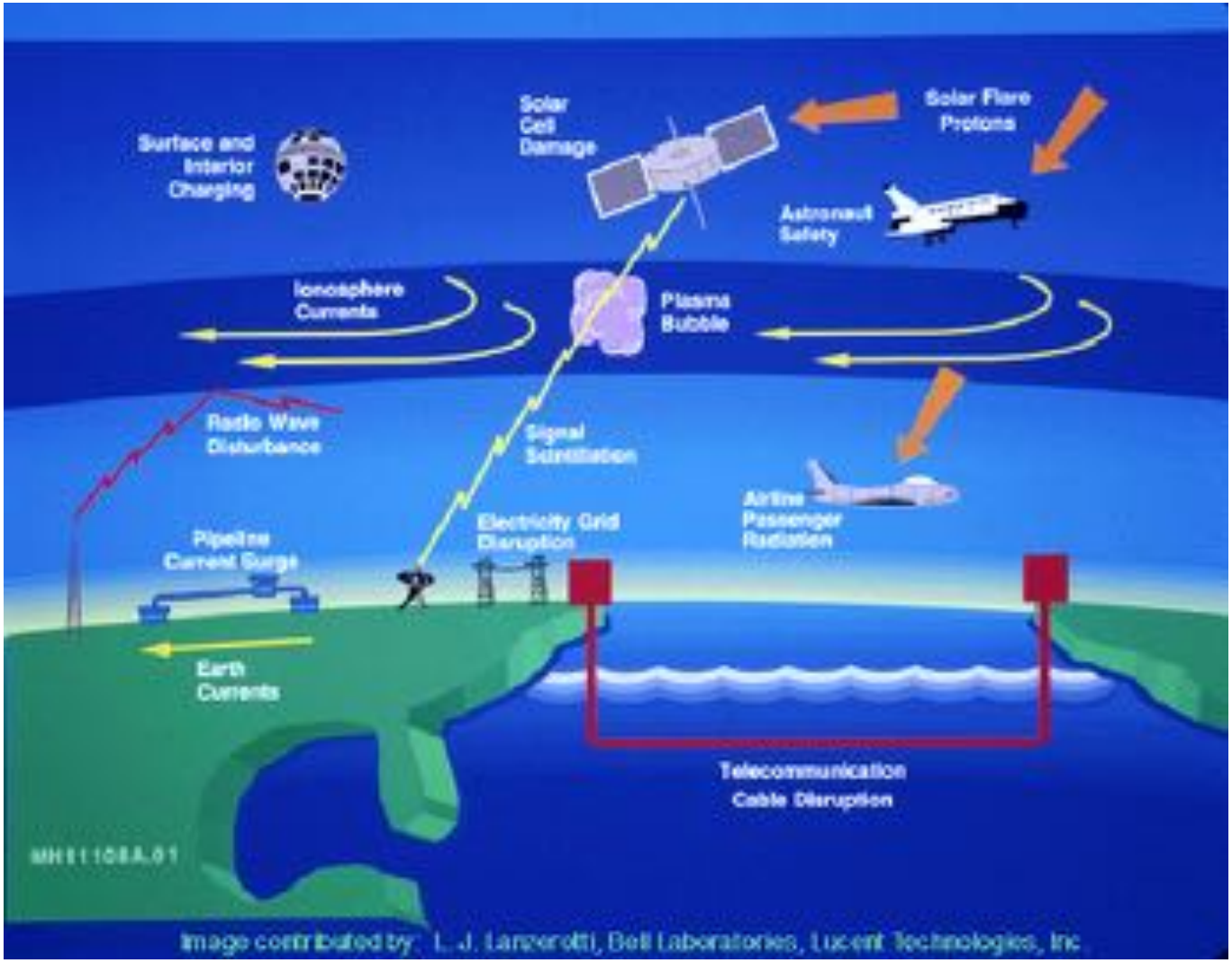
Space Weather Effects

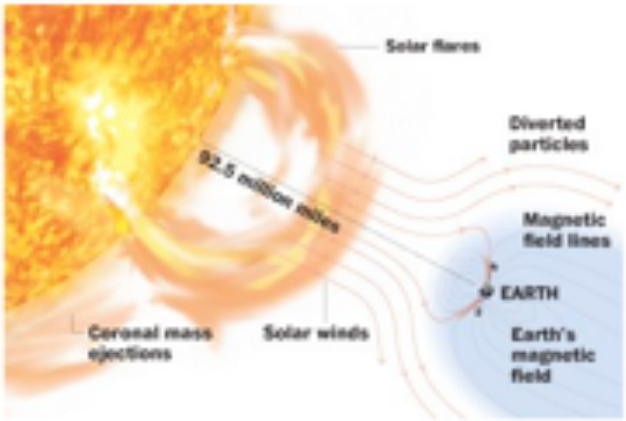


When space weather attacks!

By Brad Plumer July 13, 2013

On a cool September night in 1859, campers out in Colorado were roused from sleep by a "light so bright that one could easily read common print," as one newspaper described it. Some of them, confused, got up and began making breakfast.

Farther east, thousands of New Yorkers ran out onto their sidewalks to watch the sky glow, ribboned in yellow, white and crimson. Few people had ever seen an aurora that far south — and this one lit up the whole city.



Click on the picture for a full map showing how space weather can affect the Earth.

At the time, it was a dazzling display of nature. Yet if the same thing happened today, it would be an utter catastrophe.

Space Weather Effects

WEATHER

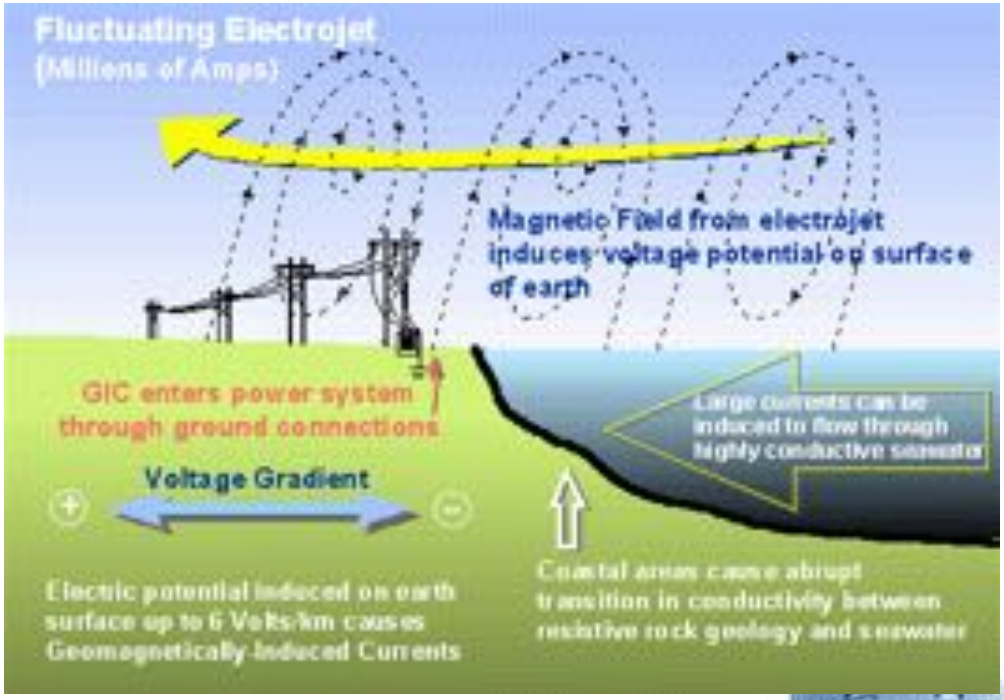
The Star-Ledger

FINAL EDITION

Sunspots threatening utilities with blackouts

The sun's threat to power lines

Image contributed by L. J. Lanzerotti, Bell Laboratories, Lucent Technologies, Inc.



PJM Public Service
Step-Up Transformer

Severe internal damage caused by the storm of 13 March, 1989

A large space storm in 1989 caused currents which damaged this transformer and shut off power for six million people for nine hours.

Space Weather Effects

Image Credit: L. J. Lanzerotti, Bell Laboratories, Lecent Technologies, Inc.

Anik-E1 and E2 satellite failures of January 1994 revisited

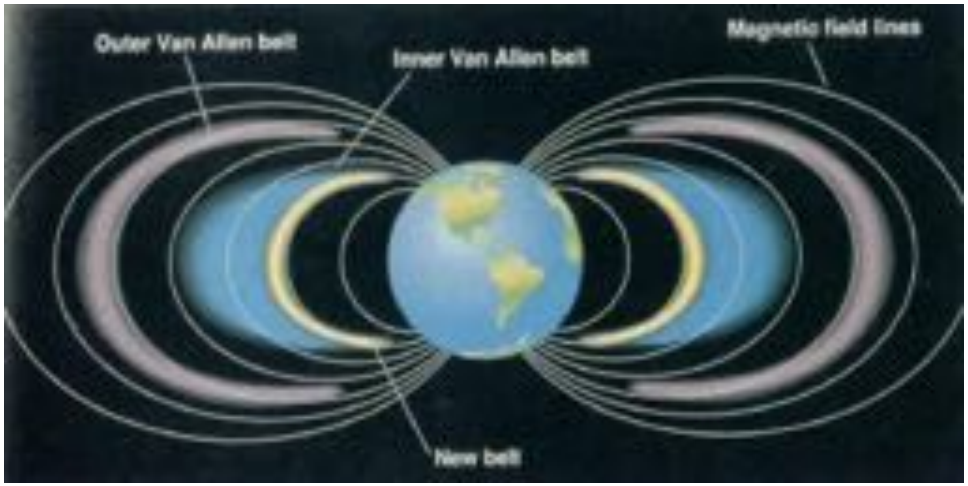
H.-L. Lam,[1] D. H. Boteler,[1] B. Burlton,[2,3] and J. Evans[4,5]

Received 11 May 2012; revised 10 September 2012; accepted 11 September 2012; published 10 October 2012.

[1] The consecutive failures of the geosynchronous Anik-E1 communication satellite on January 20, 1994, and Anik-E2 about nine hours later on January 21 (both incidents occurred on January 20 local time) received considerable publicity because the malfunctions of the satellites disrupted television and computer data transmissions across Canada, as well as telephone services to remote northern communities for hours. This often-cited event is revisited here with materials not covered before. Using publicly available information, Anik-E failure details, media coverage, recovery effort and cost incurred are first presented. This is then followed by scrutiny of space weather conditions pertinent to the occurrences of the Anik-E upsets. We trace the space weather episode's inception on the Sun, propagation through interplanetary medium, and manifestation in magnetic field variations as well as in energetic electron flux increases, and its eventual impact on the Anik-Es. The genesis of the energetic electron enhancements that have been blamed for the satellite malfunctions is thus traceable via high-speed solar wind stream with Alfven wave fluctuations to a longitudinally wide coronal hole on the Sun. Furthermore, strong magnetic pulsations preceding electron flux peaks indicate Pc5 ULF (Ultra Low Frequency) waves as a probable acceleration mechanism for the energetic electron flux enhancement that resulted in the internal charging of the Anik-Es. The magnetic fluctuations may even be possible triggers for the subsequent discharge that caused the satellites to malfunction. This incident illustrates that satellite operators should be on alert for elevated high-energy electron environment that is above established thresholds, as specifications in satellite design may not render a satellite immune from internal charging.

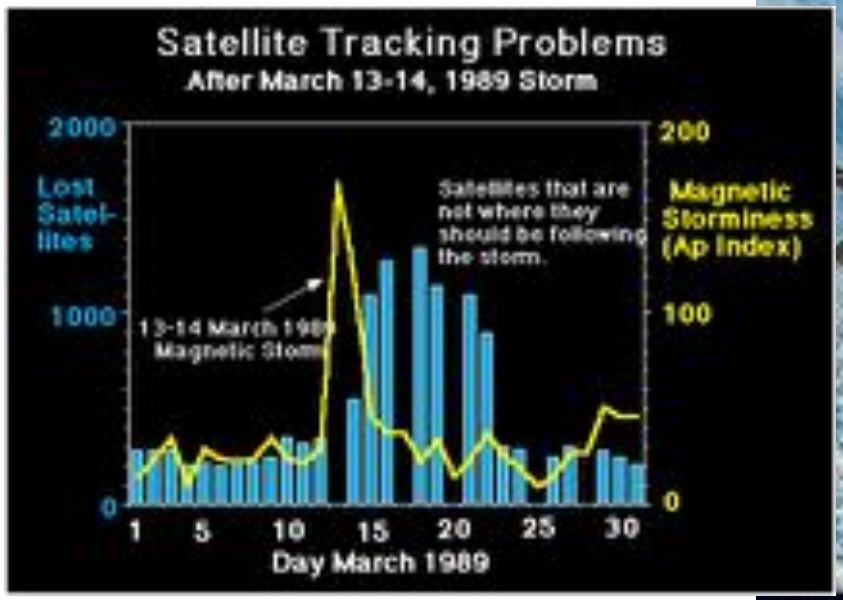
Citation: Lam, H.-L., D. H. Boteler, B. Burlton, and J. Evans (2012), Anik-E1 and E2 satellite failures of January 1994 revisited, *Space Weather, 10*, S10003, doi:10.1029/2012SW000811.

Space Weather Effects



Energetic particles cause damage to solar panels and can cause deep dielectric charging.

Space Weather Effects



Atmospheric drag leads to uncertainty in orbit calculations.

NATIONAL SPACE WEATHER STRATEGY

PRODUCT OF THE

National Science and Technology Council

October 2015

EXECUTIVE OFFICE OF THE PRESIDENT
NATIONAL SCIENCE AND TECHNOLOGY COUNCIL
WASHINGTON, D.C. 20502

October 29, 2015

Dear Colleagues,

Space weather is a naturally occurring phenomenon that has the potential to cause substantial detrimental effects on the Nation's economic and social well-being. Preparing for and predicting space-weather events and their potential effects on Earth is a significant challenge. Recent efforts led by the United States and its international partners have resulted in significant progress toward improving the understanding, monitoring, prediction, and mitigation of this hazard, but much more needs to be done.

Over the past 5 years, OSTP has coordinated interagency efforts to improve the Nation's ability to prepare, avoid, mitigate, respond to, and recover from the potentially devastating impacts of space-weather events. These efforts included the establishment of the Interagency Space Weather Operations, Research, and Mitigation (SWORM) Task Force in November 2014. The goal of the SWORM Task Force was to unite the national- and homeland-security enterprise with the science and technology enterprise to formulate a cohesive vision to enhance national preparedness for space weather.

This *National Space Weather Strategy* and accompanying *National Space Weather Action Plan* are the result of the SWORM Task Force's efforts. These documents transcend agency-mission and sector boundaries to describe how the Federal Government will coordinate its efforts on space weather and how the Federal Government plans to engage academia, the private and public sectors, and other governments on space weather. The Strategy and associated Action Plan aim to enhance the preparedness of the Nation by interweaving and building upon existing policy efforts to identify overarching goals that underpin and drive the activities necessary to improve the security and resilience of critical technologies and infrastructures.

These documents represent only a next step to improving national preparedness for space weather. The Strategy sets overall goals for Federal action, while the Action Plan establishes Federal actions and timelines for implementation. Many of these activities will require long time horizons, which will necessitate sustained engagement among government agencies and the private sector. This challenge requires the Nation to work together to continually improve understanding, prediction, and preparedness to enhance the Nation's resilience against severe space-weather events.

Sincerely,

John P. Holdren
Assistant to the President for Science and Technology
Director, Office of Science and Technology Policy

114TH CONGRESS
2D SESSION

S. 2817

To improve understanding and forecasting of space weather events, and for other purposes.

IN THE SENATE OF THE UNITED STATES

APRIL 19, 2016

Mr. PETERS introduced the following bill; which was read twice and referred to the Committee on Commerce, Science, and Transportation

---

A BILL

To improve understanding and forecasting of space weather events, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the "Space Weather Research and Forecasting Act".

SEC. 2. SPACE WEATHER.

(a) IN GENERAL.—Subtitle VI of title 51, United States Code, is amended by adding after chapter 605 the following:

"CHAPTER 607—SPACE WEATHER

"60701. Space weather.
"60702. Observations and forecasting.
"60703. Research and technology.
"60704. Space weather data.

"§ 60701. Space weather

"(a) FINDINGS.—Congress makes the following findings:

"(1) Space weather events pose a significant threat to humans working in the space environment and to modern technological systems.

This bill directs the Office of Science and Technology Policy to:

- improve the nation's ability to prepare, avoid, mitigate, respond to, and recover from potentially devastating impacts of space weather events;
- coordinate the activities of the National Space Weather Program Council members; and
- develop an integrated strategy for solar and solar wind observations beyond the lifetime of current assets.

The National Science and Technology Council shall establish an interagency working group on space weather.

The National Oceanic and Atmospheric Administration (NOAA) shall:

- secure reliable secondary capability for near real-time coronal mass ejection imagery; and
- develop requirements and a plan for follow-on space-based observations for operational purposes.

The National Science Foundation (NSF) and the Air Force shall each:

- maintain ground-based observations of the Sun; and
- provide space weather data by means of ground-based facilities, including solar observatories.

NOAA and the Air Force shall conduct a survey to prioritize the needs of space weather forecast users.

The NSF, NOAA, and the National Aeronautics and Space Administration (NASA) shall pursue multidisciplinary research in subjects regarding solar physics, space physics, and space weather.

NASA shall seek to implement missions meeting science objectives identified in National Academy of Sciences (NAS) Solar and Space Physics Decadal surveys.

NASA, the NSF, NOAA, and the Air Force shall:

- develop a mechanism to transition NASA and NSF research findings, models, and capabilities to NOAA and the Department of Defense space weather operational forecasting centers; and
- enhance coordination between research modeling centers and forecasting centers.

NASA and the NSF shall support the development of technologies and instrumentation to improve space weather forecasting lead-time and accuracy.

NASA and the NSF shall:

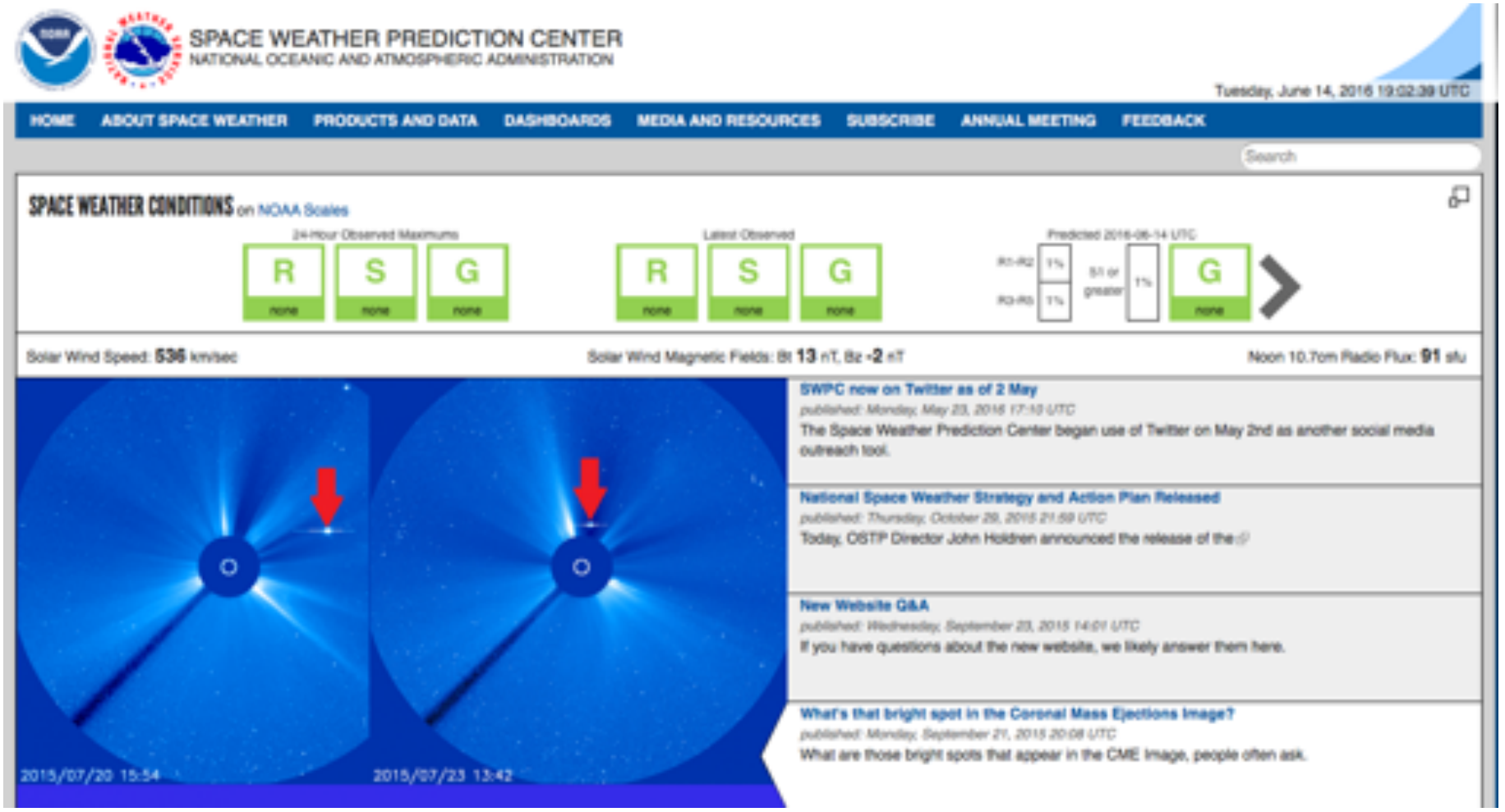
- make space weather related data obtained for scientific research available to space weather forecasters and operations centers, and
- support model development and applications to space weather forecasting.

The Space Weather Interagency Group shall develop benchmarks for measuring solar disturbances.

NOAA shall inform the Department of Homeland Security about space weather hazards to protect national critical infrastructure from space weather events.

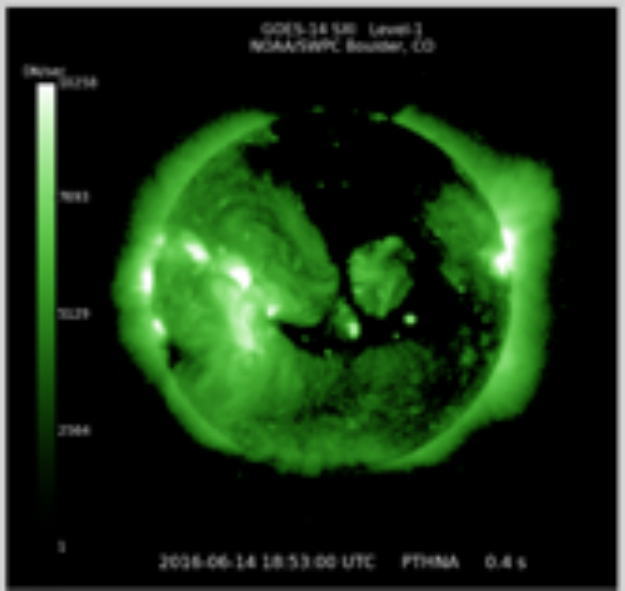
The National Security Council shall develop mechanisms to protect national security assets from space weather threats.

https://www.congress.gov/bill/114th-congress/senate-bill/2817

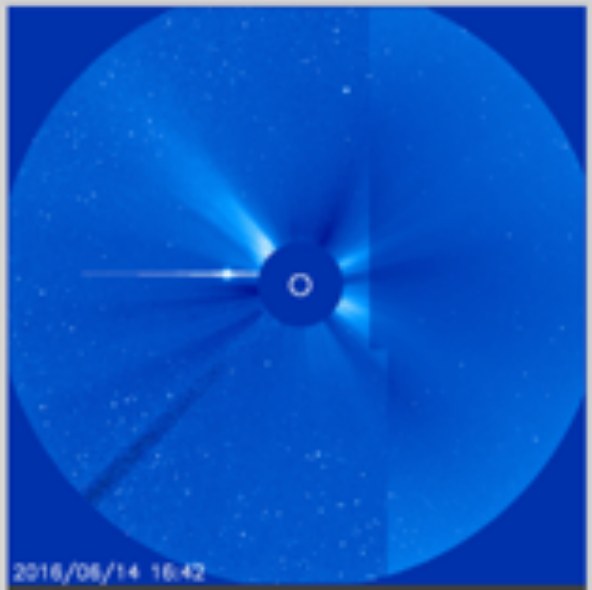


http://www.swpc.noaa.gov

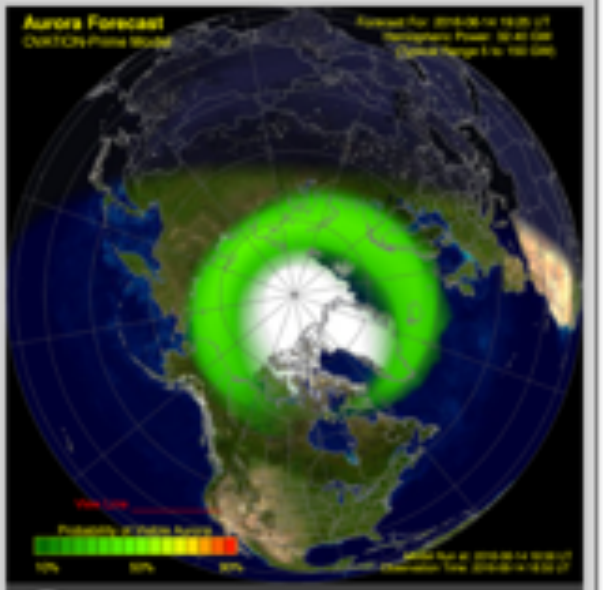
THE SUN'S X-RAYS



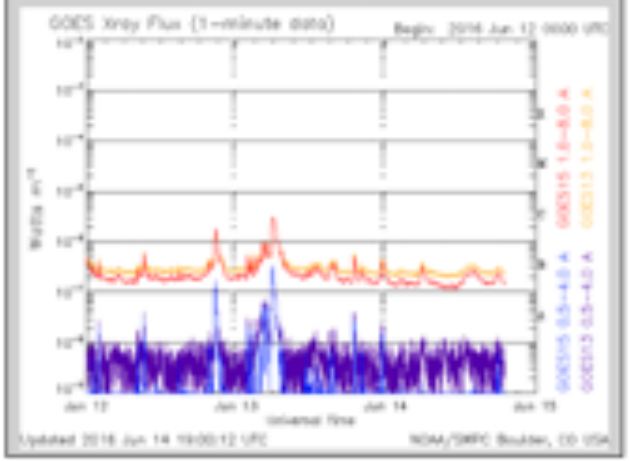
CORONAL MASS EJECTIONS



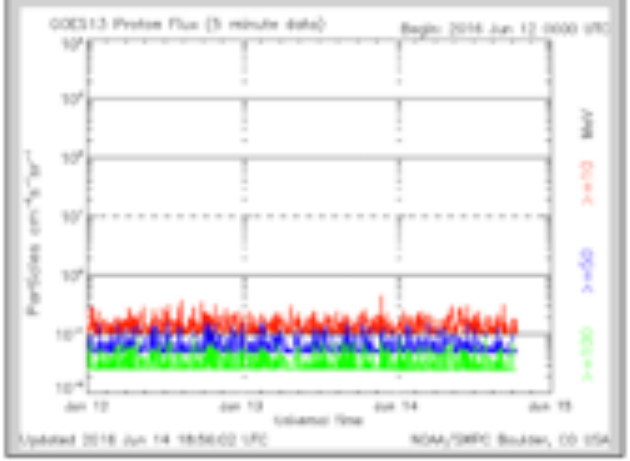
THE AURORA



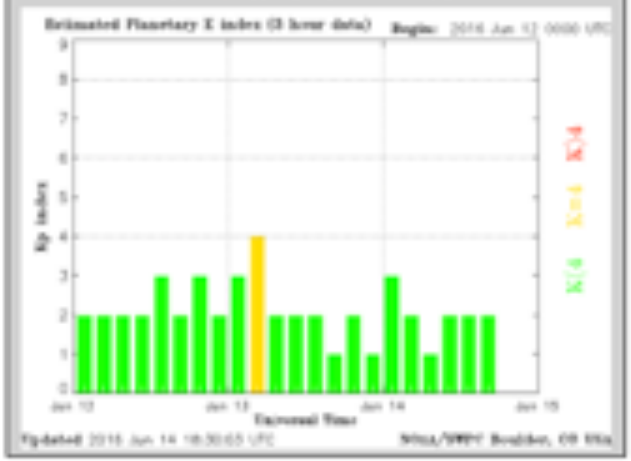
GOES X-RAY FLUX



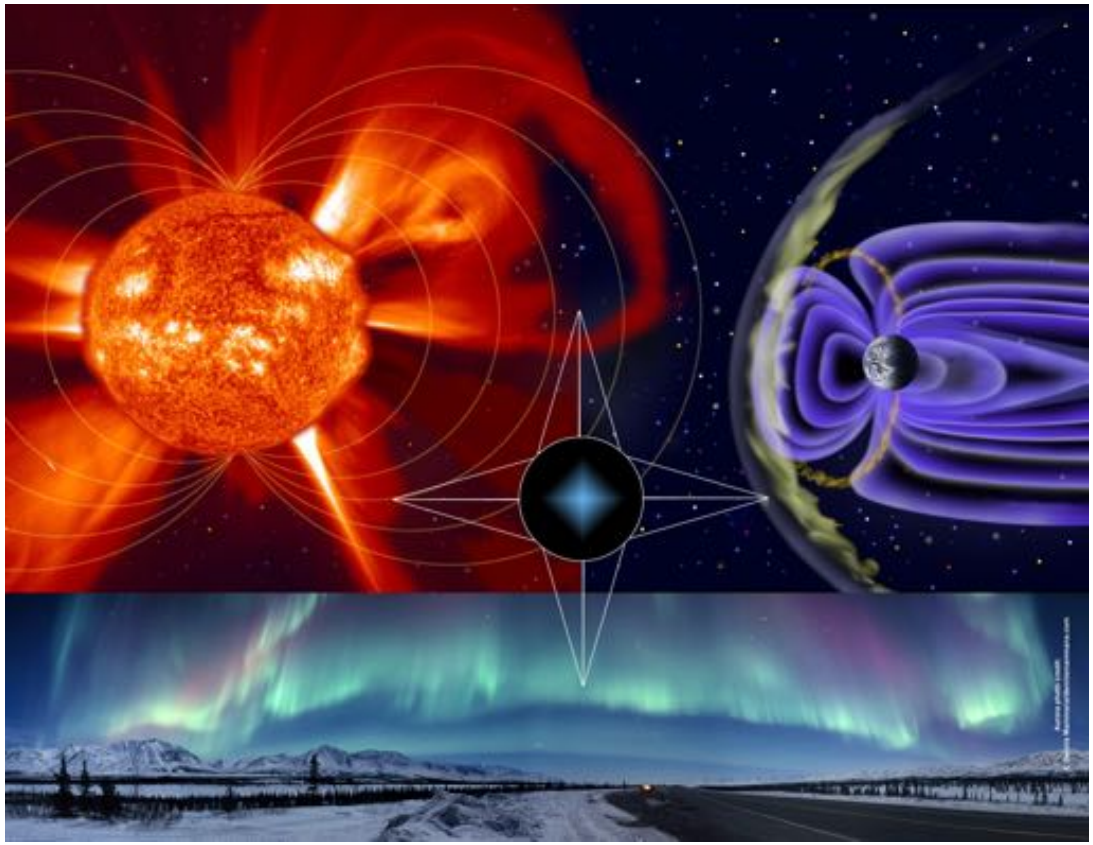
GOES PROTON FLUX



ESTIMATED PLANETARY K-INDEX



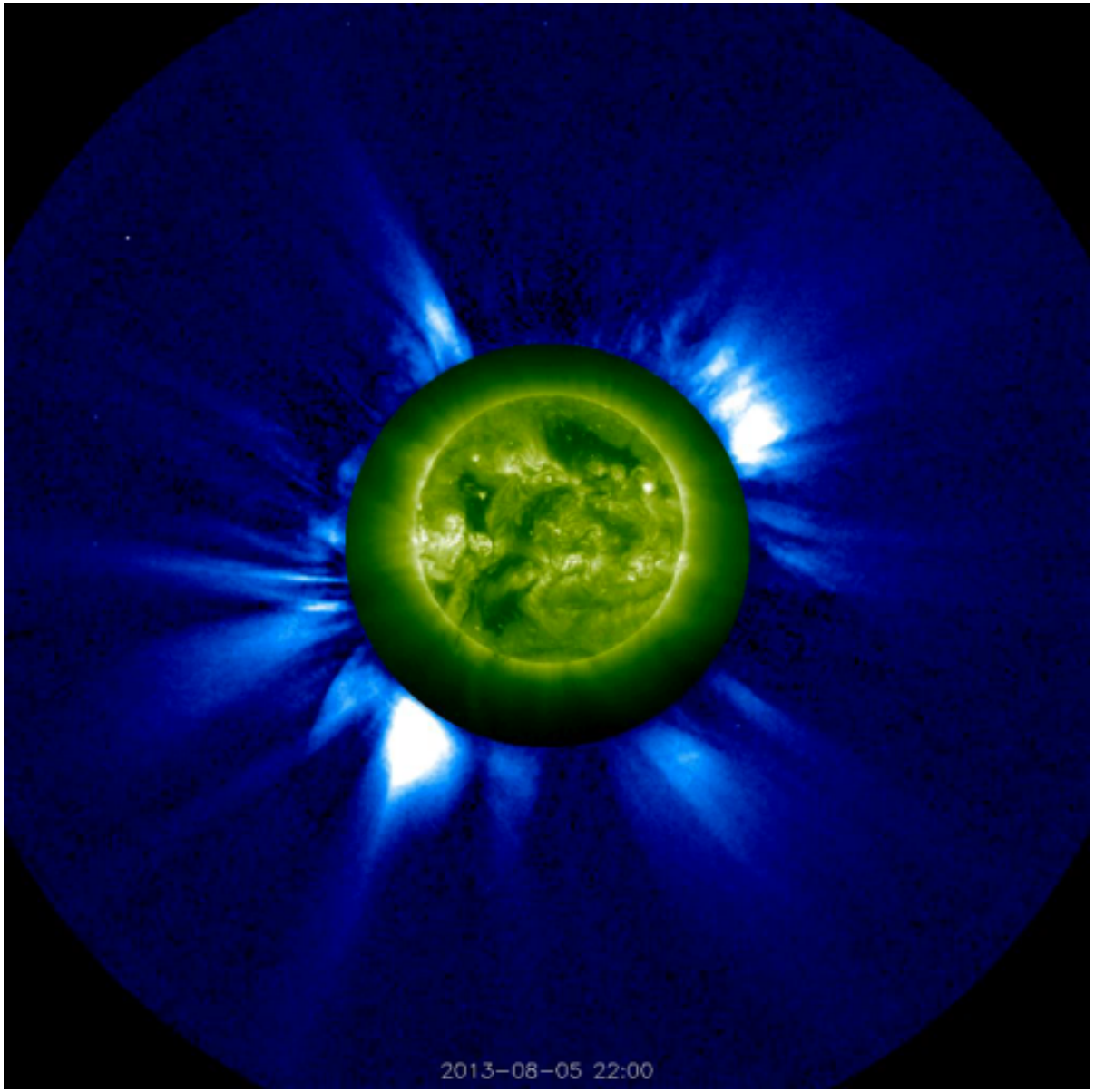
What do we need to know?



Space weather originates on the sun. So, we need to know:

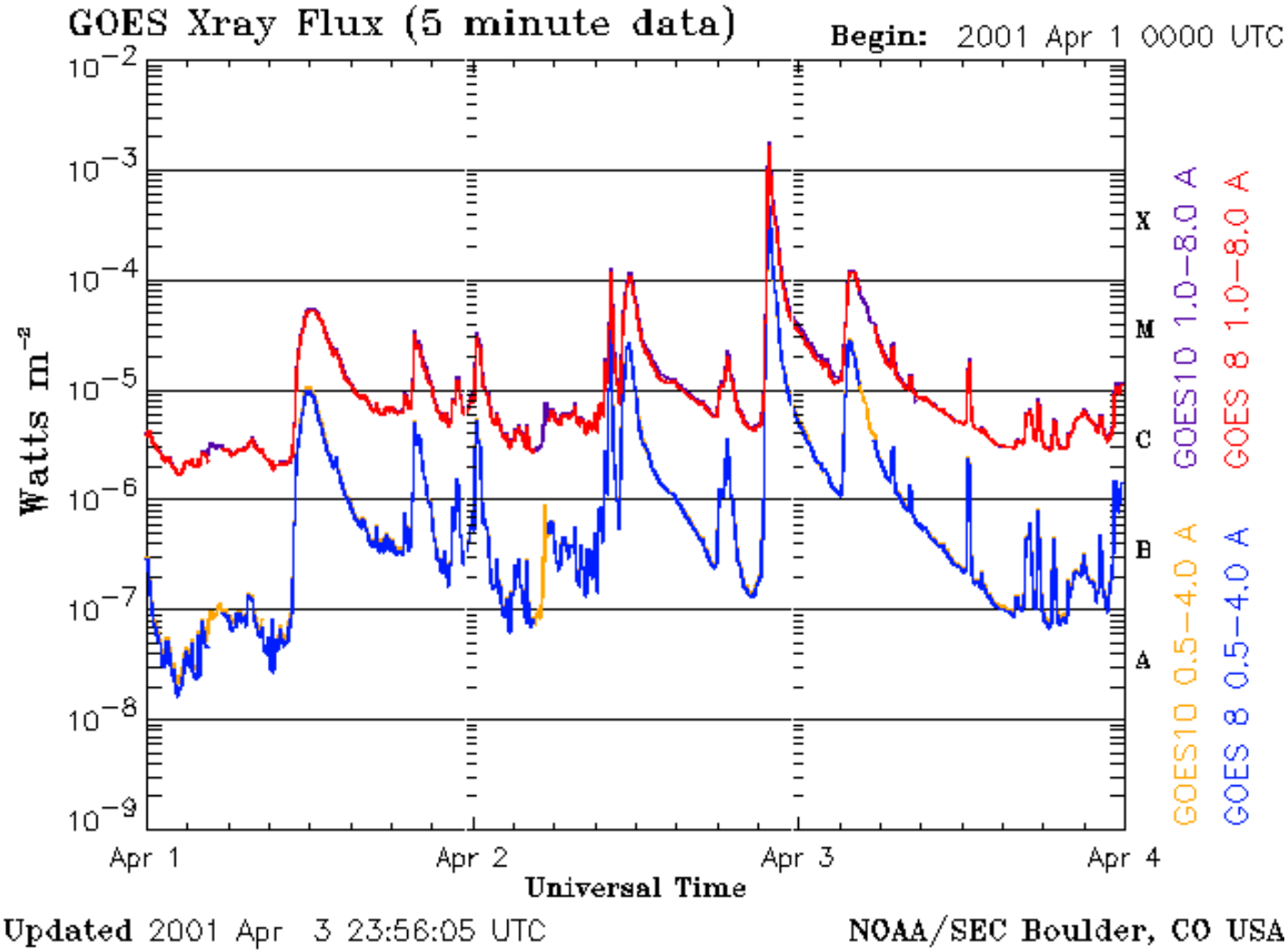
- Has an event occurred on the sun?
- Was the event in a position to generate a *geoeffective* solar wind disturbance?
- What effects are expected?
- When will effects be felt on earth?

Watching the Sun

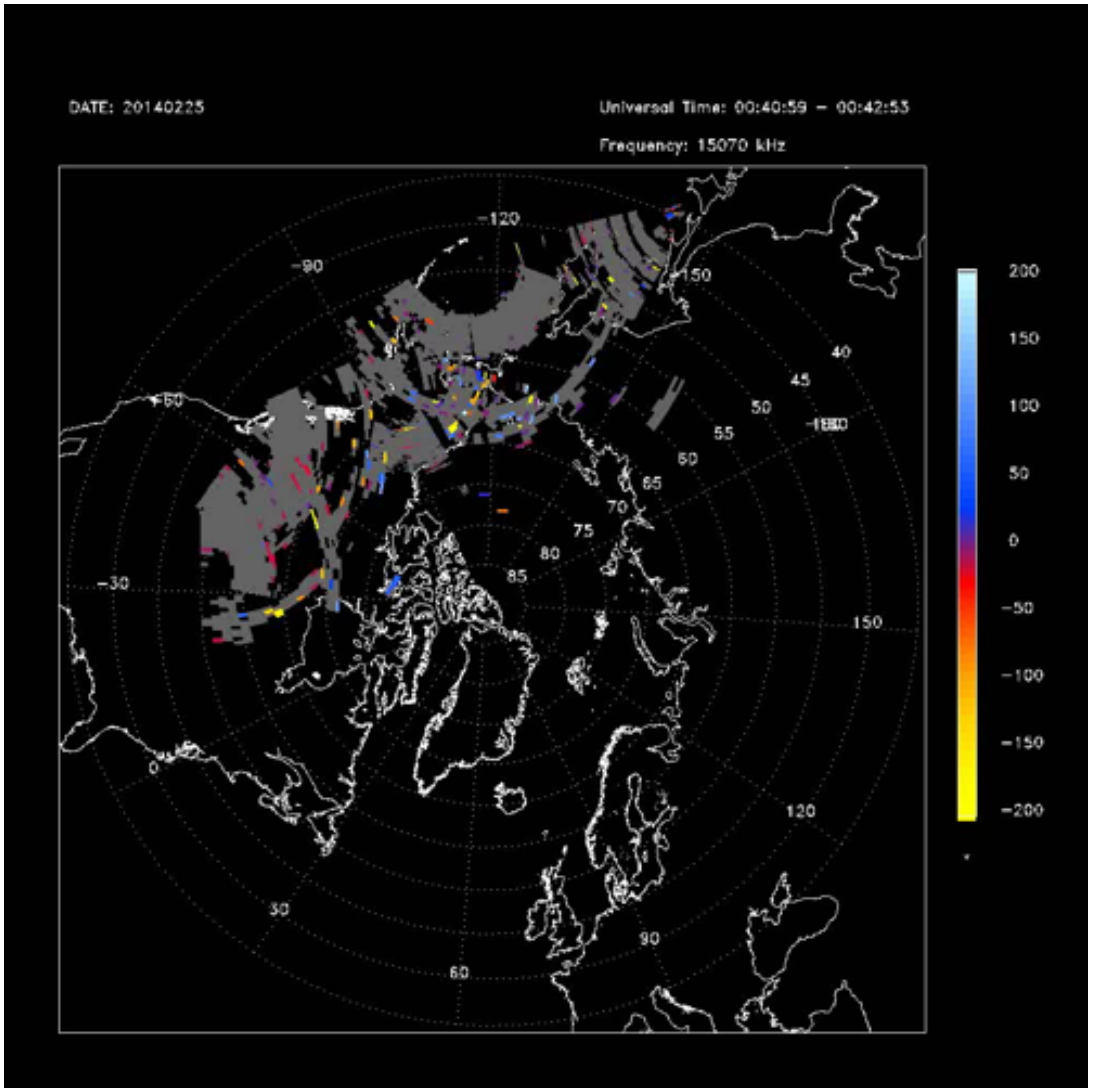


http://stereo.gsfc.nasa.gov/gallery/stereoimages_storms.shtml

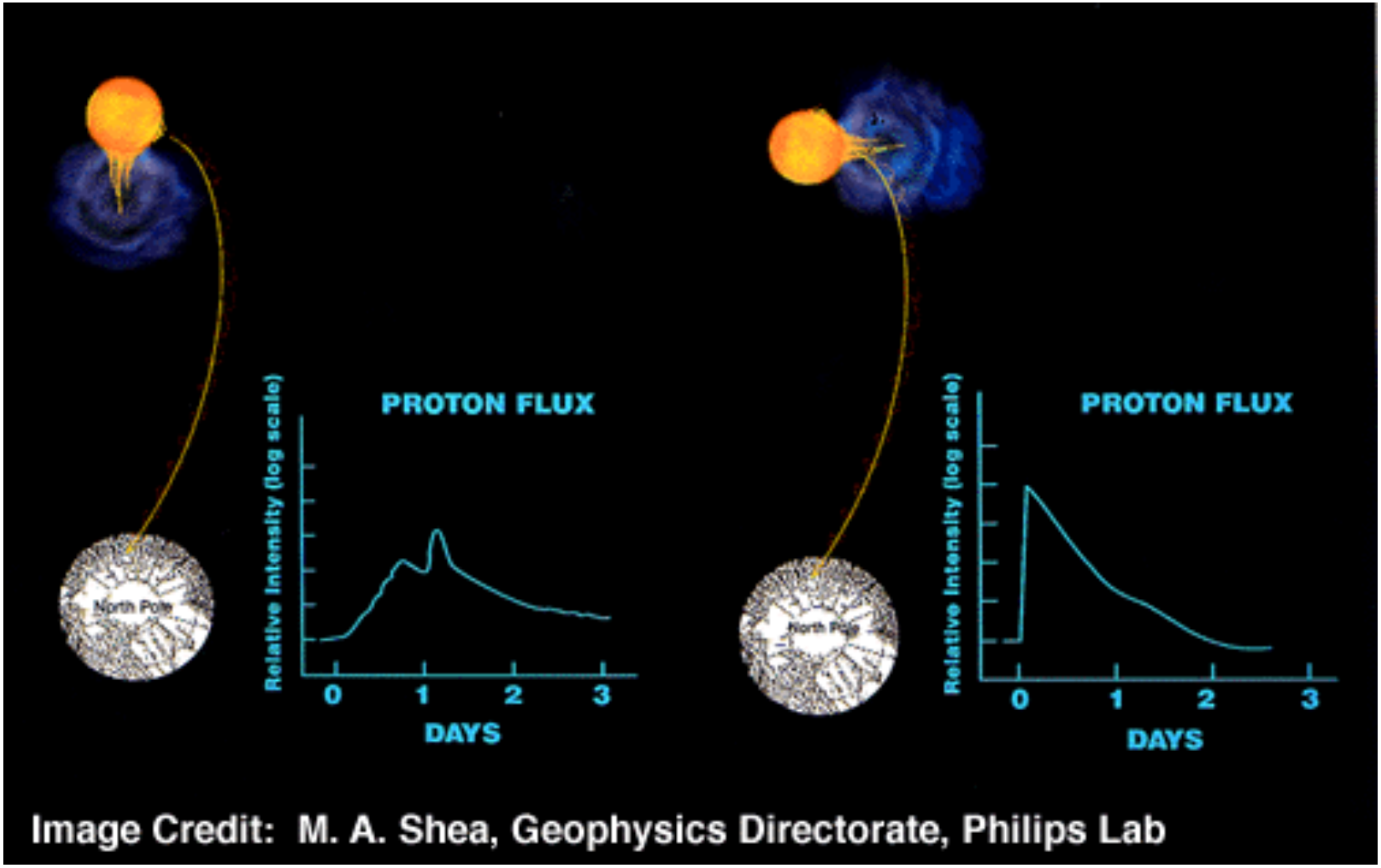
Solar Radiation

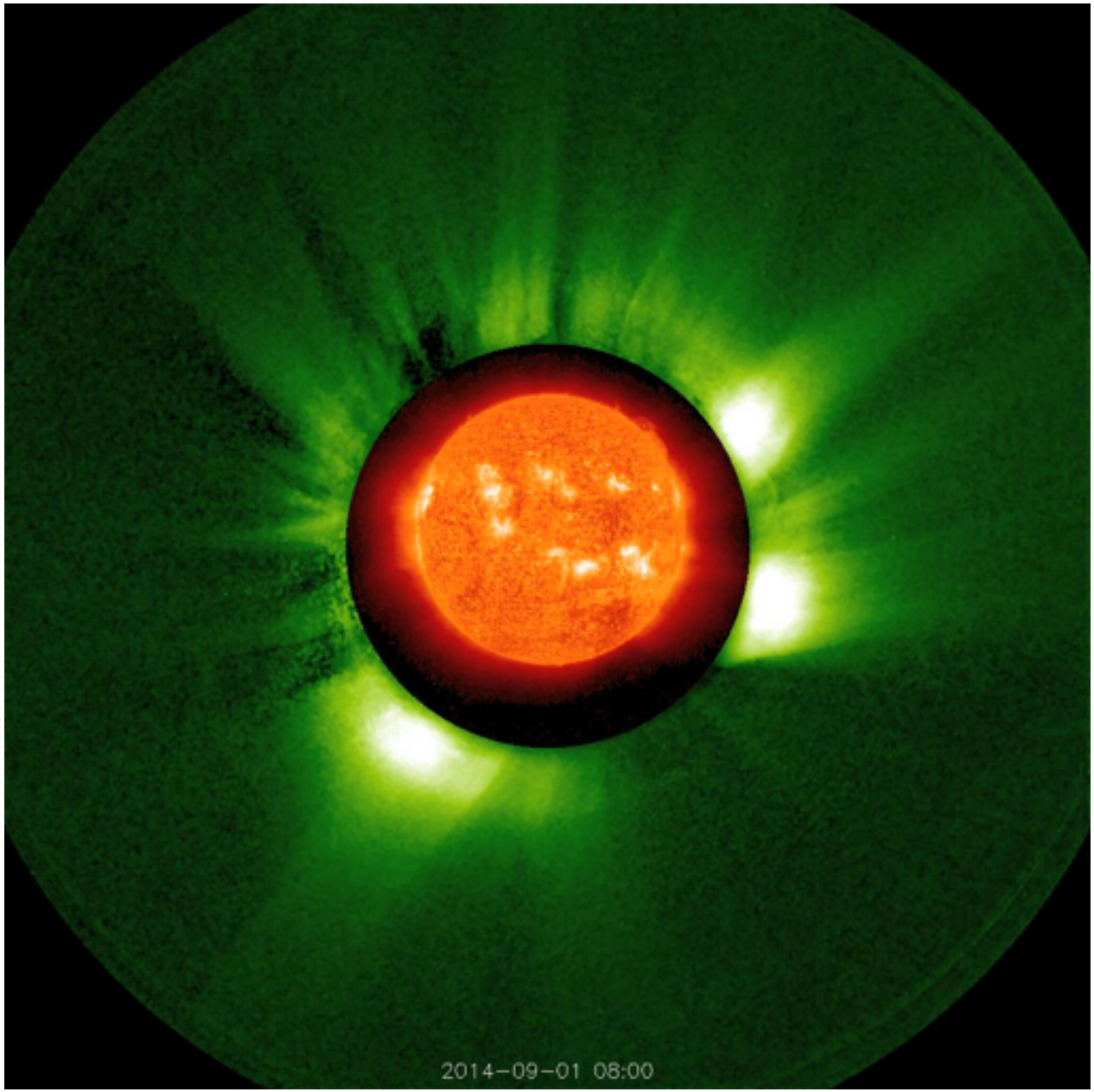


Ionospheric Effect of Flare



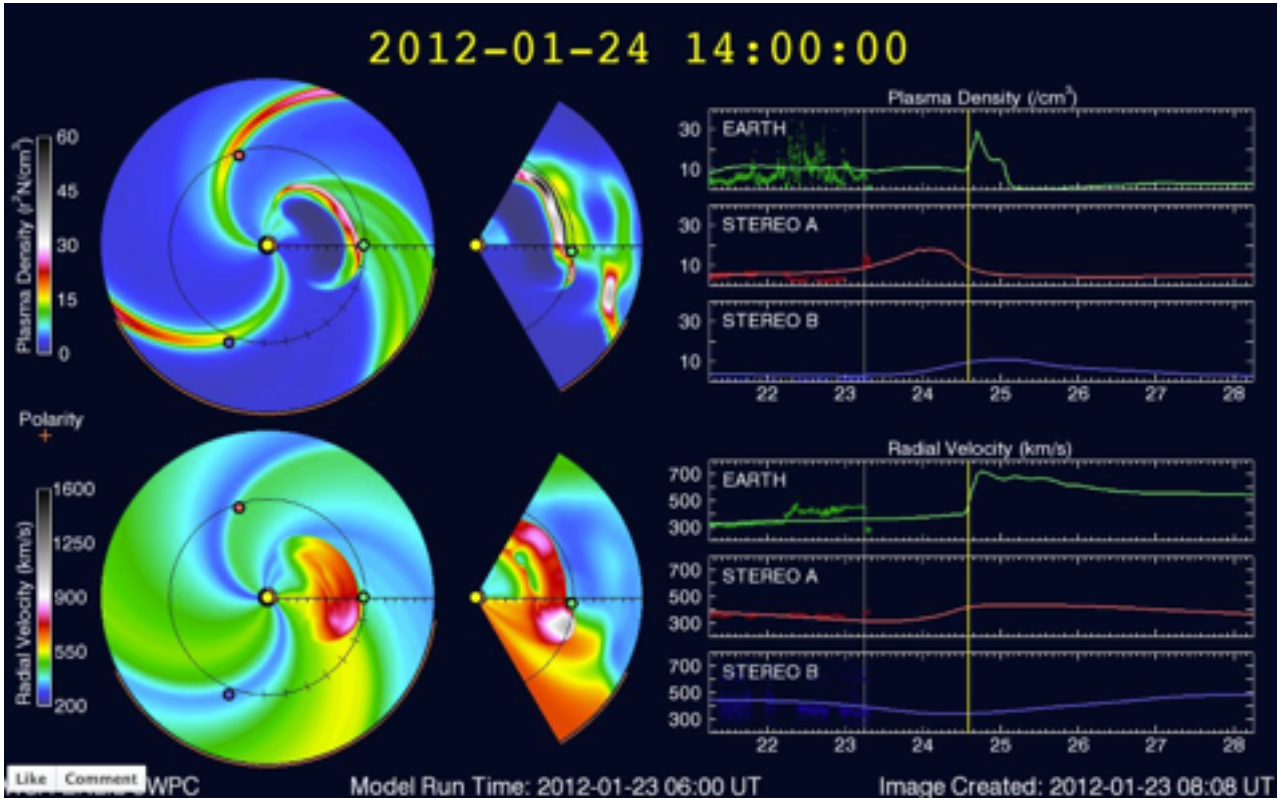
Solar Protons



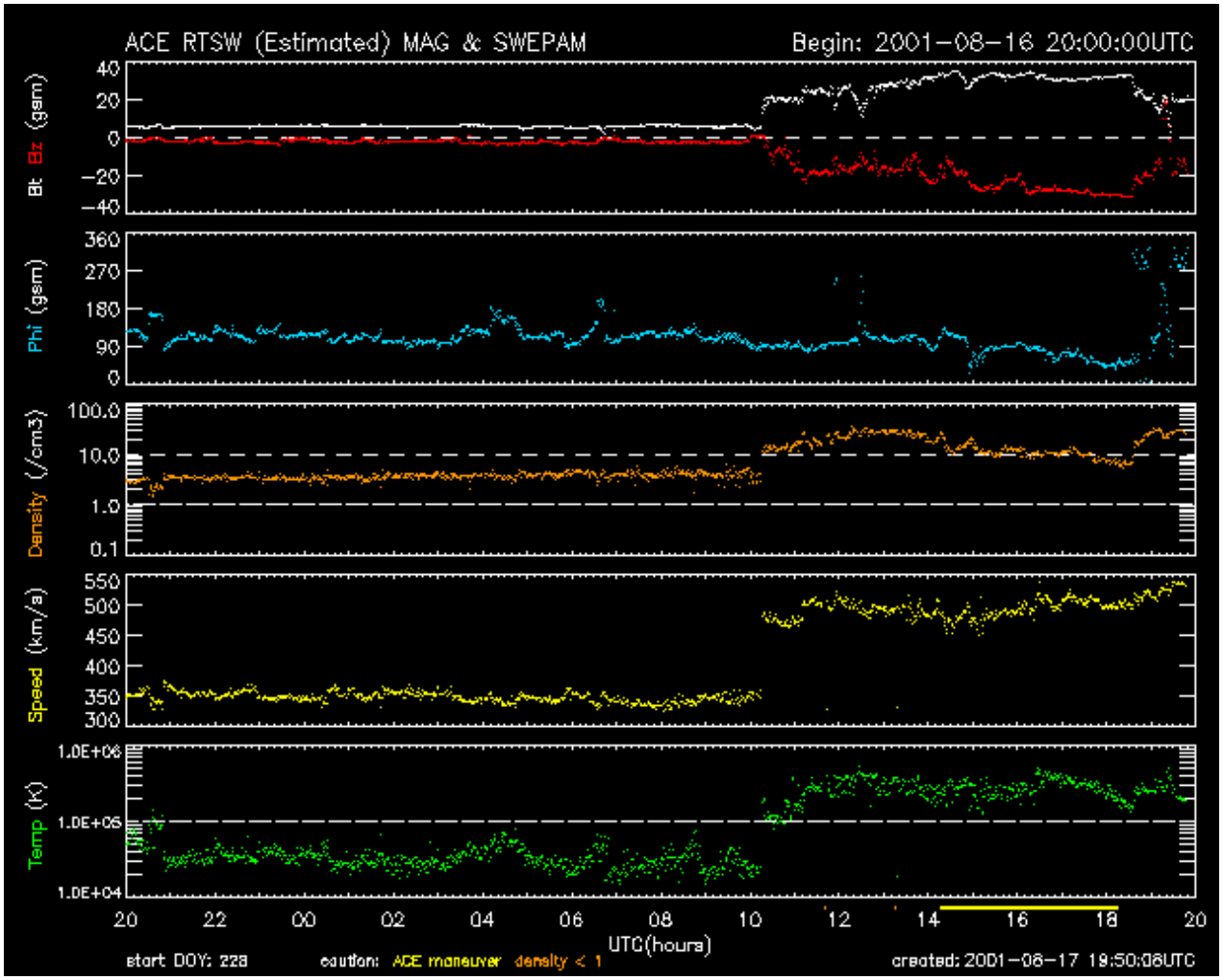

2014-09-01 08:00

Predicting Arrival

(the 93 million mile gap)



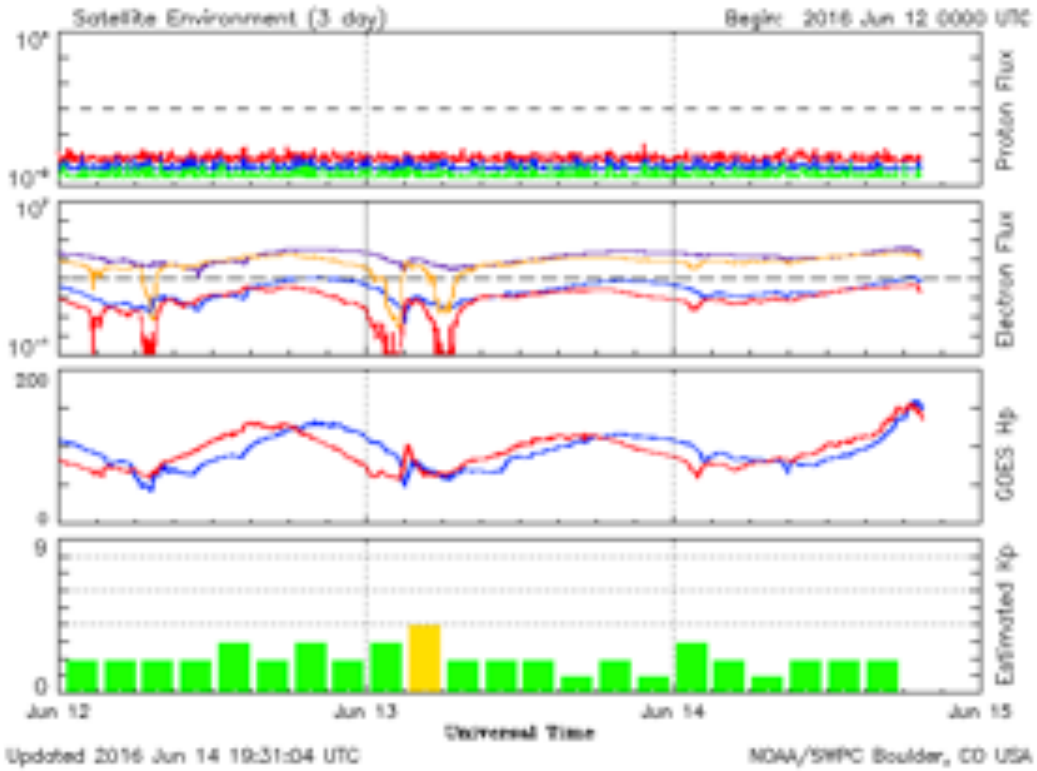
Solar Wind Monitoring



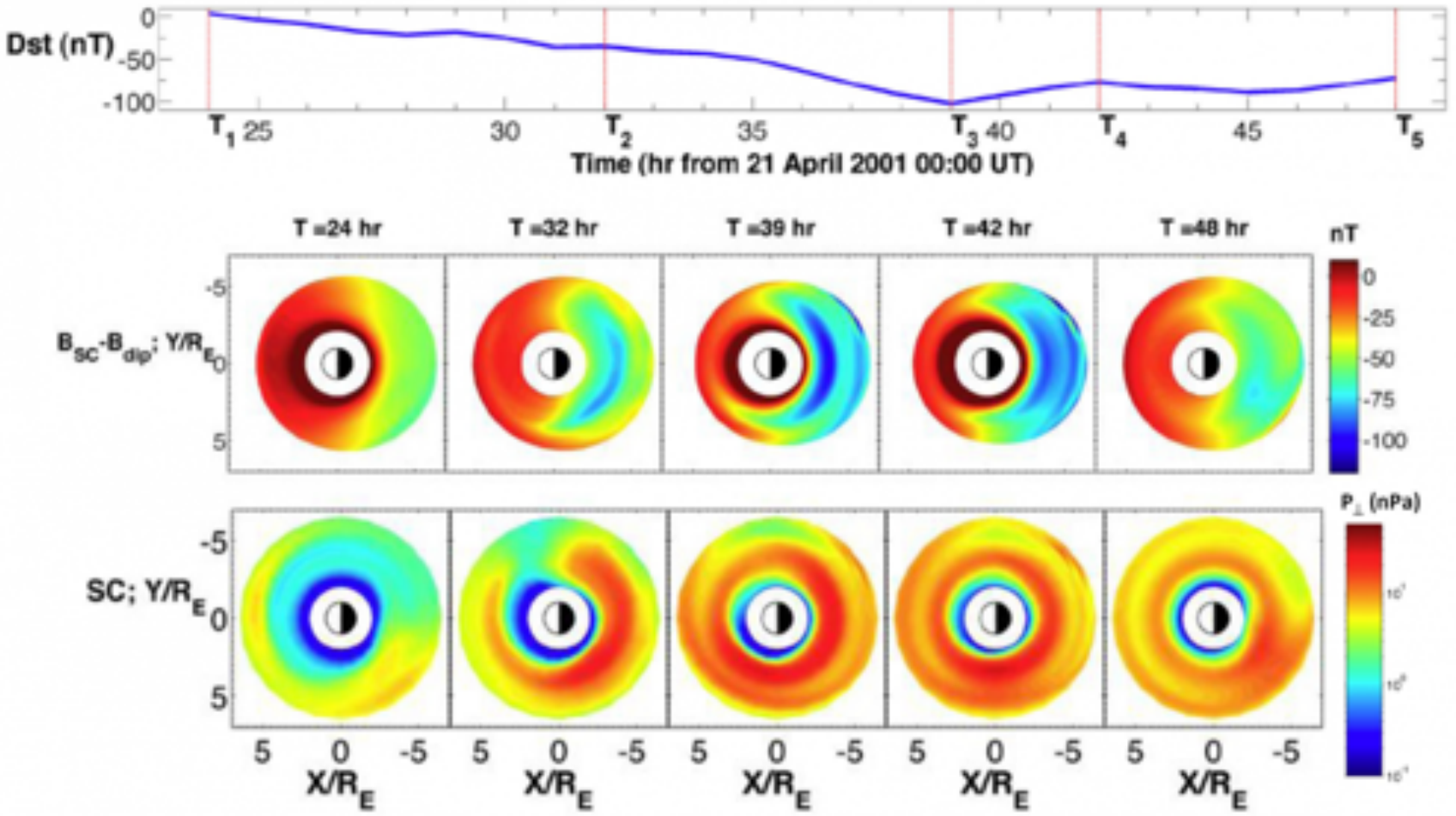
CURRENT SPACE WEATHER CONDITIONS on NOAA Scales

R none | S none | G none

SATELLITE ENVIRONMENT



Ring Current Particles



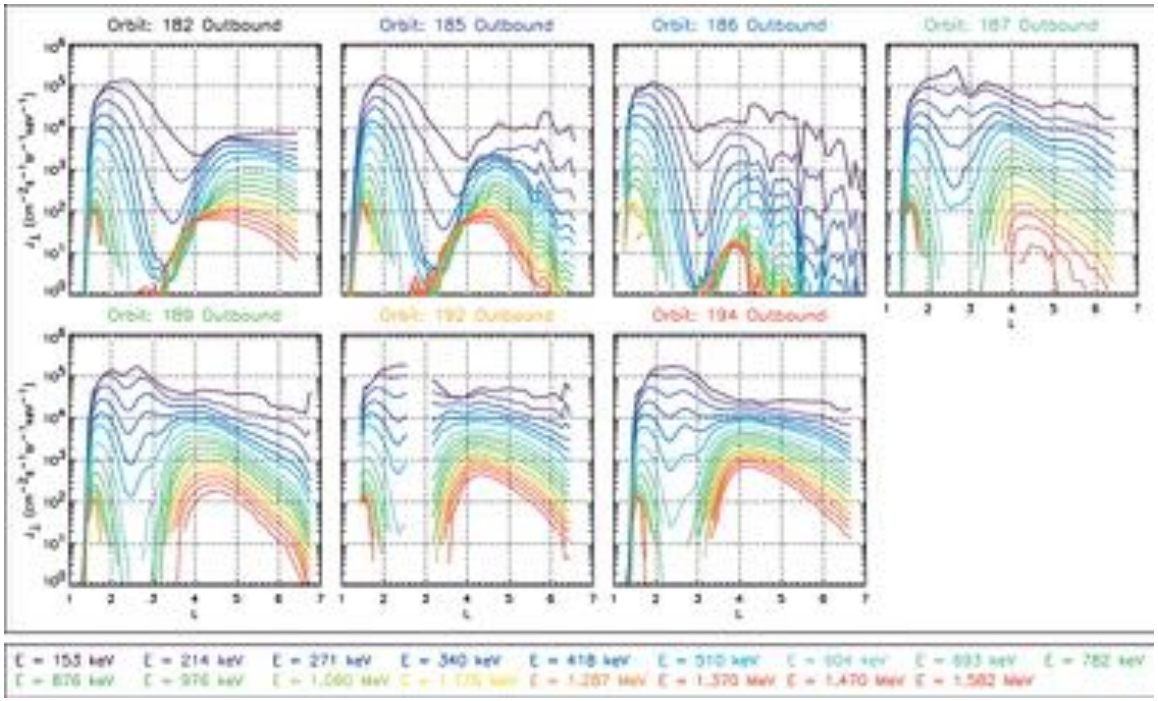


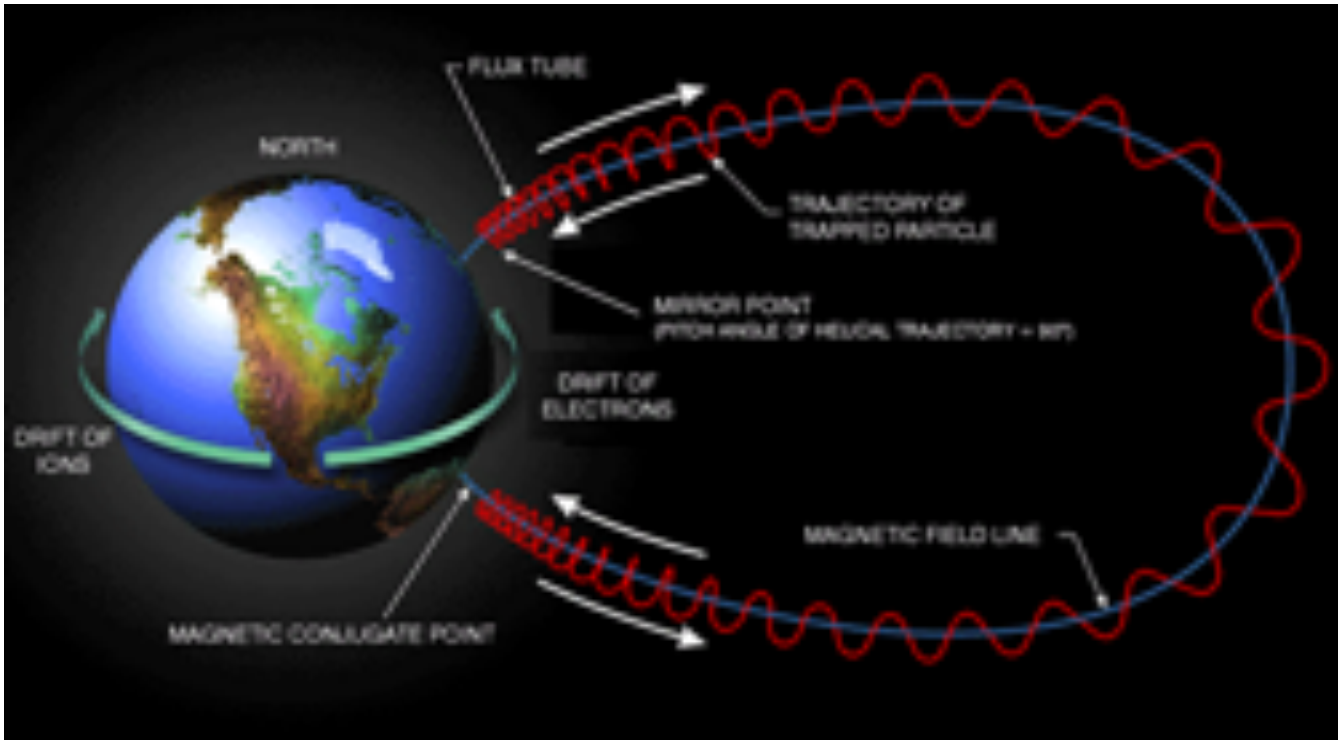
Fig. 1. Radial profile of electron flux measured by CRRES at energies from 153 keV to 1.58 MeV showing the two-zone structure of the radiation belts, and variability during geomagnetic storms (reproduced from Horne et al., 2003, Copyright 2003 American Geophys...

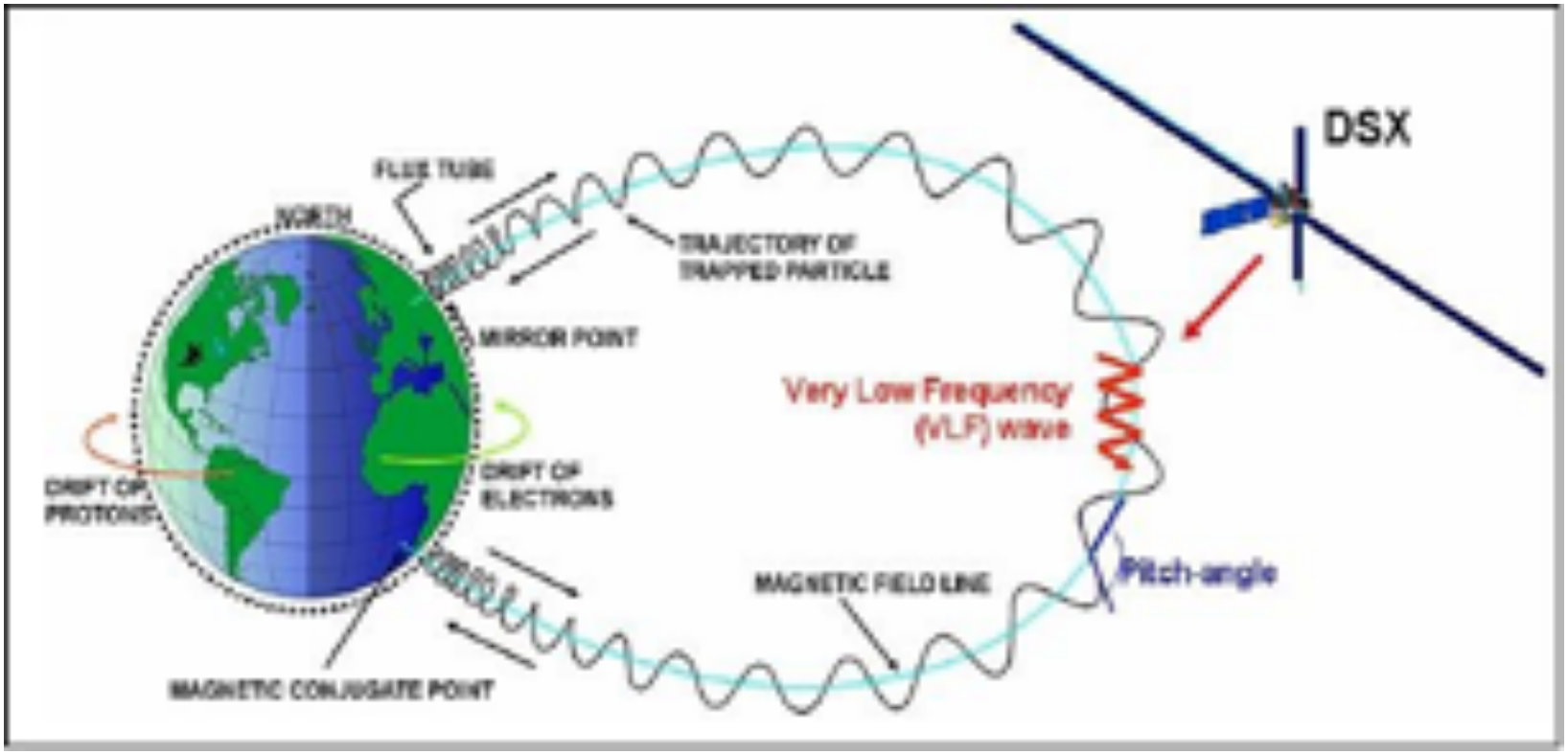
R.M. Millan, R.M. Thorne

Review of radiation belt relativistic electron losses

Journal of Atmospheric and Solar-Terrestrial Physics, Volume 69, Issue 3, 2007, 362–377

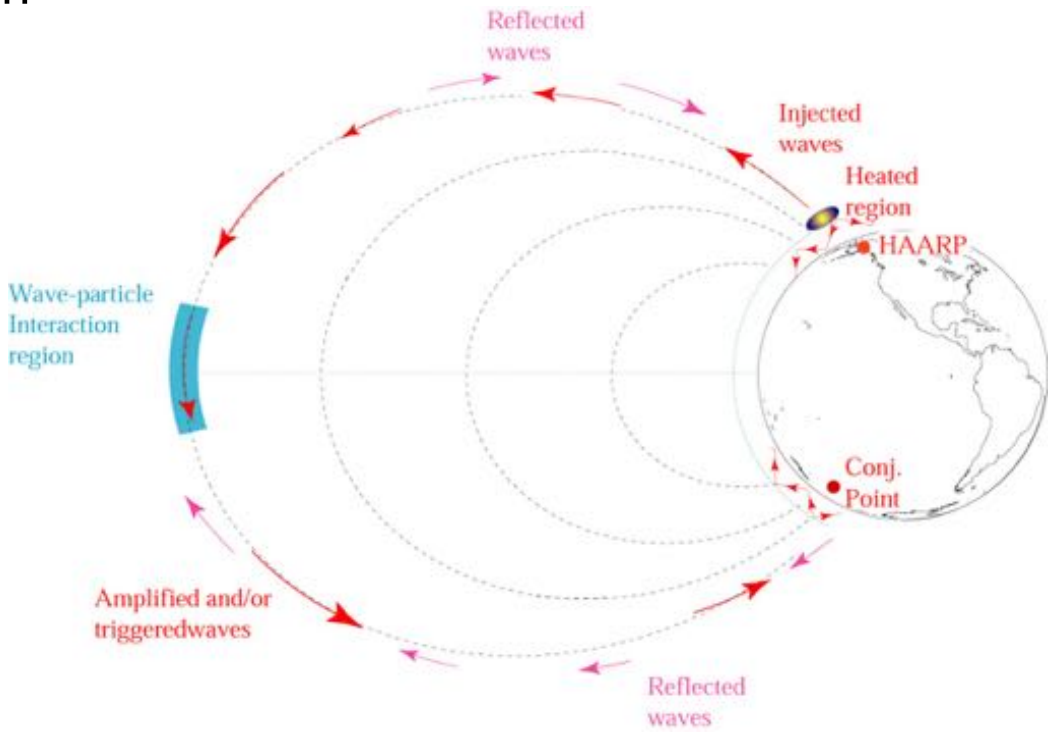
http://dx.doi.org/10.1016/j.jastp.2006.06.019


FLUX TUBE
NORTH
TRAJECTORY OF
TRAPPED PARTICLE
MIRROR POINT
DRIFT OF
ELECTRONS
DRIFT OF
IONS
MAGNETIC FIELD LINE
MAGNETIC CONJUGATE POINT


DSX
FLUX TUBE
NORTH
TRAJECTORY OF TRAPPED PARTICLE
MIRROR POINT
Very Low Frequency (VLF) wave
DRIFT OF PROTONS
DRIFT OF ELECTRONS
Pitch-angle
MAGNETIC FIELD LINE
MAGNETIC CONJUGATE POINT

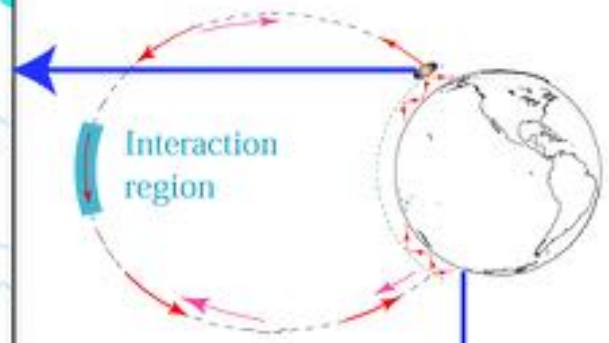
Why DARPA was interested in HAARP – **Controlling Space Weather**

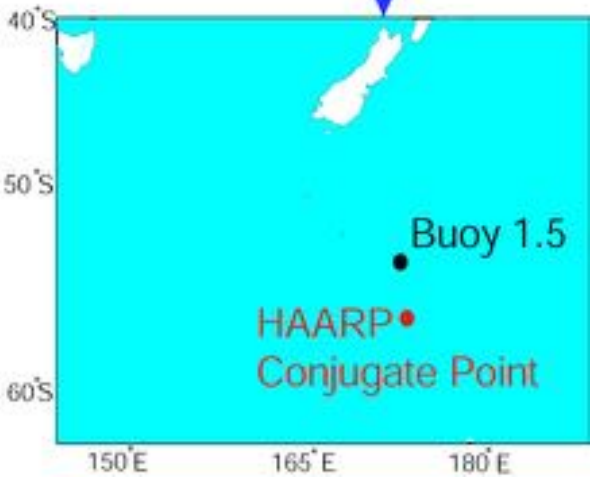
- High-energy electrons and protons in the Van Allen radiation belts are a major hazard to spacecraft
- VLF electromagnetic waves can act to remove particles from Van Allen belts
- Ionospheric heating can inject VLF waves into space
- HAARP location suitable for experiments of this type



Experiment Setup

- Alaska: Chistochina receiver site (36 km from HAARP facility)



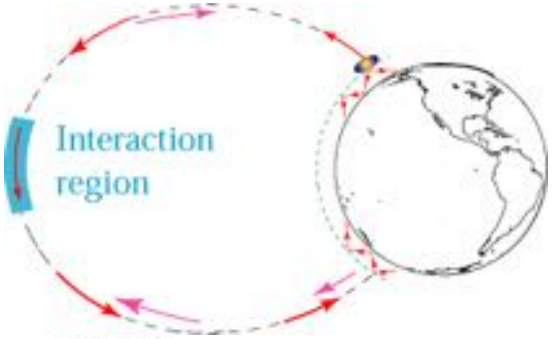


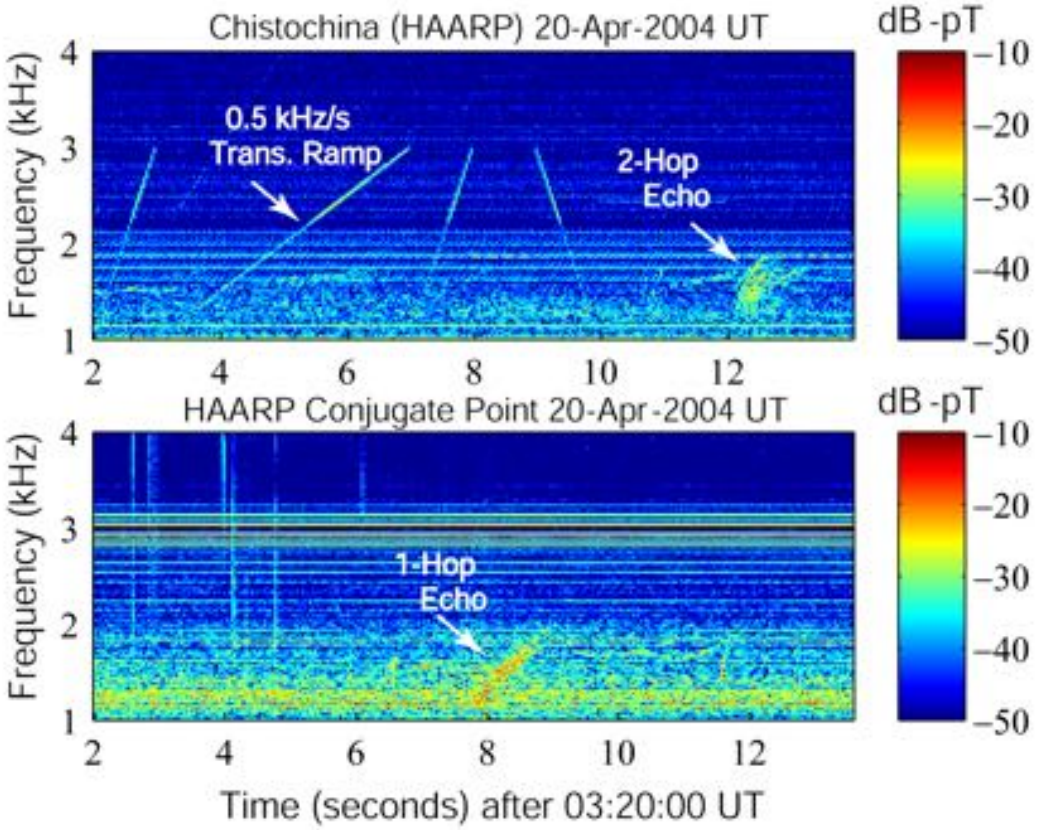
- Conjugate Point: ship-borne and buoy measurements

Slide shamelessly stolen from Mark Golkowski

First Observation (2004)

- Original HAARP Facility (960 kW)
- Echoes observed for ~30 minutes





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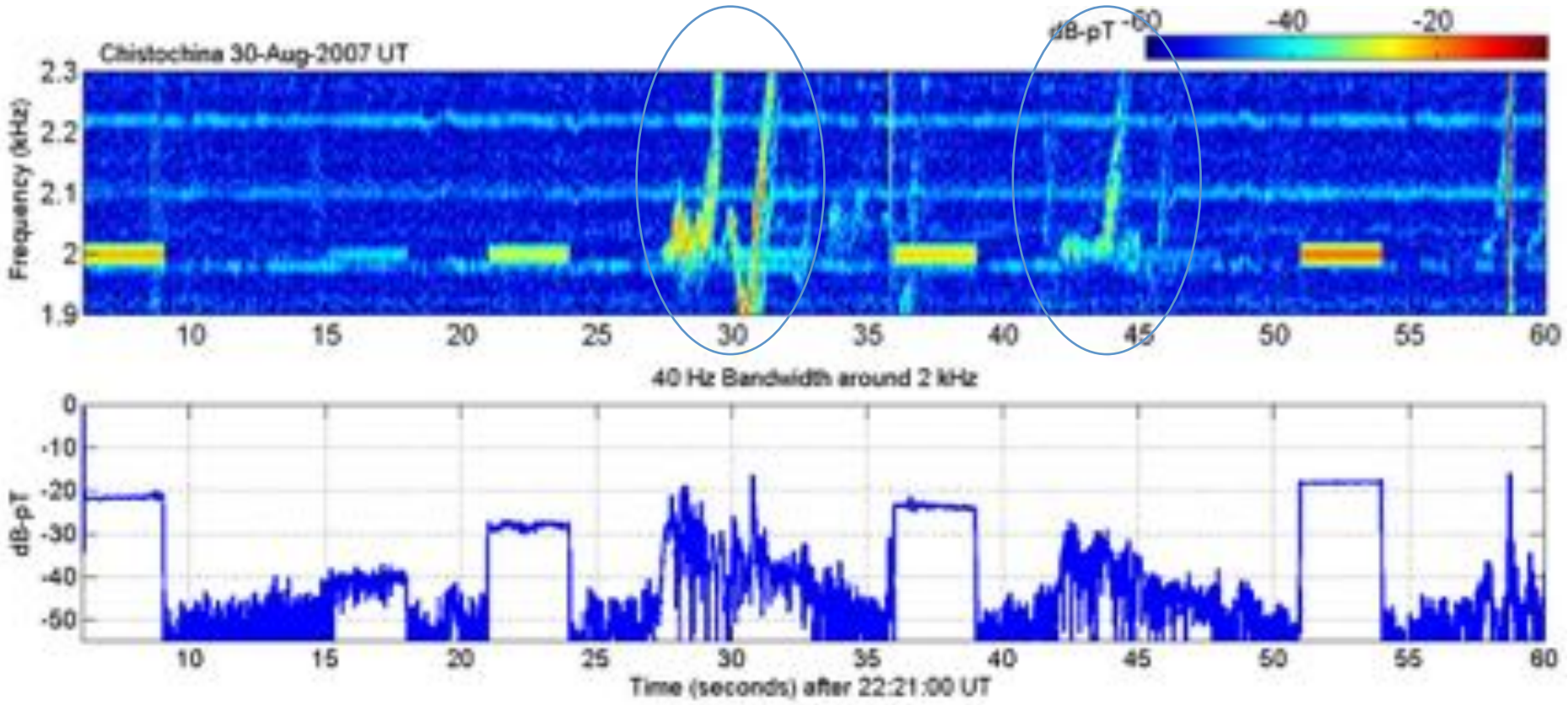
Different Methods of Generation

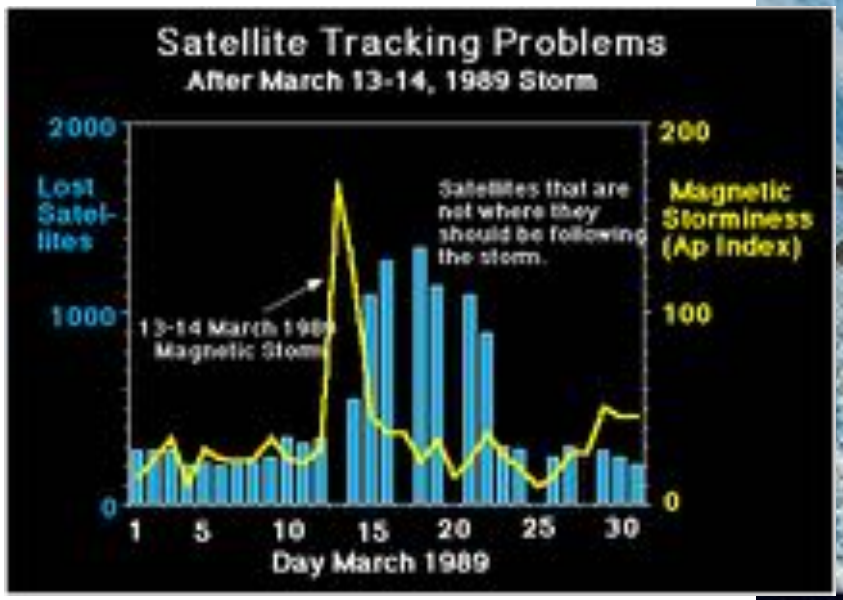


AM	Line Sweep	Circle Sweep	'Beam Paint'

- Stimulated emissions indicate removal of high-energy particles

Slide shamelessly stolen from Mark Golkowski

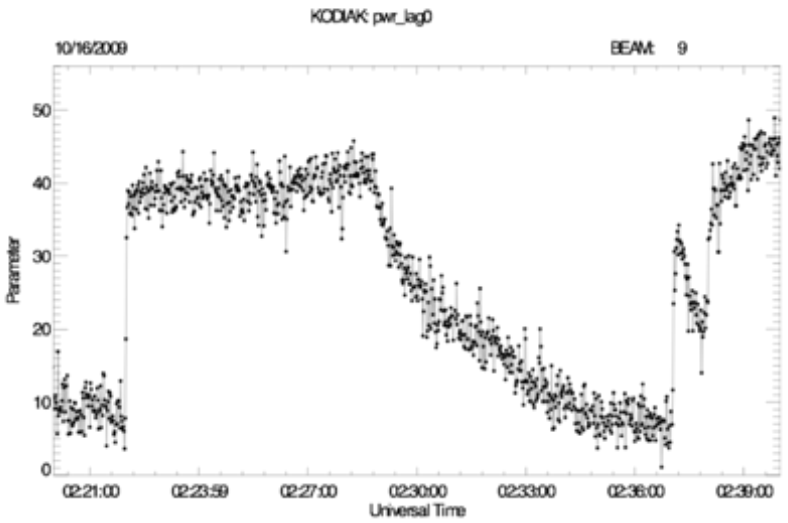
Space Weather Effects



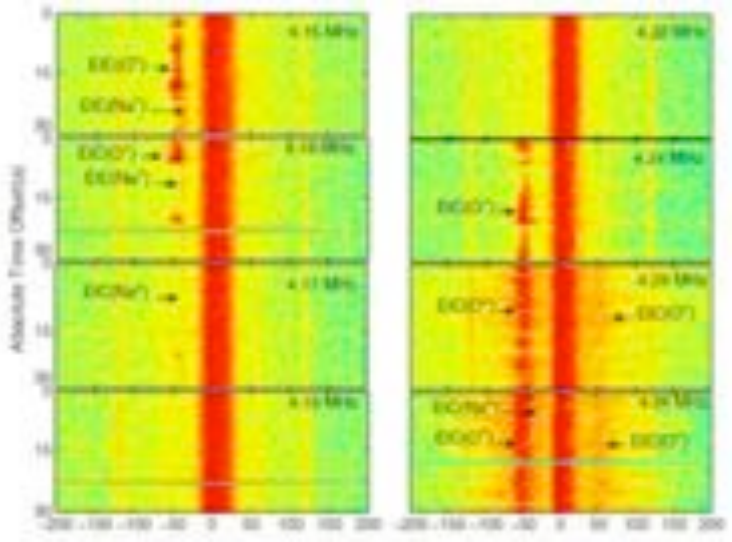
Atmospheric drag leads to uncertainty in orbit calculations.

We should learn how to predict drag

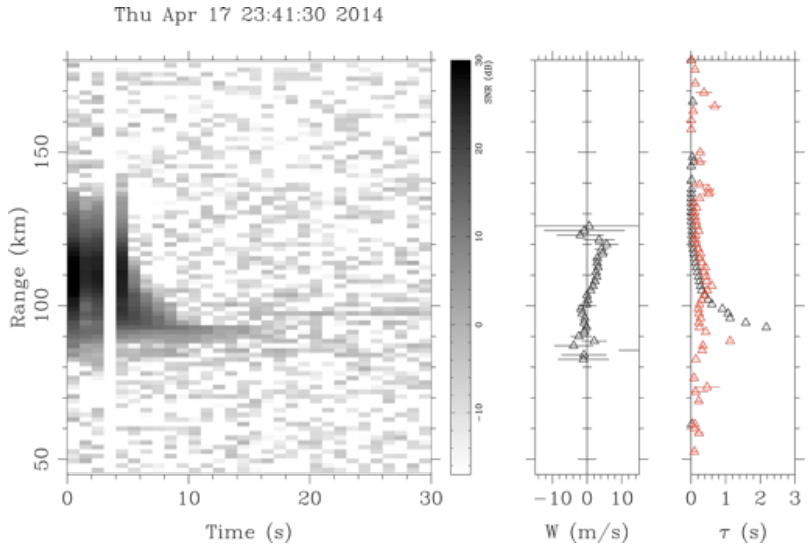
Use HAARP to Learn about Space Weather



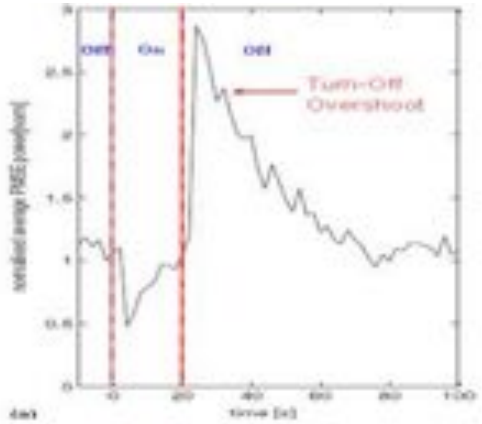
Formation and decay of FAI give estimates of diffusion



Ionospheric Composition from narrow band SEE



Neutral density and drifts and electron densities from API



Dust charging in polar mesospheric clouds

High Frequency Active Auroral Research Program (HAARP)

Its Purpose:

SUPER WEAPON FOR SPACE WEATHER RESEARCH

- 62.39 deg (North) lat; 145.15 deg (West) Gakona, AK
- Ionospheric Research Instrument (IRI) - phased array HF transmitter; 2.8 to 10 MHz; ~1000 acres; 5 x 3600 hp diesel engines; 3.6 MW; $290M
- Air Force Research Lab (RV) Kirtland AFB, NM