Status of NSF Space Physics

- Janet Kozyra
- Therese Moretto Jorgensen, Sunanda Basu, John Meriwether, Ilia Roussev

rogress on DRIVE

Diversify

- New Instrumentation: LISN, AMISRs, AMPERE-II. CubeSa

Realize

- Adequately fund existing instrumentation (ISR, SuperDARN etc.)

Integrate

- Interagency Plasma Physics & Laboratory Plasmas
- Multi-disciplinary INSPIRE awards (topics that fall through t cracks: i.e., planetary ionospheres, exo-planets)
- Space- and ground-based collaborations (proposed ICON/C – NSF collaboration, RAX & FISR ionospheric irregularities)

Venture

- Large-scale science investigations (IMAGE, EarthCube, FE NSF-NASA SpW Modeling, PREEVENTS)

Educate

- CubeSats
- Aurorasaurus

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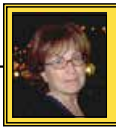

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ACI/Earth Cube

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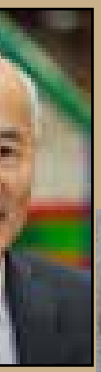

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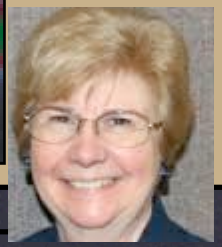

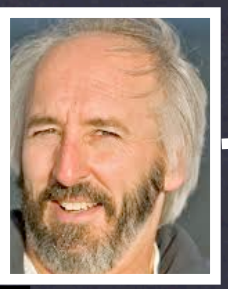

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ERIC
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ANJULI
BAMSAI

ATMOSPHERIC CHEMISTRY

SYLVIA EDGE

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DAVID
VERARDO

GEOSPACE
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JANET KOZYRA
ACTING SECTION
HEAD

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MAGNETO-SPHERES
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GEOSPACE FACILITIES
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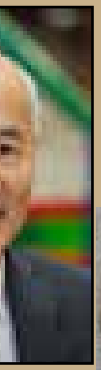

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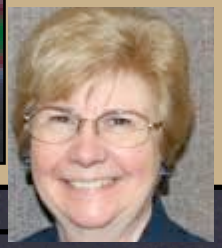

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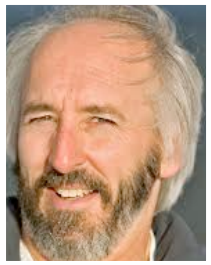

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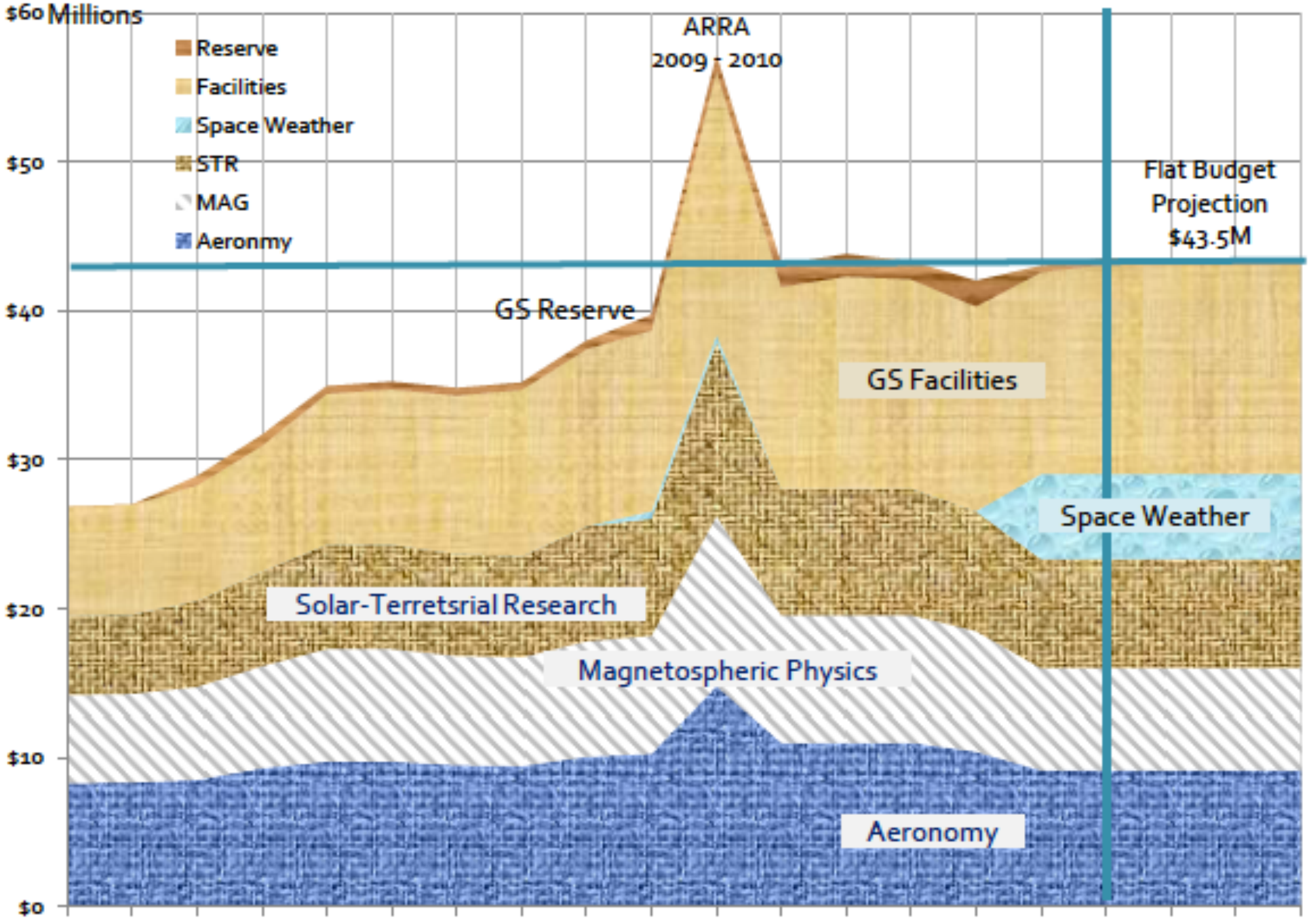
Geosciences Org Chart

U.S. Bureau of Labor Statistics' Inflation (http://data.bls.gov/cgi-bin/cpicalc.p

$1.00 in 1999 equals to $1.41 in 2015



- ***PR Committee membership (13 members; January 2015)***
- ***Criteria and strategy (January-February 2015)***
- ***PR Committee Charge and Formation (February 2015)***
- ***PR Teleconferences (March 4, 16, and 31, 2015)***
- Collect data and begin assessment (February – March, 2015)
- First PR Committee in-person meeting at NSF (April 6-7, 2015)
- Seeking community input via emails and workshops (April – June 2
  see (http://www.nsf.gov/geo/ags/geospace-portfolio-review-20
- Visiting selected facility sites (tentative; April – June, 2015)
- PR Committee drafts their report (June - August 2015)
- Second PR Committee in-person meeting at NSF (August 2015)
- GS Portfolio Review Report to GEO/Advisory Committee (Sep 2015
- GEO/Advisory Committee reviews the GS/PR Report (October 201
- GS programs response to the PR Committee Report (November 20

AS Assessment of Portfolio Revi

Funding in place to begin

Purpose: Evaluate consistency of PR with decadal survey recommendations taking into account actions already taken by expected budget evolution, scientific balance, alignment betwe facilities & community science needs, new technology development, balance of investments across portfolio

SPA Newsletter 9 Oct 2015: Request for suggested committ members (Deadline COB 20 Oct)

- 12 members, first meeting planned for ~Nov 2015
- Meet 3 times in 5 months starting with the publicly availabl Portfolio Review (1st draft report to AC GEO Oct 2015)
- Pre-publication version of assessment in 10 months; final re in 12 months (~ Oct 2016)

Transitions

Arrivals:

- John Meriwether, Facilities Program Director

Section Head Search – nearing completion

Program Director searches in progress for:

- Aeronomy PD
- Floating PD contributing to all programs

R FY 2015

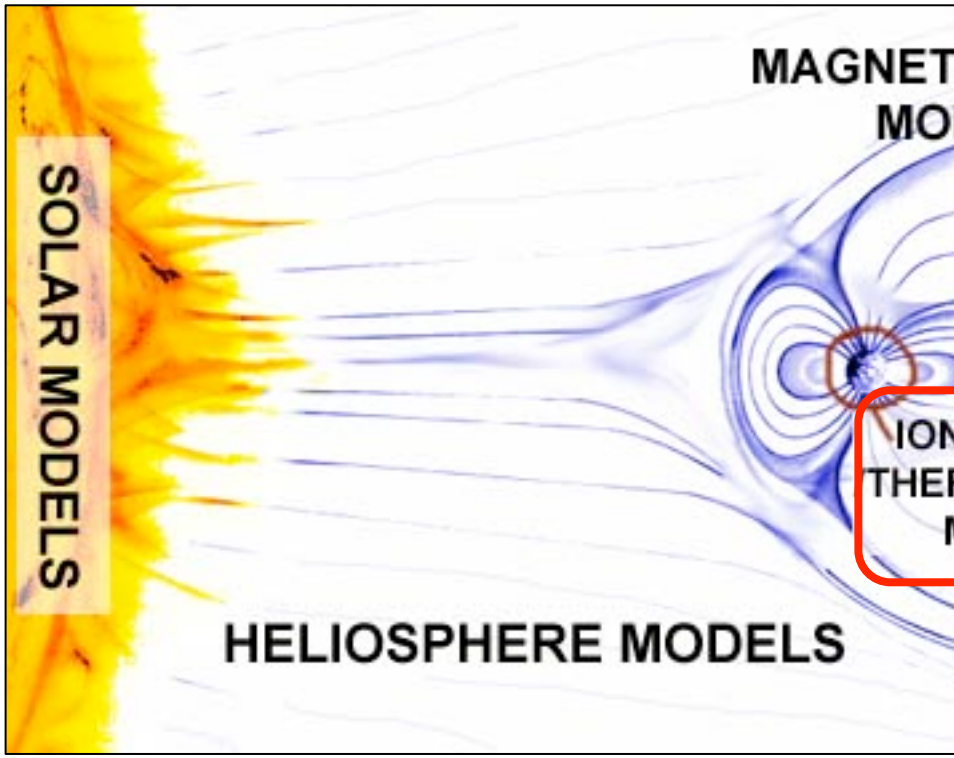
proposals (33 independent projects) submitted
DAR proposal review panel, 13-15 Oct 2015
new awards (~20% proposals), ~$1.0M
xt competition deadline is 18 July 2016

FY 2015

proposals (45 independent projects) in Oct 2014
nel review was 8-10 April 2015
roposals to be funded (16%), $800K
xt competition deadline is 15 Oct 2015

E FY 2015

proposals (45 independent projects) 2014 competition
virtual panels: 12-14 Nov and 17-19 Nov 2014
proposals funded (25%), $1.2M for new awards



Supporting Education Initiatives

Enhancing ITM Capabil

	PI	Institutions	Description	Da Am
ls, ns &	Ja Soon Shim, et al.	CUA	Expanding ITM models, visualization and analysis tools, developing ensemble modeling, leading community-wide ATM model validation activities and adding data assimilation models.	9/2 9/2 $20
, , ent	Masha Kuznetsova et al.	NASA GSFC	Promote space environment awareness in core education, facilitate the establishment of SpW university programs worldwide, provide	9/2 9/2

Geospace Facilities Program

- Program Director, John Meriwether
- Six incoherent scatter radar sites (five awards:~$12M)
- LIDAR Consortium (six institutions: ~$2M)
- Miscellaneous facility-related awards

RISR-North

PFISR

Sondrestrom

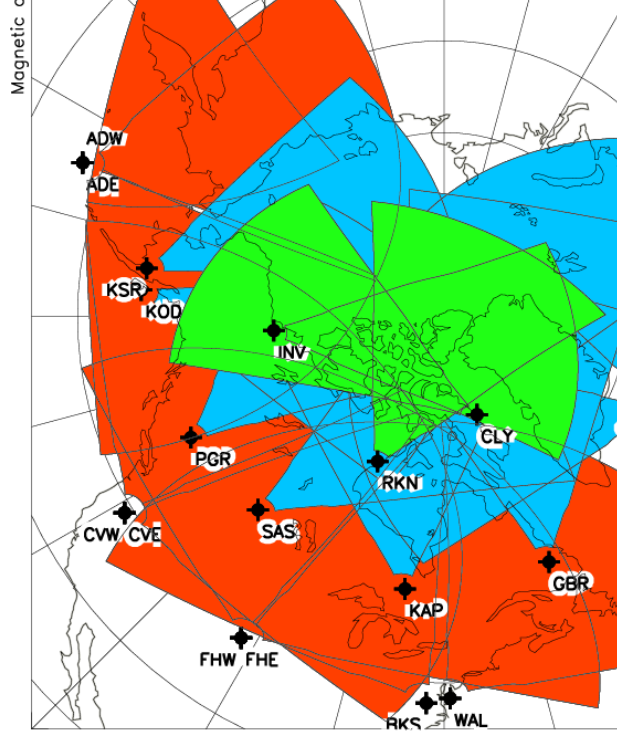
Construction complet
(summer 2015) of the
second (south-facing)
Advanced Modular
Incoherent Scatter Ra
(AMISR) at Resolute
Canada.

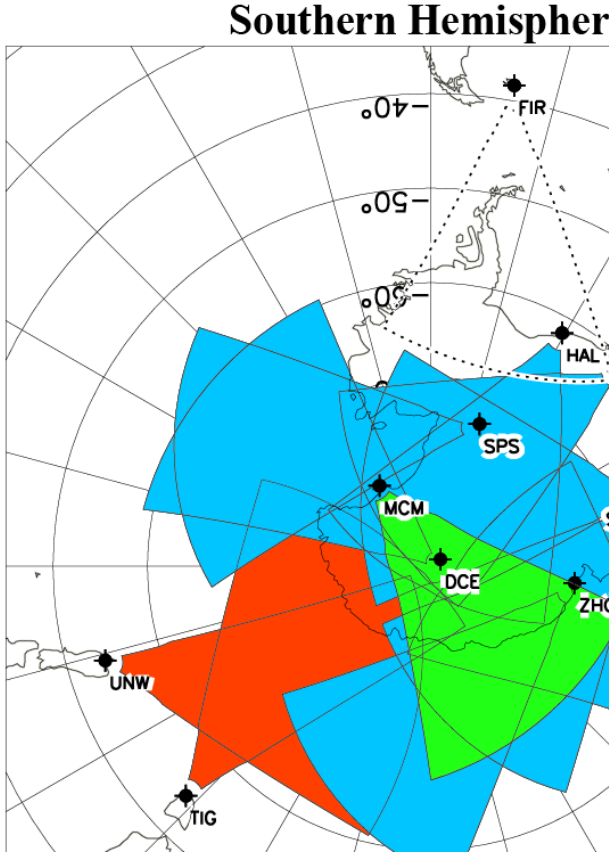
ew radar completes a
-its-kind pair looking in
ite directions into both the
polar cap and into the
where the northern lights
a borealis) form

5 SRI International.

SuperDARN:

- All 11 U.S. Northern Hemisphere radars are now in one award:
  - Extended consortium: VT, JHU/APL, UAF, Dartmouth
  - Total award $4.7M
- Two NSF-funded radars are operational in the Antarctic:
  - South Pole and McMurdo
  - Total award $1.2M





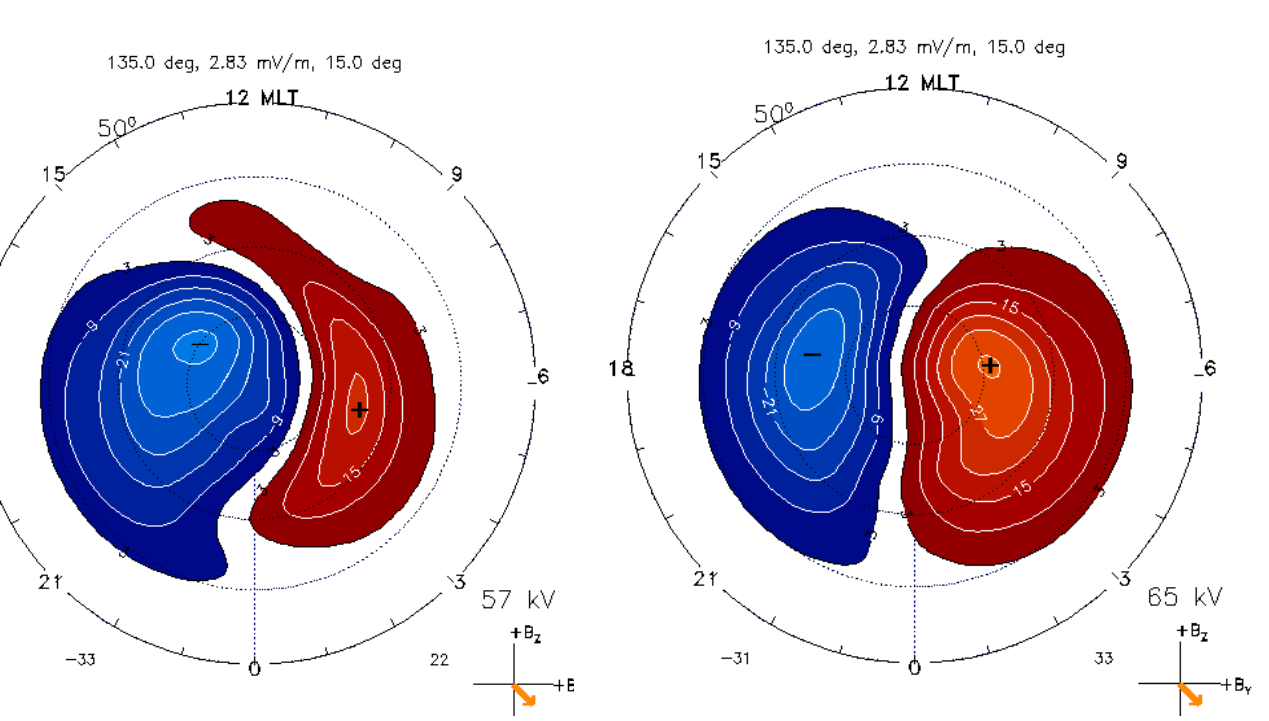
SuperDARN is a worldwide collaboration of 34 radars funded by 11 different countries!

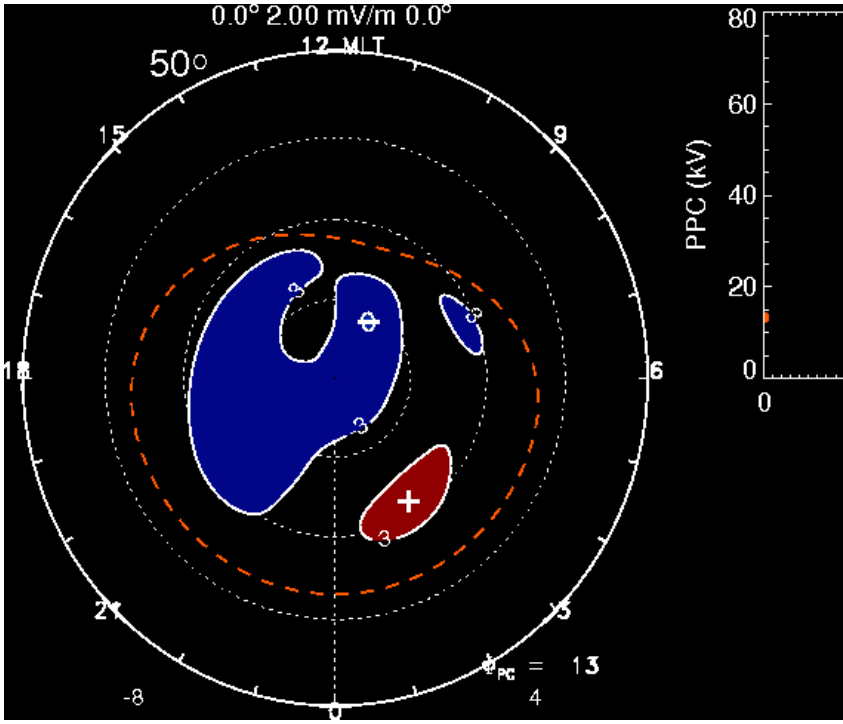
Virginia Tech
Invent the Future®

THAYER SCHOOL OF ENGINEERING AT DARTMOUTH

JOHNS HOPKINS UNIVERSITY

UAF UNIVERSITY OF

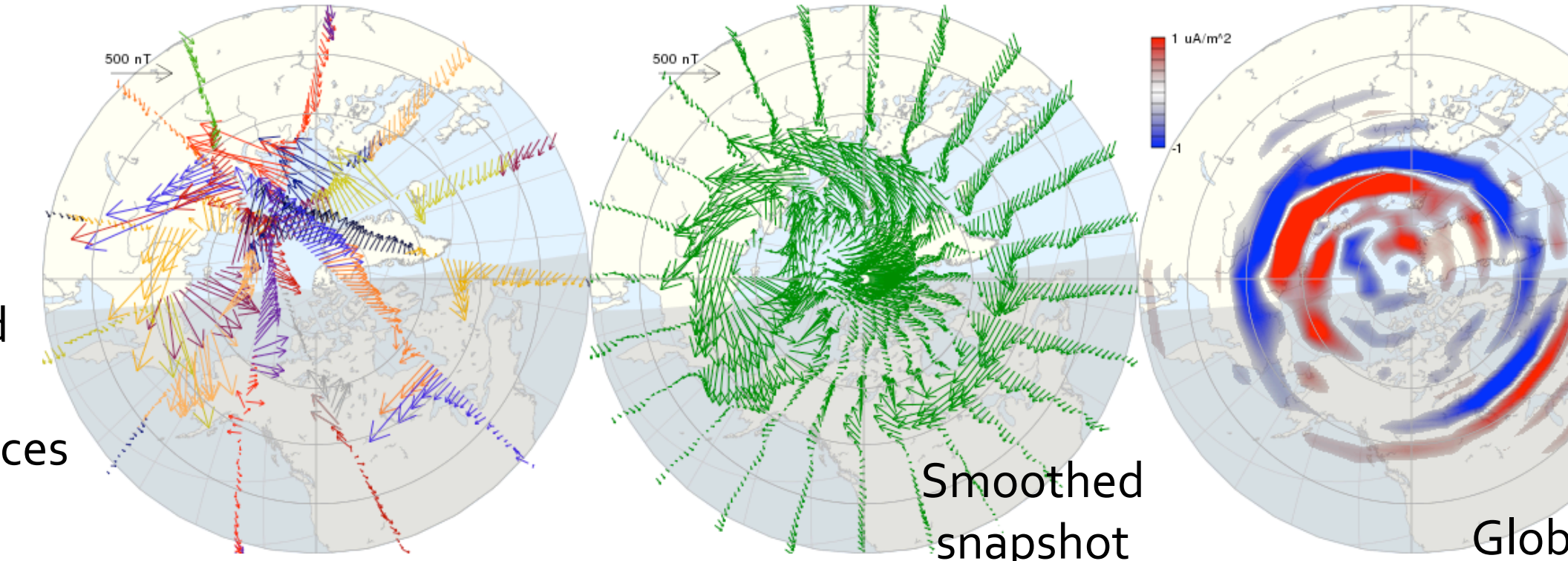




- Climatological convection patterns derived from the North and Southern hemispheres
- SuperDARN data reveal interhemispheric asymmetries ar strong dipole tilt factor (left two panels)
- Results have been coded into a new dynamical convectio model (right panel)
- Dominant modes of variability have been related to the I components through the Empirical Orthogonal Functions analysis

- $5.1M Award for continuation of AMPERE and installation on Iridium NEXT

Global Space Weather Research Facility
(every ~10-min snapshots of both Polar Regions)



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Smoothed snapshot

Glob
sna

- SuperMAG

- $450K award for continuation of SuperMAG service to

1: Development of Global Currents

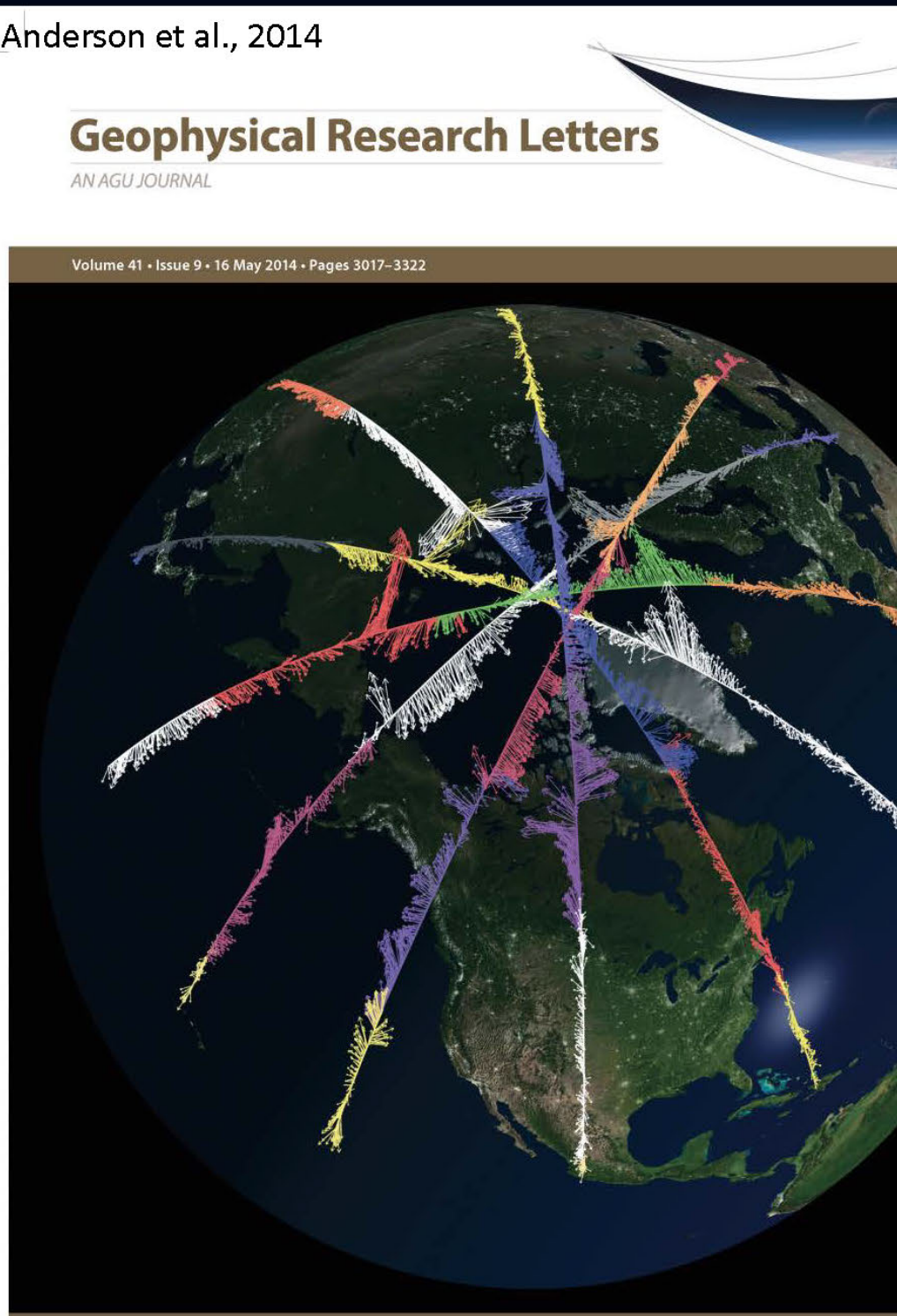
rst global measurements of
rkeland currents that drive aurora
nd ionospheric electrodynamics.

lobal coverage, 9-min. cadence
dium constellation: >70 satellites,
orbit planes, ~11 satellites/plane.

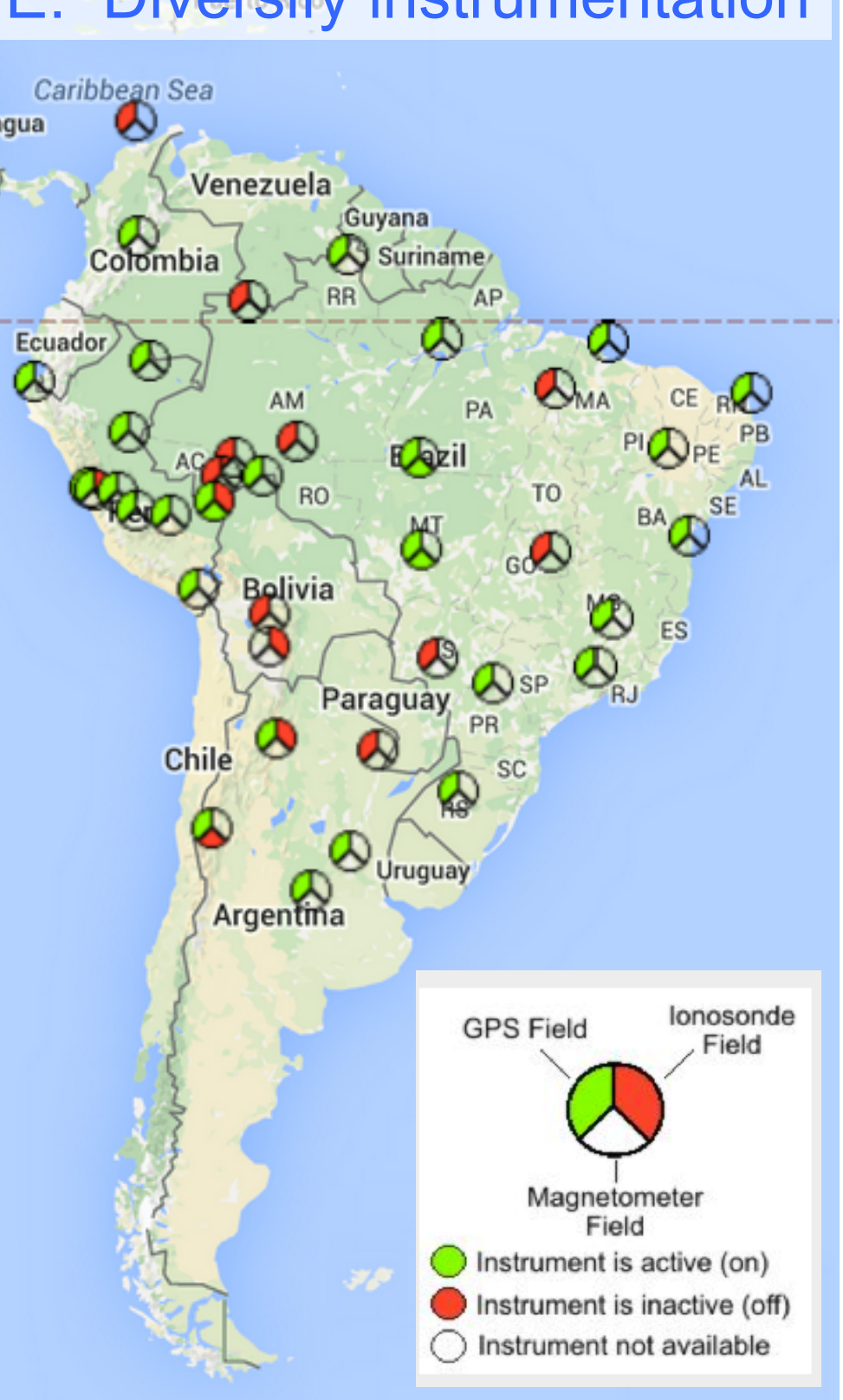
urrents develop first on the
ayside and only after onset near
idnight does the global average
attern develop.

lajor shift in understanding: Prior
onception that the poleward
urrents are 'driven' and the
quatorward currents are a
esponse' is wrong

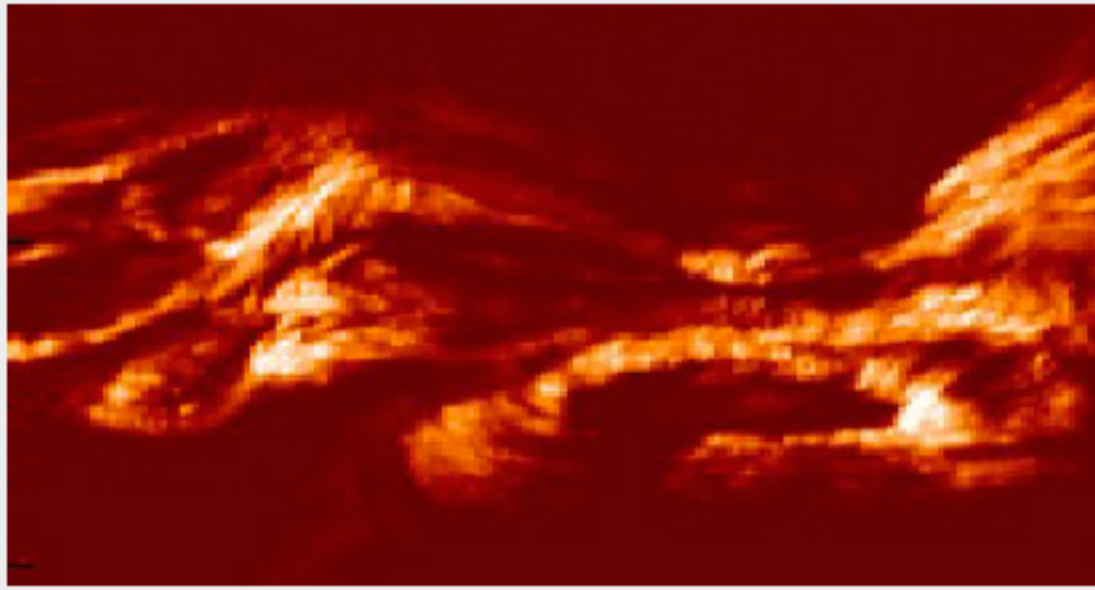
Anderson et al., 2014



2. Diversify instrumentation



Started with MRI award in 20

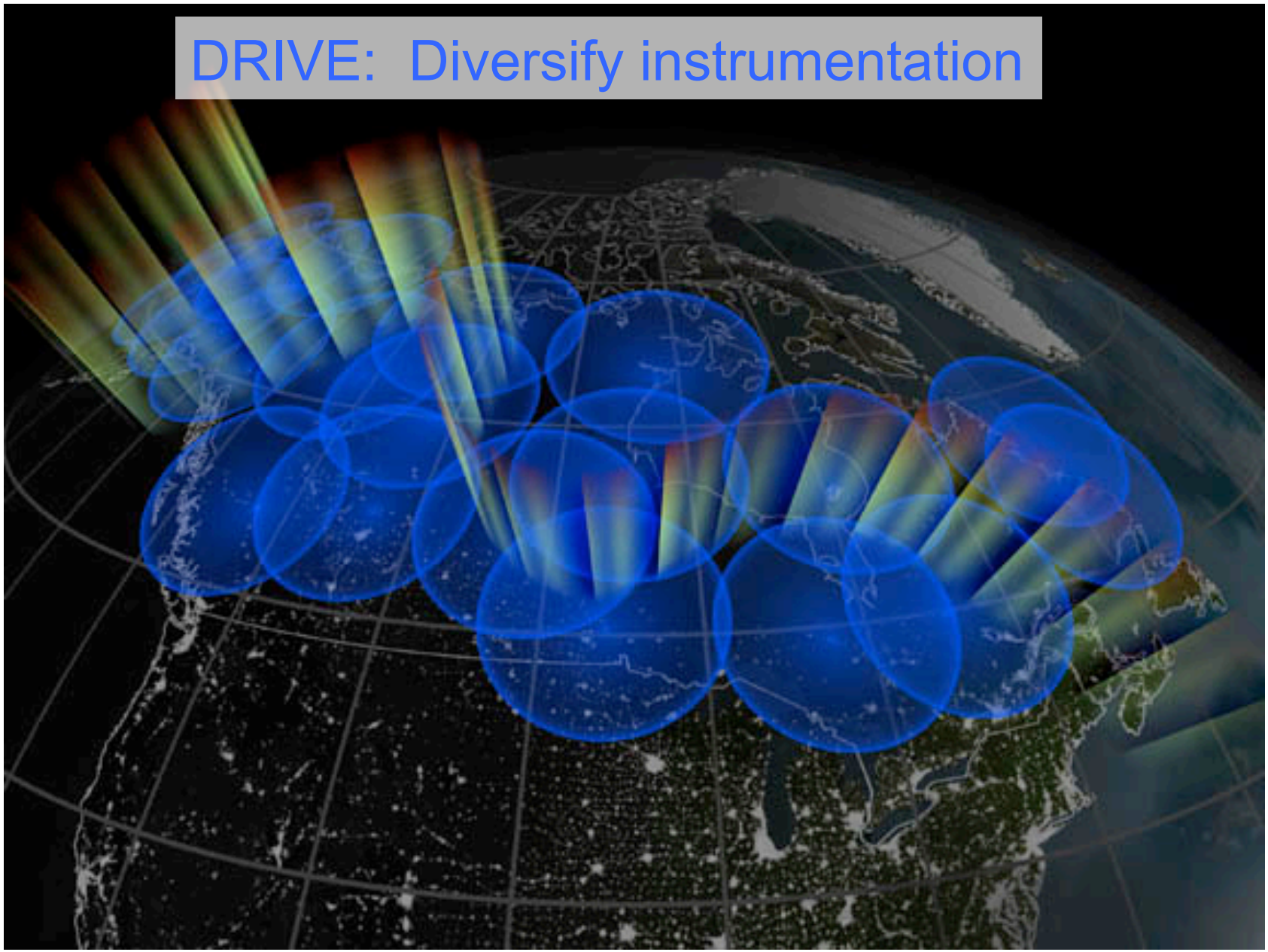


Spread F phenomena

Next steps: Develop real-time assimilation to
drivers (i.e., meridional winds, vertical drifts); v
assimilations with Jicamarca radar & FPIs; dev
forecast capabilities

LISN workshop held 1-9 Aug 2015 at Jicamarc
participants how to deploy instruments & analy
participants from 7 South American countries.

No funding for operation, no funding for scienc
original MRI. Will now compete in the individu
programs for science funding.

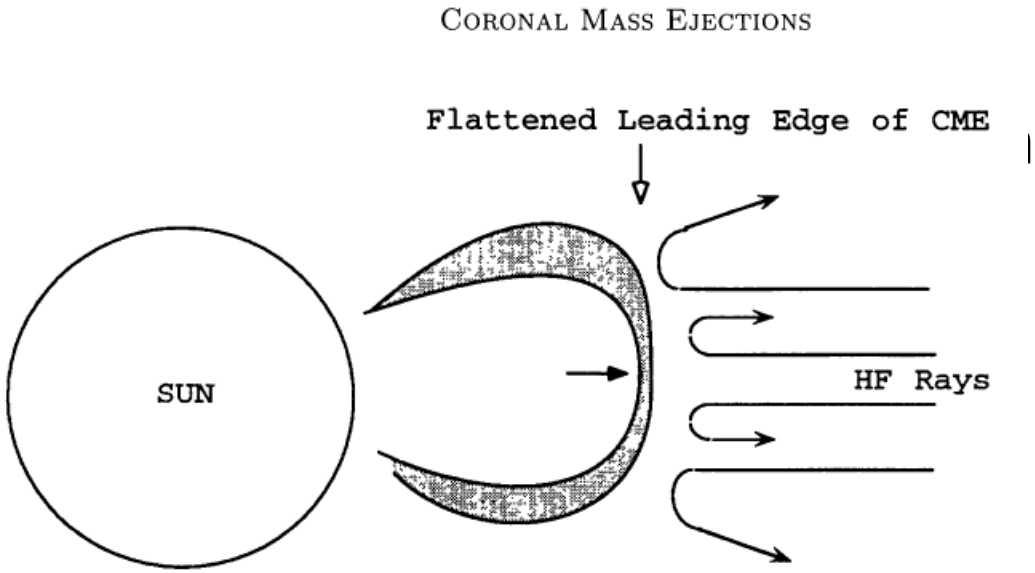


g September 1, 2011 NSF agreed to fund operation of the Alaska/Greenlan
or the next 5 years under the name:
d-based Imager and Magnetometer Network for Auroral STudies (GIMNAST

loring New Observing Capabilities for Ra

ME events are known to be
ctrostatic waves.

ch waves would possibly
nerate coherent radar echoes



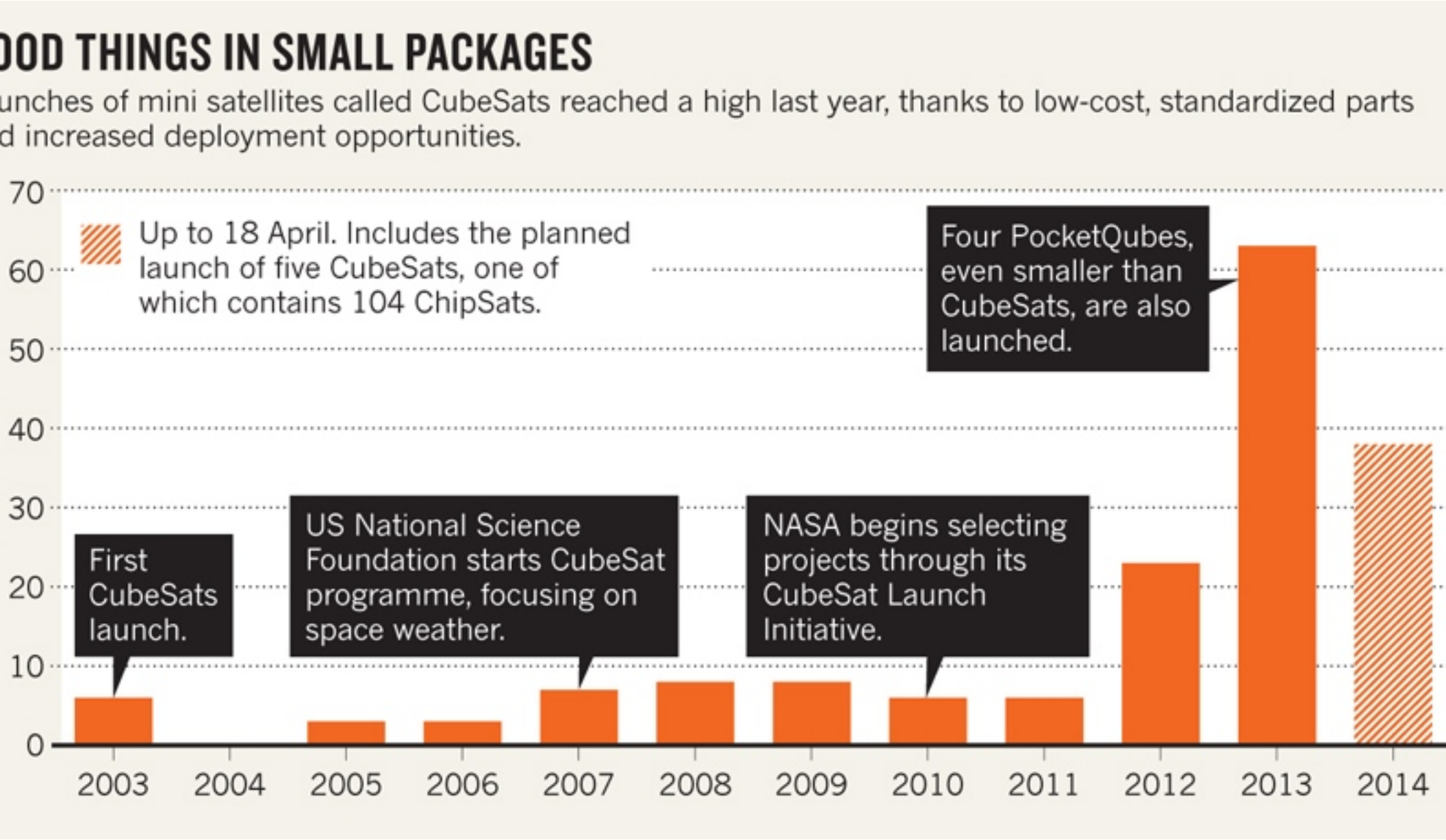
Rodriguez 1996

e prospects of detecting in real
e a CME event would open the door to new exciting science enabling grou
sed exploration of CMEs as they interact with the Earth's magnetic field.

estigation of the *feasibility* of such a radar is underway within the ISR comm
e vision is for a new ISR facility located in the southwest where land is chea
skies generally clear enabling simultaneous optical observations (OASIS).

mmunity Initiative led by Prof Dave Hysell (Cornell) to hold a Geospace-ori
rkshop entitled, "Exploring the Geospace Frontier Quo Vadis". Tentative ti

NSF role in CubeSats



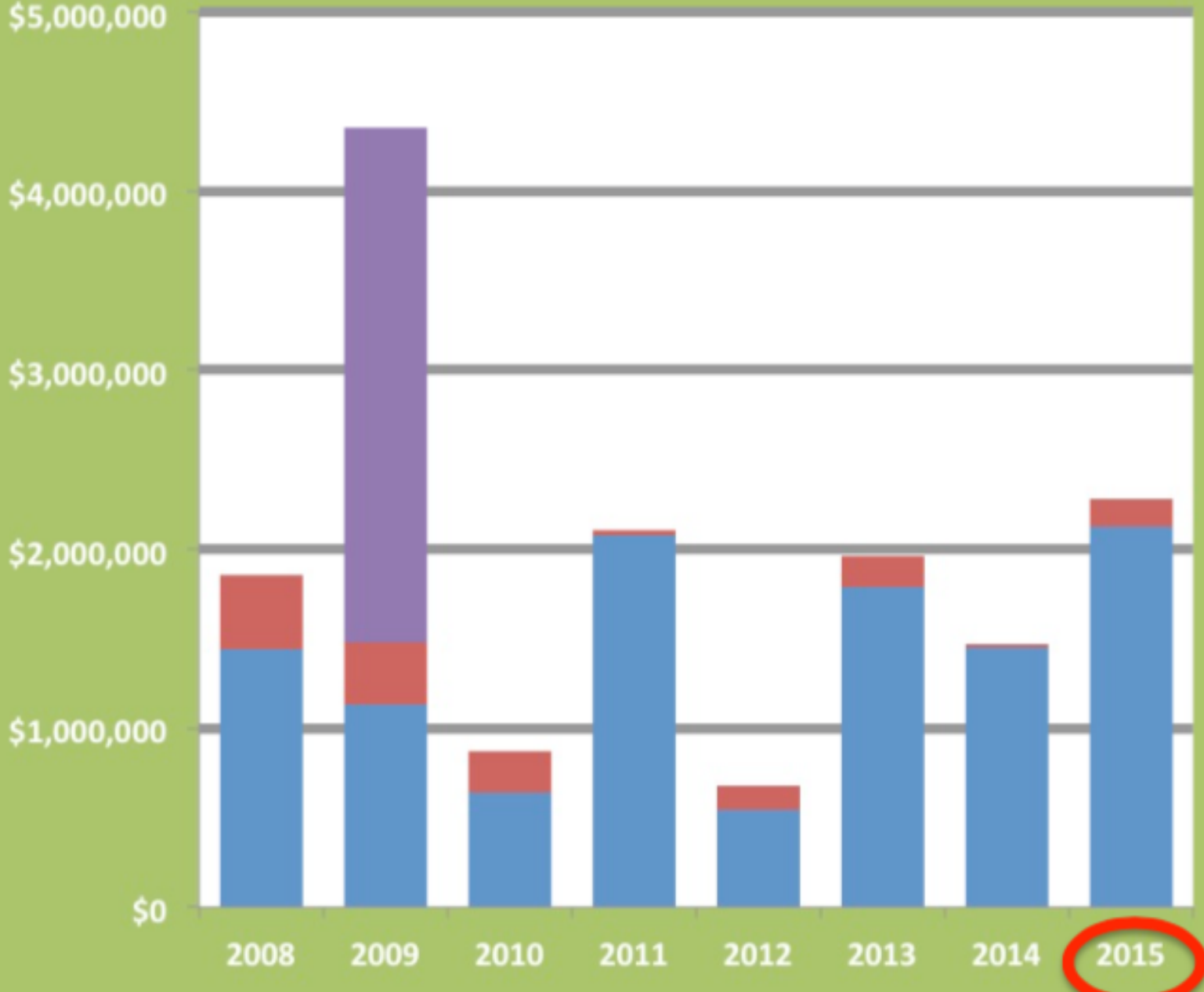
		10/2011		
	2009	10/2011	ASTRA, Utah State	Stormtime E fields, p density
A	2009	9/2012	UC Berkeley	Energetic particle inp neutral drivers
	2010	9/2012	U Colorado	Outer belt, solar ener protons and electron
-II	2009	12/2013 & 1/2015	UNH, Montana State	Relativistic electron b
Y	2008	11/2013	Siena College, GSFC	Terrestrial gamma ra
	2011	Planned 2015	U Michigan	Thermospheric comp & dynamics
UBE	2011	1/2015	Scientific Sol's, U Wisc., Cal Poly, GSFC	Exospheric structure dynamics
	2013	Planned 2016	U Illinois, VT	Gravity waves – IT c
	2014	Planned 2015-16	U of Colorado (5 other institutions)	Participate in interna QB50 – lower thermo

pposals in 2014, 3 awards in 2015. Tryad possible due t
co-funding from EPSCOR

e	Start	Launch	Investigators	Science Target
S	2015	TBD	Montana State, APL, SRI	1st 2D images of O+ d the topside transition
	2015	TBD	Cal Poly, SRI	Ionospheric scintillatio equatorial spread-F
	2015	TBD	U of Auburn, U of AL-Huntsville	Terrestrial gamma ray flashes, triangulation

$15.6M

CubeSat Funding FY 2008-2015

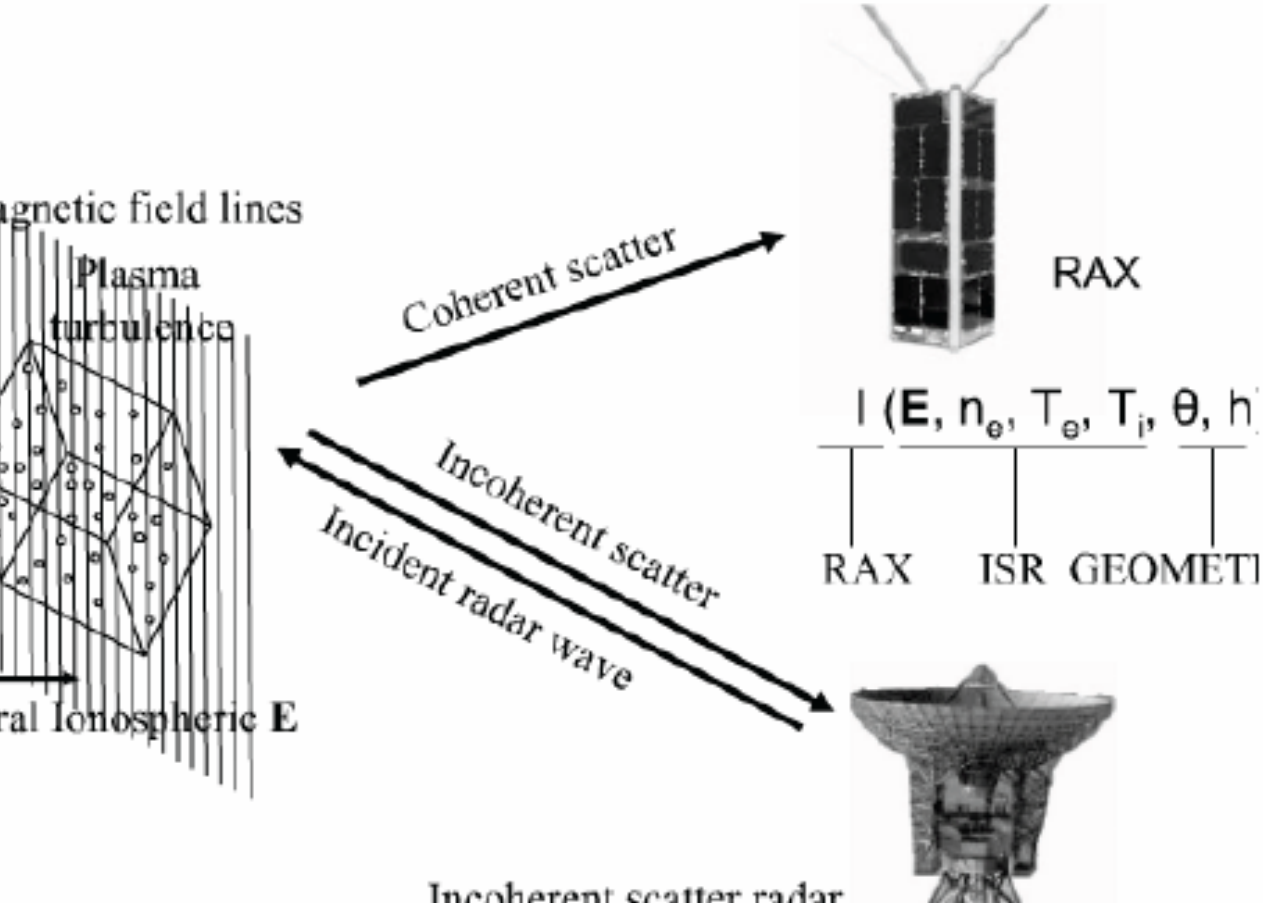


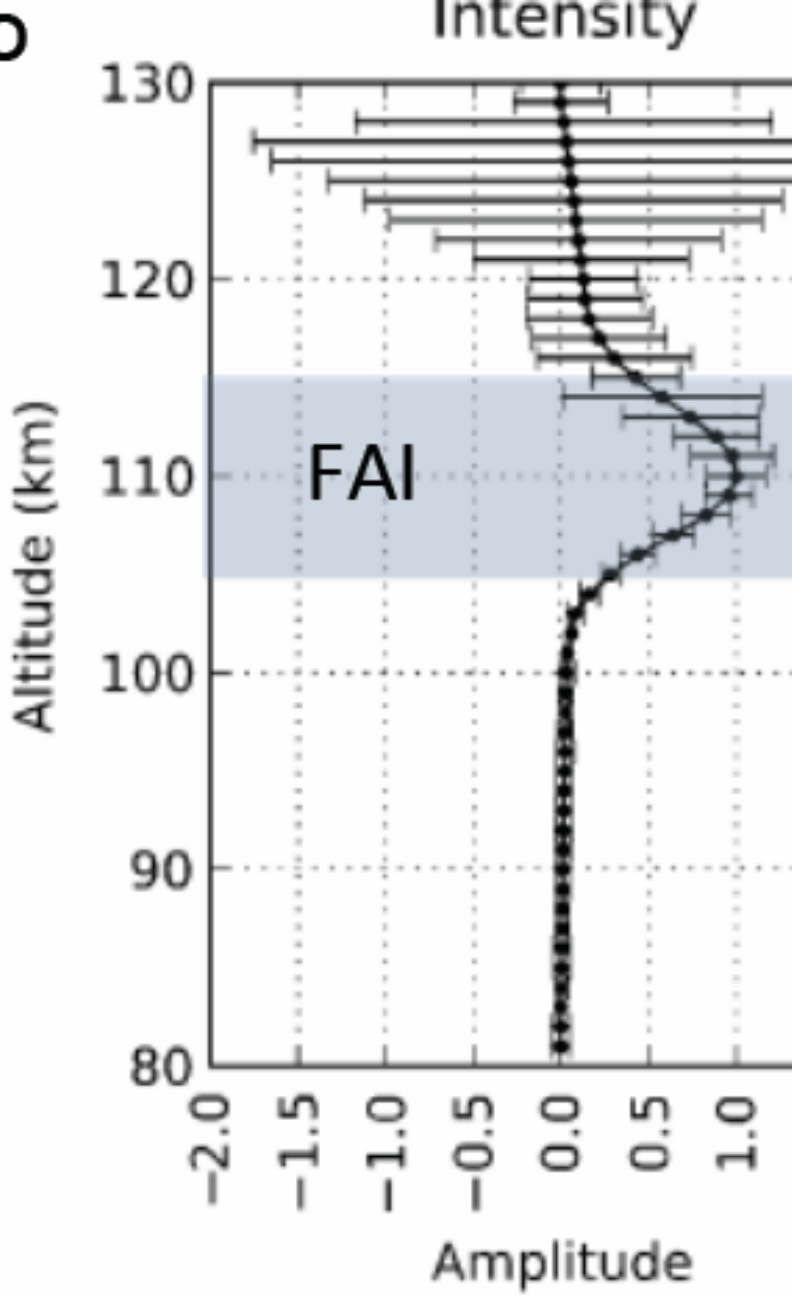
Average (excl.
over 8 years:

ISR (Poker Flat, AK) and the Radio
rora Explorer (RAX) CubeSat

nderstand the features of meter-scale
nospheric field-aligned irregularities
AI) that disrupt communication and
vigation systems in polar region

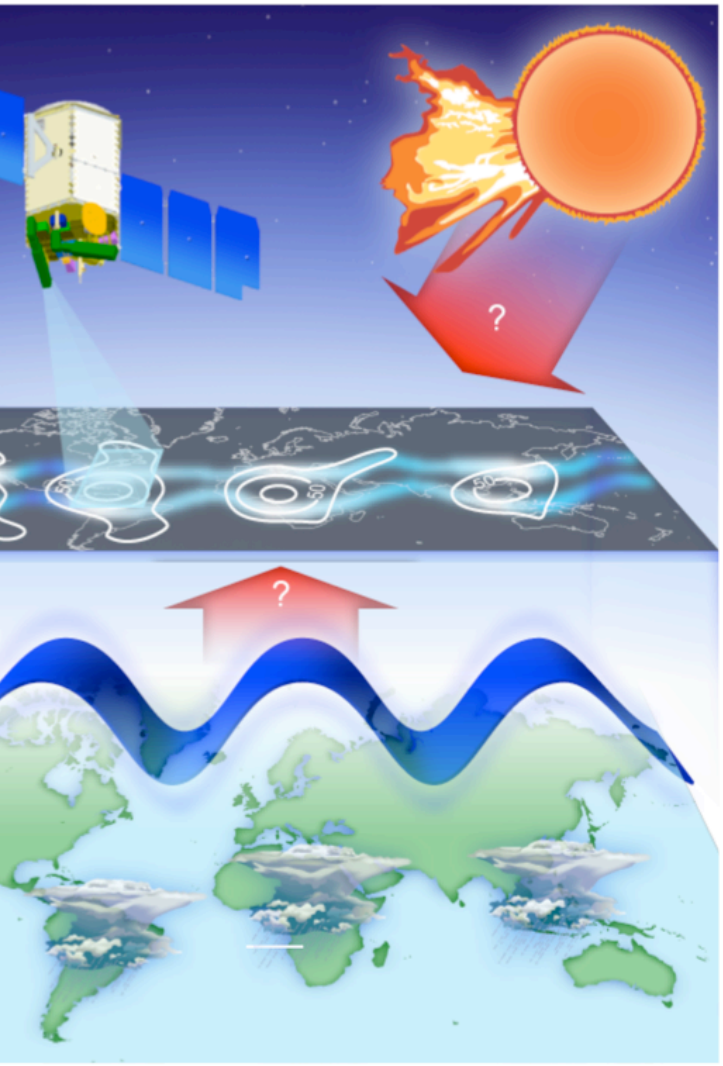
ow field-aligned are they?
isalignment results in wave-generated
rallel electric fields & plasma heating



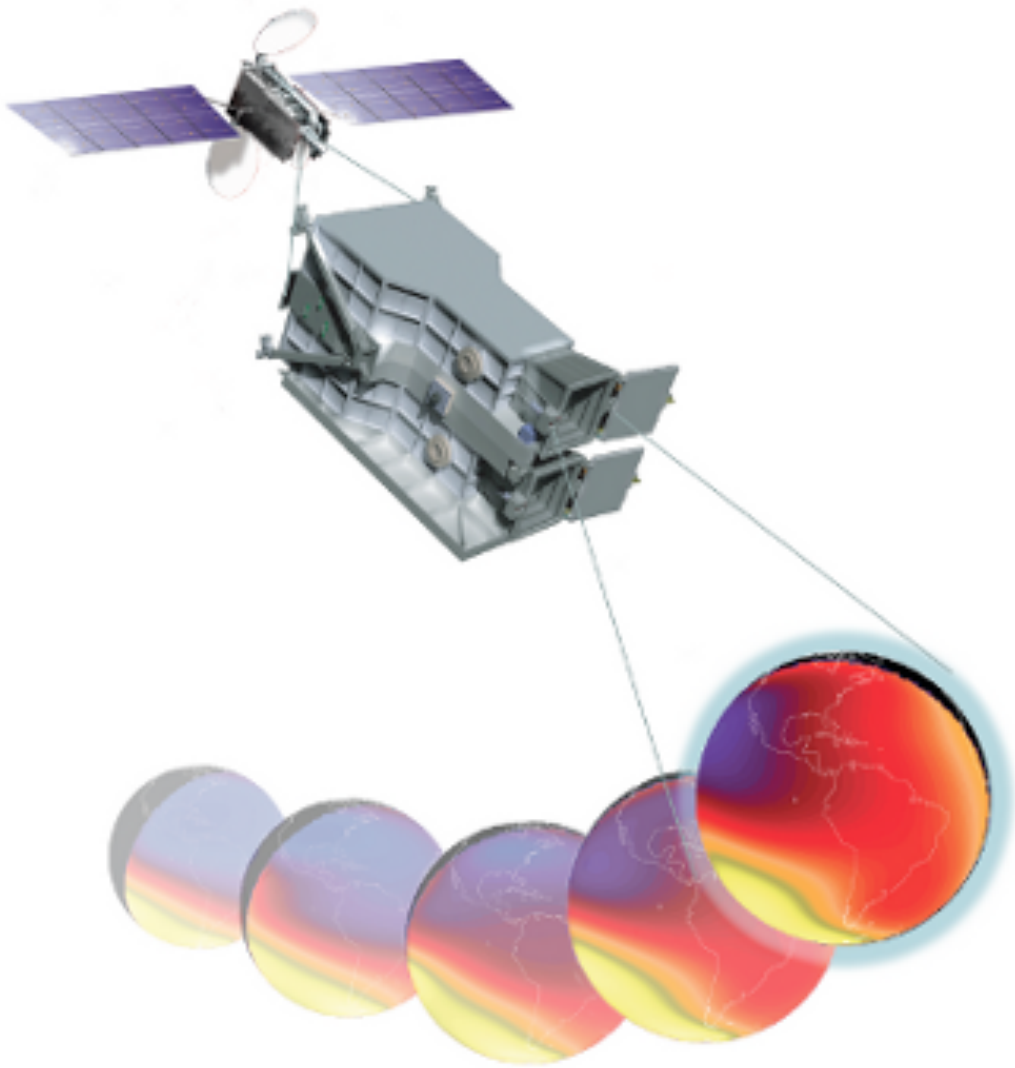


- Confined 106-112 km
- Intensity drops by almost 2 orc magnitude by 100 km
- 1st altitude-resolved estimates

Exploring New NSF-NASA ICON/GOLD Collaboration



oheric Connection Explorer
N). Simultaneous in-situ &
e sensing of the IT system

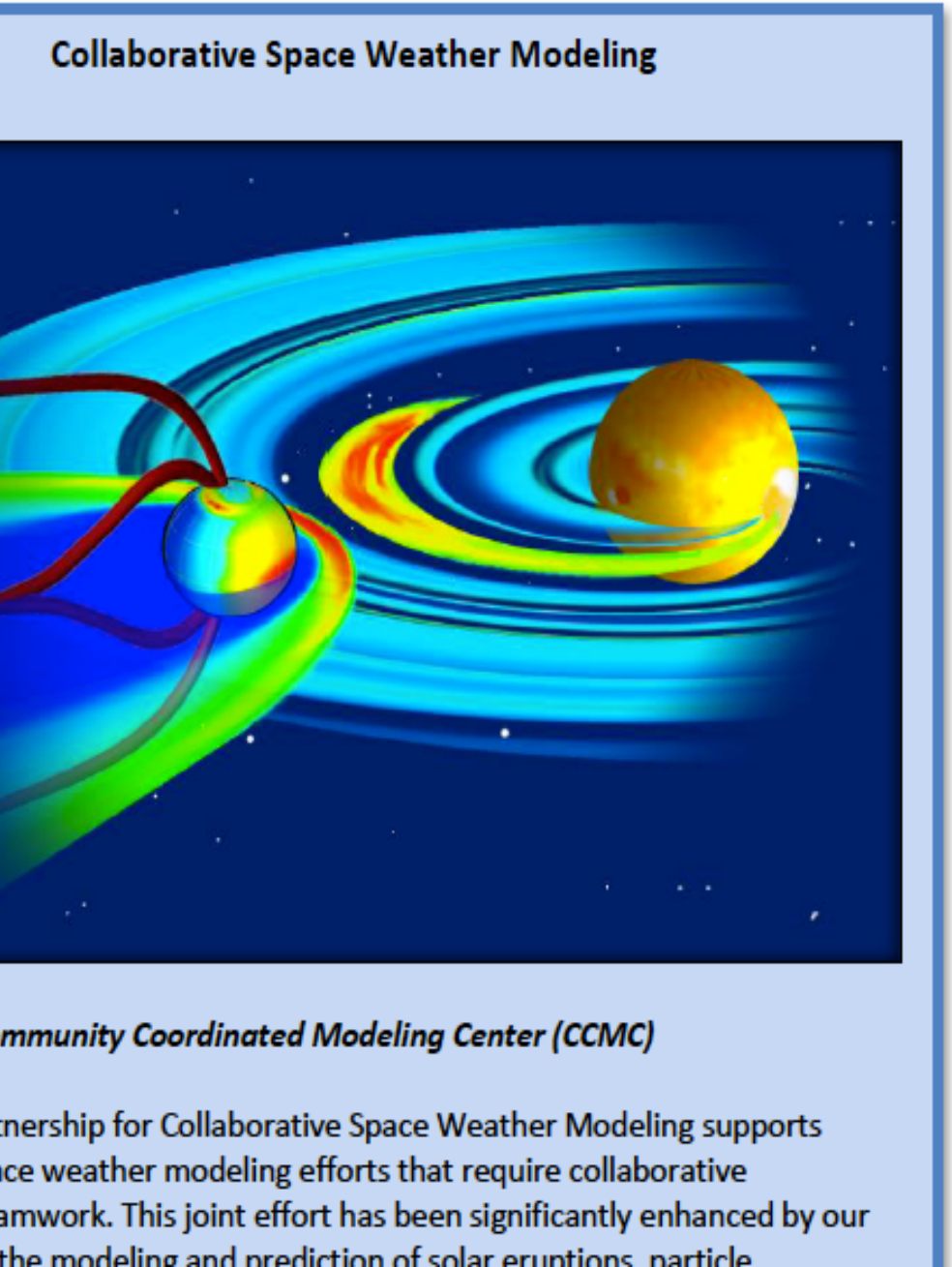


Global-scale Observations of the
Limb and Disk (GOLD)

munity workshop planned to lay out interesting science questions and impo

deling (2013-2018) – Midterm Review (March 20

ontinuing awards, 1.5M/y (NSF), 2.5M/y (NASA) for 5 y:



- Fisher; UC Berkeley, Stanford, Lock
  Coronal global evolutionary model
- Schunk; Utah State, JPL, U of Sout
  1st principles-based data assimilatic
  for the global ionosphere
- Bhattarcharjee, Princeton, GSFC, L
  UCSD; Kinetic Effects in Global
  Magnetosphere Models
- Mansour, Real-time heliospheric sp
  weather modeling
- Odstrcil, UMD, GMU, UCB; Magnet
  emergence and transport
- Antiochus; UMich, NASA, NRL; Mo
  flares, coronal mass ejections (CME
  their interplanetary impacts
- Mannucci; JPL; IT storm fronts

Plasma Physics Funding in GS

CLA BaPSF (Basic Plasma Physics Facility)
Funded partially by GS ($150K/yr, 5 year award). Balan
from DOE and NSF MPS
Renewal proposal in 2016
New PI is Troy Carter. Previous PI was Walter Gekelma
Site Visit (Joint with DOE) tentatively Dec 2015

SF/DOE Plasma Physics Partnership
GS typically co-funds several new grants each year

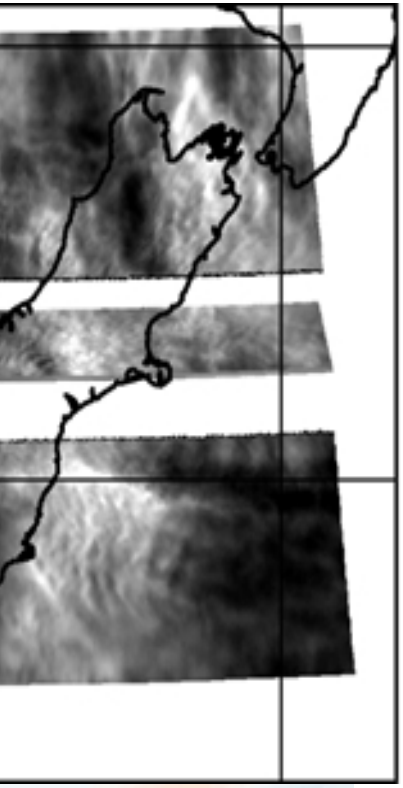
S section plans to participate in Town Hall "NSF support o
sma physics" at the APS-DPP meeting, 16 Nov 2015,
vannah, Georgia

pwave: Sources, propagation, momentum fluxes, effects of gravity waves

unded by NSF Aeronomy, Climate & Large-Scale Dynamics, Physical & Dy
blogy Programs

GATS
Utah State
Yale U.
NCAR
NRL
DLR

nts over mountain wave locations over
wnwind of region near New Zealand
v at altitudes 9-13 km
g GW structures 15-200 km
bservations in May-July 2014



Some early surprises:

- Highly variable mountain wave (MW) energy fluxes
- Secondary GW generation in regions of strong MW breaking
- Observed MWs penetrating to high altitudes with very large amplitudes & momentum fluxes
- Generation of ship-wave patterns at small scales and large amplitud mesosphere/lower thermosphere due to small islands

IVE: Venture into science frontiers that span discipline areas

: Kristi Donahue, UNH Institute for the Study of Earth, Oceans, and Space

spikes in polar ice are thought by some to be associated with the process whereby highly energeti
s driven by solar events penetrate Earth's atmospheric layers and interact with chemical compon
ally, be deposited as nitrate. By confirming a link between extreme solar activity and the ice core r
ts would be able to use deep ice cores to unlock historic information of extreme solar events and
ted atmospheric transport, photochemistry, ozone destruction, and other Earth impacts.

esults: A state-of-the-art global climate model and a unique dataset of snow samples indic
rate signatures in ice are largely due to sources other than solar energetic particles. Cann
used as a means of reconstructing the sun's history.

SD award
n Spence (UNH)
ons Involved: National Center for Atmospheric Research, the University of Colorado, NASA Godda

E: Venture into science frontiers that span discipline areas

Collaboration: AGS & EAR

nts: multispectral incoherent scatter radar
all-sky cameras, Fabrey Perot
meter, high resolution magnetotelluric array
ntric grids of 25 synchronous instruments
oader field of Earthscope sensors

Poker Flat Research Range (near
s, AK)

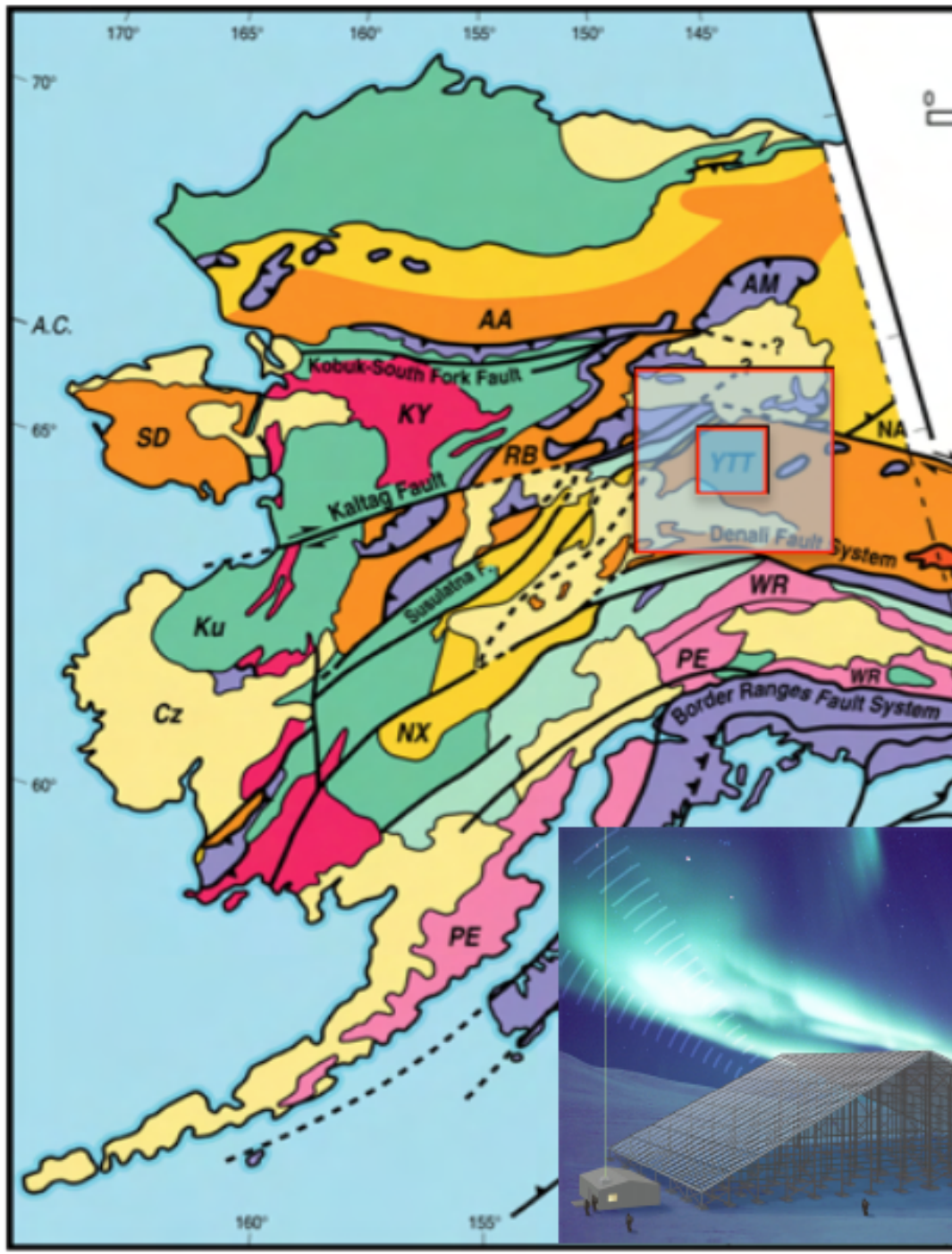
Outcomes:

rrent systems of auroral arcs including
etosphere and ground coupling

ew of conductivity structures in the
phere & upper mantle

ce input to empirical model of GIC (ground
ed current) hazards

ration of possible EM earthquake
rsors

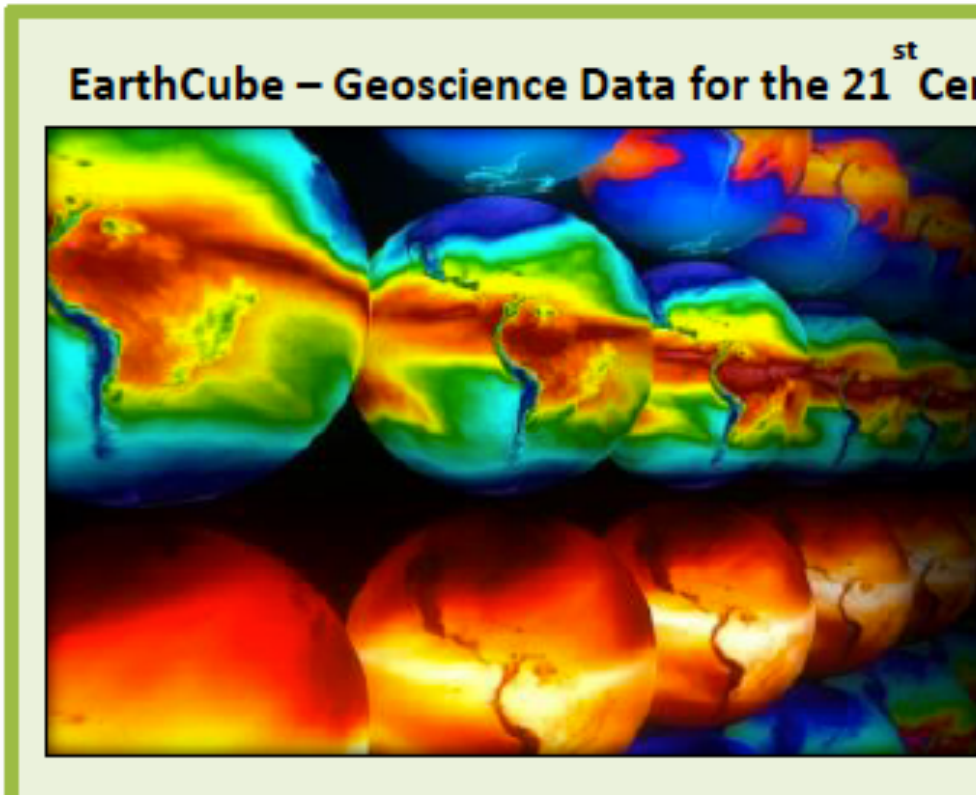


r-action s and	David Alex-ander, et al.	Rice	Understanding the role of magnetic fields, to ultimately provide information on the habitability of exoplanets	10/2015–10/2020	AST, GS, Of disciplinary A OIIA $1M total
Earth, , Exo-	Mendillo, Withers	BU	Create all-purpose ionospheric models for planets & exo-planets, and foster student training that removes discipline barriers.	9/2015 - 9/2019	AST, GS/AE Integrative A $1M total
i-Scale lasmas	Gabor Toth et al	U of Mich	Combining the kinetic & fluid type methods in an adaptive & dynamic fashion to improve the efficiency of present plasma simulation models by a factor of 1000 or more.	8/2015-8/2020	Physics and Computation Programs, A INSPIRE $1M total
maging or d Earth	Russell Cosgrove et. al.	SRI, Oregon State	Geospace currents coupled to Earth's surface producing GICs. Proposed to image the ground conductivity with magnetotelluric sensors (Earthscope) & ionosphere with PFISR, ASI, FPIs	10/2013–10/2016	GS/AER, MA OIIA $800K total
	Elizabeth McDonald	New Mexico Cons.	Exploring the aurora through human-centered computing, citizen science, & SpW research.	9/2013 – 9/2016	GS/SWR, H Advancing I STEM Learn
lop- e MAG, …	Ennio Sanchez	SRI, Stanford, PPPL	Controlled experiments with MeV class electron beams that open up a laboratory in-space in an entirely new energy regime.	9/2013 – 9/2016	AER, MAG, OMA $750K total

SF Geospace & Earth Cube

***thCube** is a community-led erinfrastructure initiative for the sciences.*

(ACI) and GEO



	PI	Institutions	Description	Start D Amou
d nce ory	Asti Bhatt, et. al.	SRI, VT	Unified toolkit of data & associated software contributed by separate geospace communities to enable study of whole Sun-Earth system	9/2015 8/2017 $800K
	Jesper Gjerloev	JHU	New set of high-latitude, electrodynamic, MIA cyber-based	9/2015 8/2017

ospace Science & zard SEES

grate across multiple plines to promote research advances new paradigms contribute to creating a ety resilient to hazards.

***ES** = Science, Engineering, & Education for Sustainability*

ect	PI	Institutions	Description	St Da Ar
hazard iction: From r wind to power ems impacts	Thomas Overbye	U of IL	Develop improved models of solar storm-driven geomagnetic disturbances, currents induced by those geomagnetic disturb-	8/ 8/ $2

Start of New Program: PREEVENTS

PREEVENTS = PREDICTION OF AND RESILIENCE AGAINST
EXTREME EVENTS

eme events includes space weather.

released 9 Sept 2015. Subject to availability of funds, FY16 rele
l solicitation

l phase: Proposal only accepted through existing programs. Sc
opriate for the existing core program. Workshop proposals
uraged.

r phase: Anticipate emphasis on cross-disciplinary or resources
nd typical existing programs.

s:
nderstand fundamental processes underlying natural extreme ev
nprove models of extreme events & their impacts

Thank you.

Questions?