



@stevephenomena



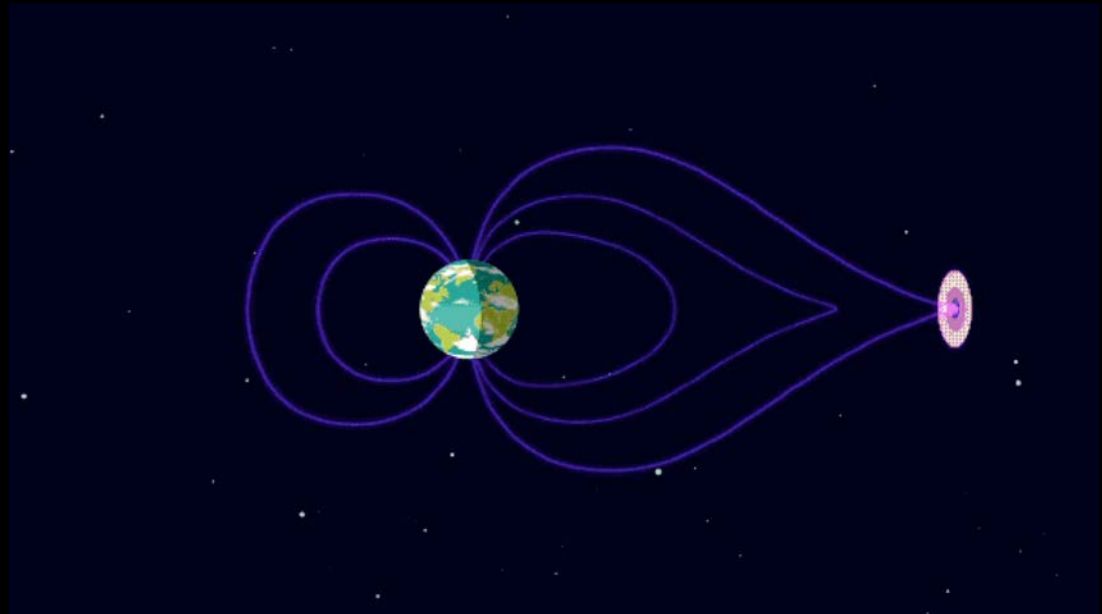
@spaceyliz

A new frontier of data science?

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AURORASAURUS FOUNDER
CEDAR, 2018

Photo credit: Paulo Fedozzi

The story of STEVE



- ▶ NASA feature: <https://www.nasa.gov/feature/goddard/2018/nasa-needs-your-help-to-find-steve-and-heres-how>
- ▶ Eric Donovan's TEDxCalgary talk: <https://www.tedxcalgary.ca/talks/how-i-met-steve-discovery-new-aurora>
- ▶ Why it's really called Steve: <https://www.youtube.com/watch?v=amwaFNZYUUY>
- ▶ Multi-faceted rich experience



Observed in Alberta, CAN and Michigan areas! Learn more here: <http://blog.aurorasaurus.org/?p=449>

- Traditional science missed something
- Timelapse photos at lower than usual latitudes enable a different viewpoint



The New York Times

SCIENCE

That Ghostly, Glowing Light Above Canada? It's Just Steve

ra

WHAT is the significance of STEVE?

▶ **Larry Lyons, quoted in The Atlantic:**

“It is truly exciting, to us as aurora scientists, that there is a group of amateurs out there who enjoy the aurora so much that they could put together something that is this new to us. That’s just unbelievably cool.”

“I’ve never seen something this new discovered by citizen scientists in the aurora before.”

“Finding something you can identify as a new structure in the aurora is relatively unusual. The last major thing was poleward boundary intensification, and you can find that name used back over 20 years ago.”

New science in plain sight: Citizen scientists lead to the discovery of optical structure in the upper atmosphere, *Science Advances* 4, (2018).

2016-07-25 05:52:30 UTC

SWARM satellite track
measures particles flowing in
an SAID (subauroral ion drift)



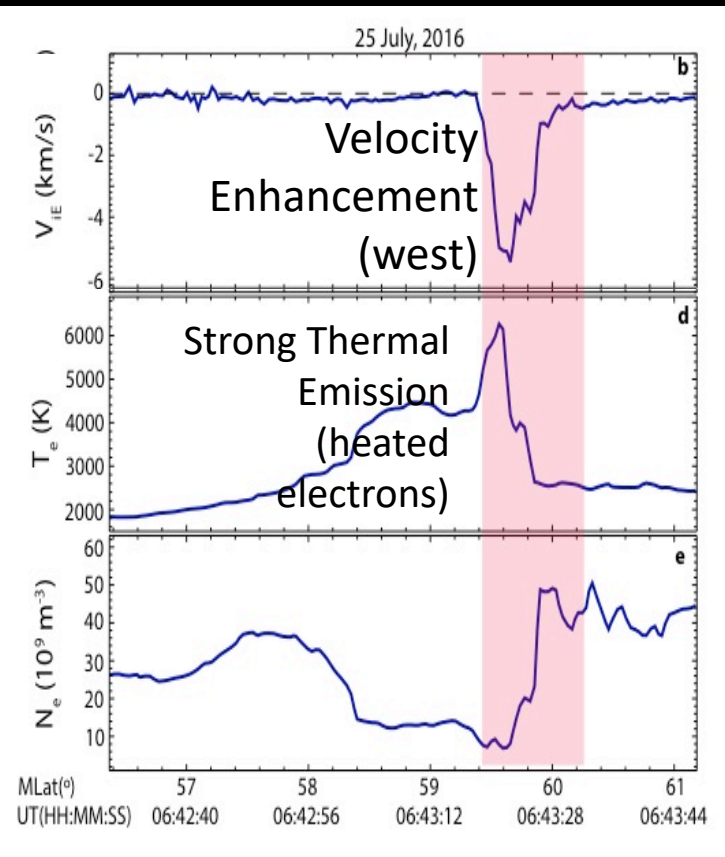
ESA SWARM
satellites



Authors: E. A. MacDonald, E. Donovan, Y. Nishimura, N. A. Case, D. M. Gillies, B. Gallardo-Lacourt, W. E. Archer, E. L. Spanswick, N. Bourassa, M. Connors, M. Heavner, B. Jackel, B. Kosar, D. J. Knudsen, C. Ratzlaff, I. Schofield.

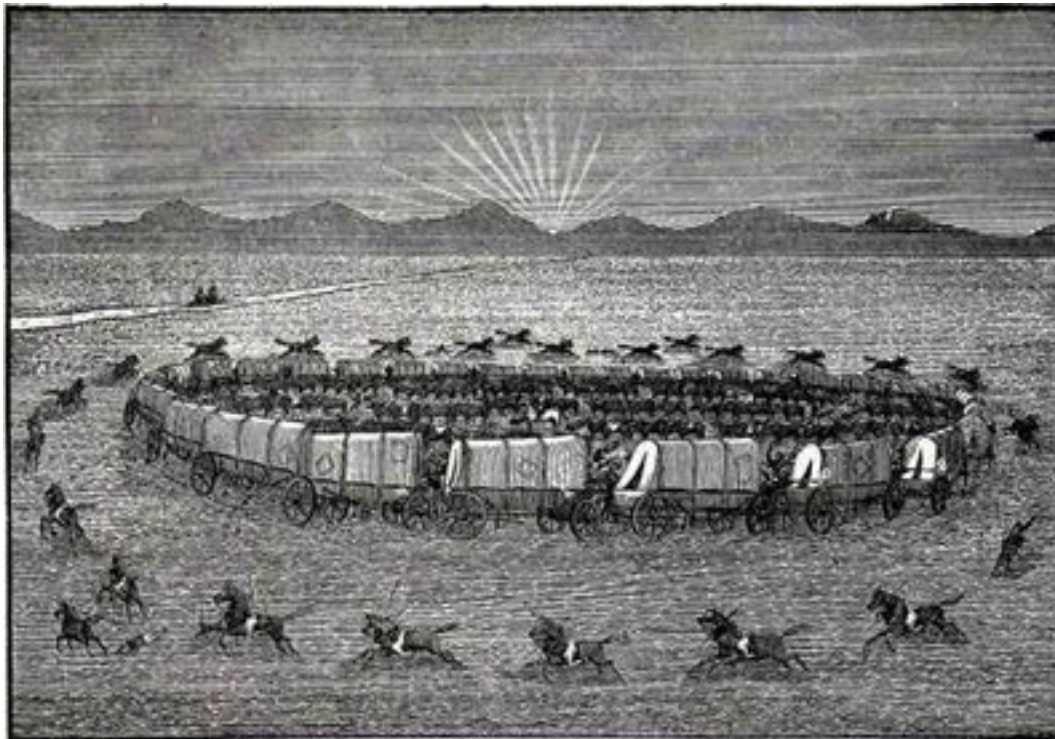
Citizen scientists, along with satellite and ground-based sensors, have revealed a new observable arc boundary visible at subauroral latitudes.

Satellite +
ground-camera
array +
expert observers
in conjunction



Benefit of hitching wagons together

- ▶ Democratized manifest destiny -> Silicon Valley



- ▶ Why are we still doing science the same as we were 10, 20, 30 years ago?

Does citizen science meet the definition?

- ▶ Broadly defined, data science refers to scalable architectural approaches, techniques, software, and algorithms that alter the paradigm by which data is collected, managed, analyzed, and communicated.
- ▶ 4 V's data: “volume (growing number of contributing observing platforms), variety (diversity of observing platforms), veracity (uncertainty of data), and velocity (the speed at which data are observed and analyzed).”
 - ▶ Veracity is easy to assume... “fitness for use” is standard

Citation:

McGranaghan, R. M., Bhatt, A., Matsuo, T., Mannucci, A. J., Semeter, J. L., & Datta-Barua, S. (2017). Ushering in a new frontier in geospace through data science. *Journal of Geophysical Research: Space Physics*, 122, 12,586–12,590. <https://doi.org/10.1002/2017JA024835>

Similarities “disruptive innovation”

- ▶ A buzzword no one agrees with
- ▶ Domain knowledge and authentic science are key
- ▶ Huge opportunities enabled by technology (smartphones, ubiquitous computing)
- ▶ Comes from outside
- ▶ We are MISSING things (due to bias)
- ▶ New “discovery” features can be found
 - ▶ Particularly at traditional boundaries, in the gaps
- ▶ Modern interdisciplinary communication
 - ▶ Learn from other fields
 - ▶ Anti-jargon
 - ▶ Learn from Twitter and share your expertise

Different methodologies

- ▶ Different funding & sustainment, miss INSPIRE
 - ▶ Citizen science has apps, lots of in's and out's
 - ▶ Citizen science data can feed machine learning problems effectively
- ▶ Hard to get funding? Skepticism
 - ▶ What is smoking gun? (STEVE)
 - ▶ Social proof
- ▶ Relatively low barrier to entry
 - ▶ Not easy at AGU.
 - ▶ CitSci is a field... have to understand the landscape
 - ▶ Journal of Citizen Science Theory and Practice

Interdisciplinary Lessons Learned

- ▶ Communication big problem. Worth grappling with. Rich nonlinear benefits.
- ▶ “Democratization” of technology
- ▶ Give benefit of the doubt – equally
- ▶ Our field is behind.
 - ▶ Inclusivity
 - ▶ Communication
 - ▶ Non-traditional approaches
 - ▶ Old guard
 - ▶ To move forward, must figure out what to let go of.