From Fermilab to Science Policy

Joe Grange
4/27/21

Fermilab background

- Had a great time living & working at Fermilab for around 10 years (!), 2009 - 2019.
    - FSPA officer (then Grad Student Association) 2010-2011

- Degree from U Florida (2013) working on MiniBooNE & MINERvA neutrino experiments.

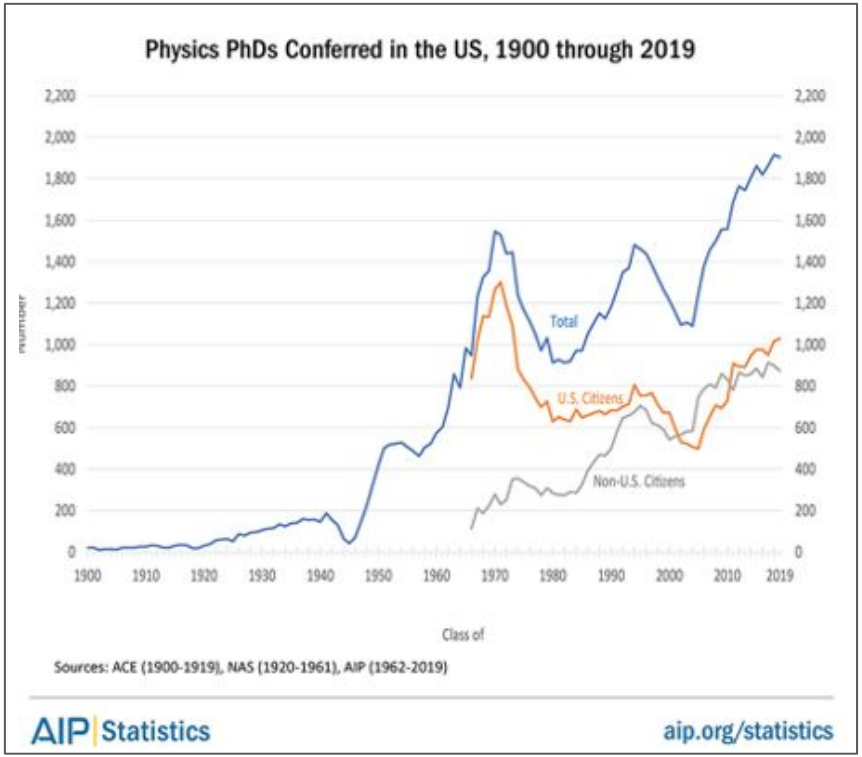
- 2013-2019: postdoc with Argonne and later U Michigan working on muon g-2 (magnetic field & vacuum chamber integration)

Muon g-2 groundbreaking ceremony (2013)

Career shift away from physics

- ~2016, after a few particularly challenging projects:
  - internally, started feeling like I couldn't see spending my career on this kind of work
  - few colleagues had recently started new faculty-equivalent positions. And I thought I worked hard as a grad student / postdoc…
  - better understood the state of physics PhD / faculty availability

- So, what next?? My best guess at the time was to pursue some intersection of my skills with social science, 'people-centered problems'



2017/8: science policy / social science intros

- Previous colleague had gone through AAAS Fellowship, joined DOE HEP office afterwards
- UChicago myCHOICE program supported a DC Sci Pol trip and helped me learn more about AAAS and other related opportunities
- Applied for AAAS Fellowship in 2018: application was accepted, but didn't take the interview work sample assignment seriously and wasn't selected.
- To broaden my experience in social science, I cold-emailed a ton of professors at the UMich School of Social Science. A few responded and over a year I was able to analyze and publish results from a gender minority healthcare survey.

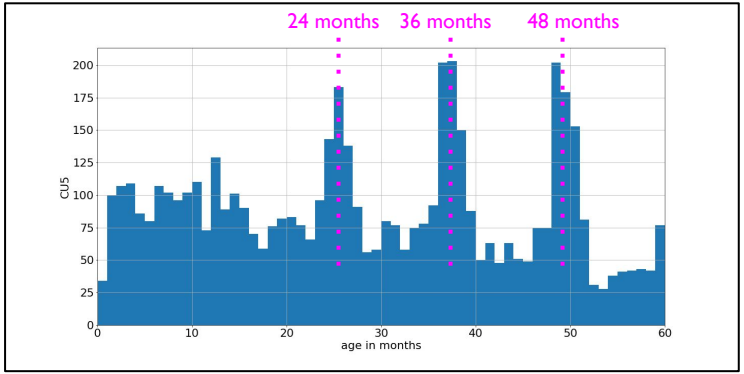
2019-2021: AAAS Fellowship at USAID

- Applied again for the AAAS Fellowship and this time overprepared the work sample exercise.
- Started September 2019 at USAID with the slightly bizarre ‘Data Scientist’ title.
- I’m the sole Data Scientist on a Monitoring and Evaluation team charged with supporting evaluations of humanitarian aid programs we fund (~$9B annually).

Work project 1 - stunting

- An important indicator for childhood nutrition in vulnerable areas is low stature. So, children's height-for-age is regularly measured and tracked.

- For this indicator we need two quantities: height and age. Unfortunately, age distributions collected typically have this 'heaping' phenomenon around integer-year ages (24, 36, 48 months).

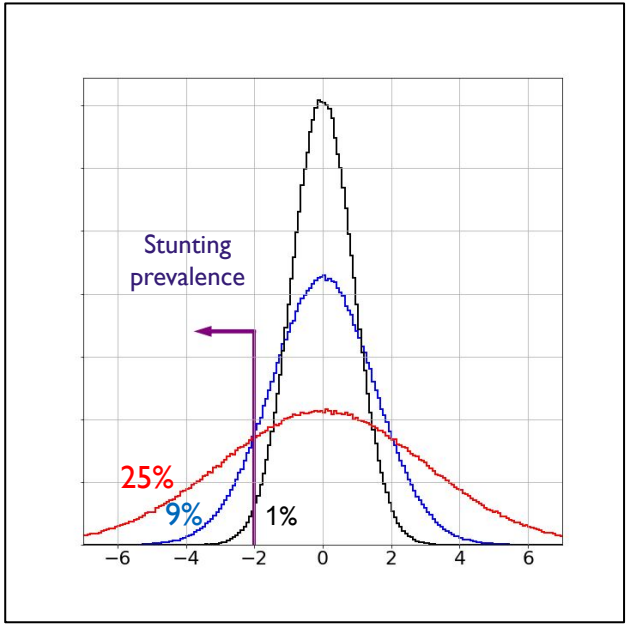


- I wanted to see what relationships and/or consequences this 'heaping' has on the stunting indicator.

Work project 1 - stunting

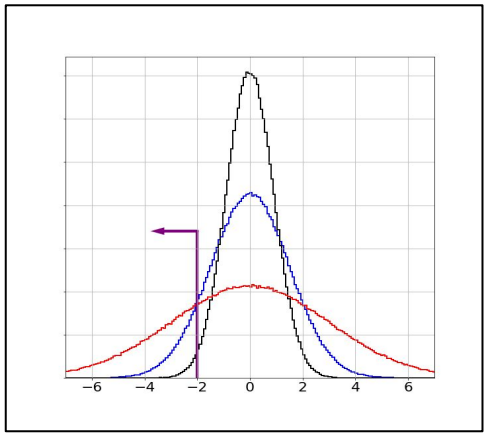
- For *any* distribution, the more random error measurement ('noise') you have, the wider that distribution will be
    - or, the standard deviation will increase

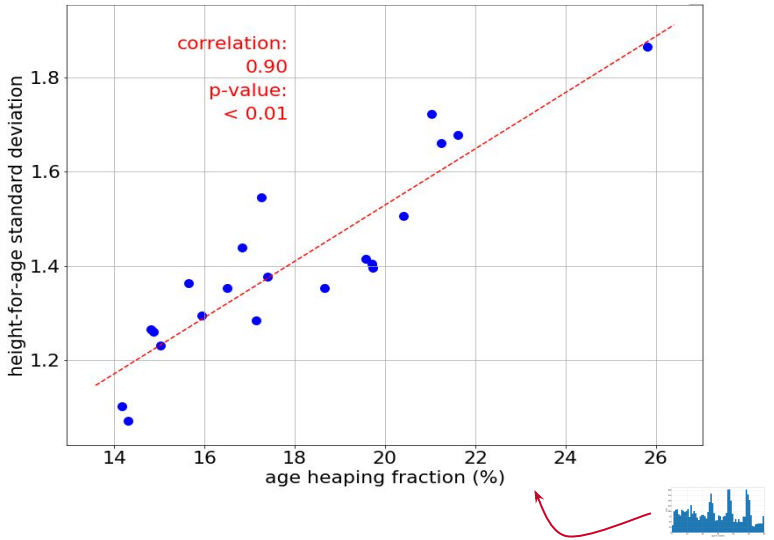
- Via a simple scatter plot, among surveys we've supported in the last decade or so, I was able to show there is a very strong relationship between 'age heaping' and height-for-age standard deviation (next slide)



Work project 1 - stunting

- So, at least among these surveys we can say age data quality played a significant role in determining the standard deviation
  - and therefore the stunting rate!
    → **systematic error**





Work project 1 - stunting

- Via simulation, can estimate the scale of that potential bias for historical and future surveys. Publication in prep.
- Some outcomes:
  - successfully got colleagues to begin thinking a little more about systematic errors (typically only statistical are evaluated)
  - our research partners are looking actively out for age heaping and will be reporting on it
  - currently chairing a WHO-UNICEF working group evaluating evidence gaps related to age measurement

Work project 2 - Tonga satellite analysis

- In early 2022, a submarine volcano near Tonga erupted with a record 36 mile-high plume

- Very close to nearby fisheries critical for Tongan food, agricultural, and culture.
- Often, marine volcanic ash deposits can lead to a bloom of phytoplankton, microscopic plants that can be toxic to the ecosystem.
- Communication with Tongan gov't, other actors not regular. ***Did a phytoplankton bloom develop? How big? For how long?***

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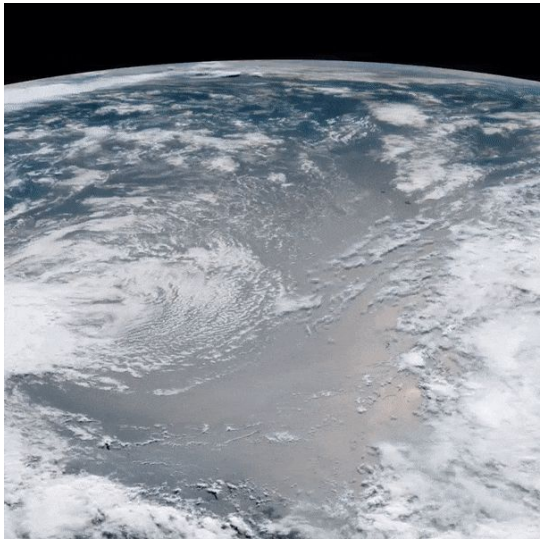
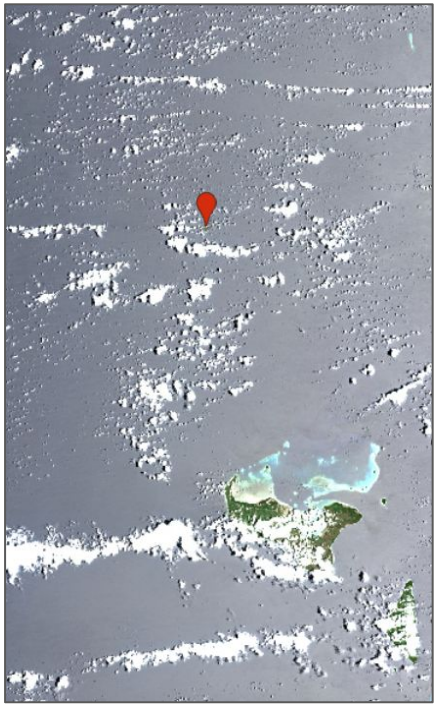


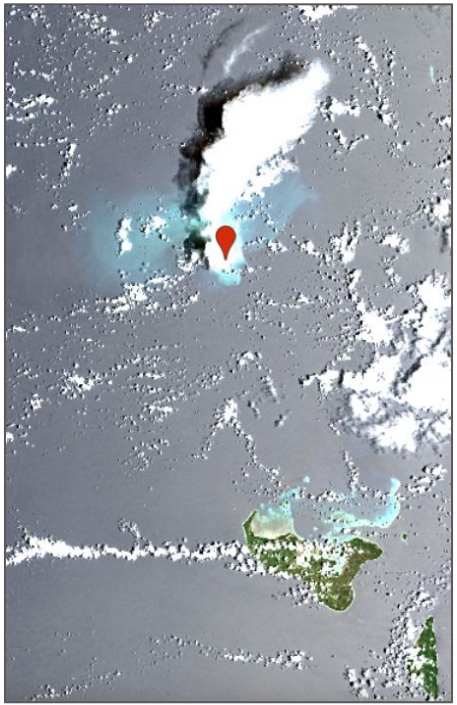
Work project 2 - Tonga satellite analysis

- Google Earth Engine - Javascript or python-based access to decades of publicly-available satellite imagery.

Dec 18 2021

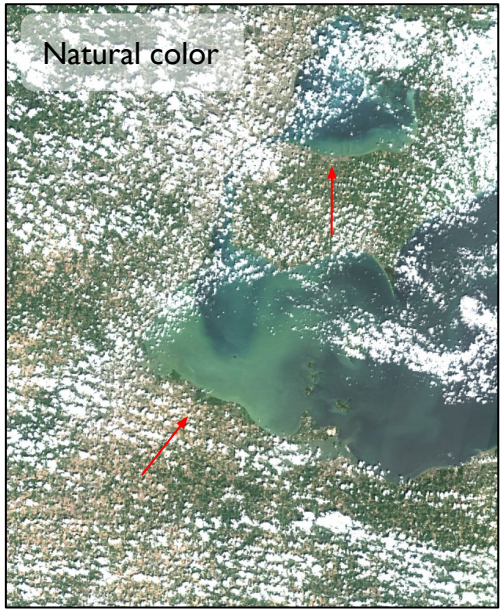


Dec 23 2021



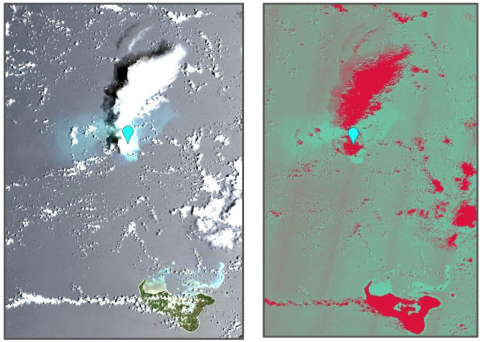
Work project 2 - Tonga satellite analysis

- Can manipulate different satellite wavelength combinations to optimize sensitivity to particular spectra
- Images on right show phytoplankton bloom on west coast of Lake Erie, August 2019

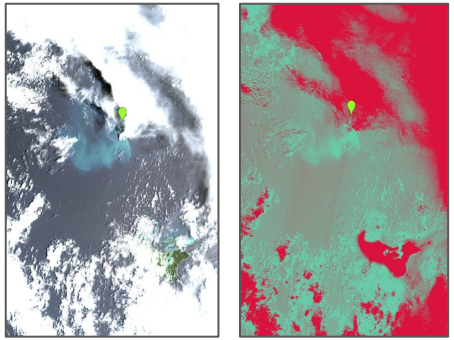


Work project 2 - Tonga satellite analysis

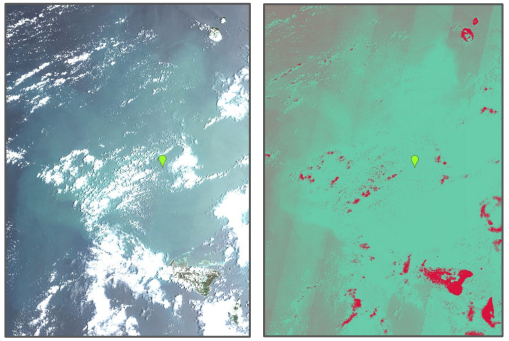
Dec 23, 2021



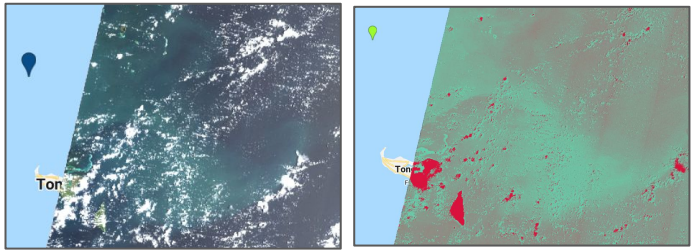
Jan 2, 2022



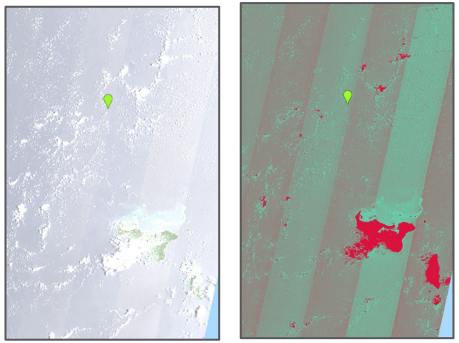
Jan 17, 2022



Jan 29, 2022

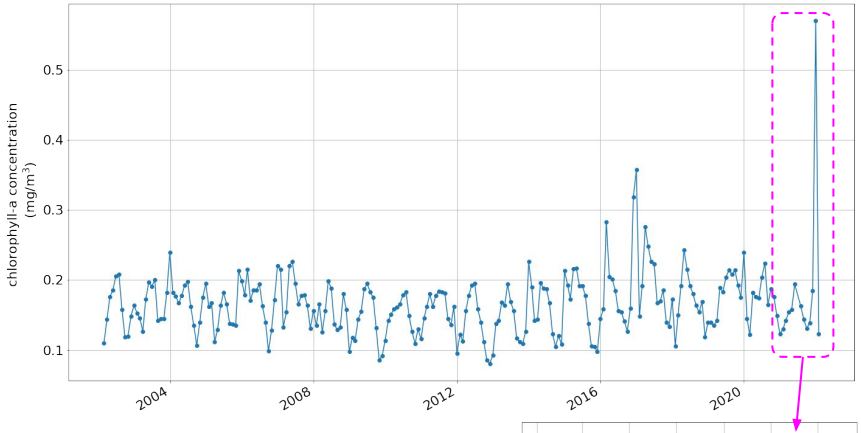


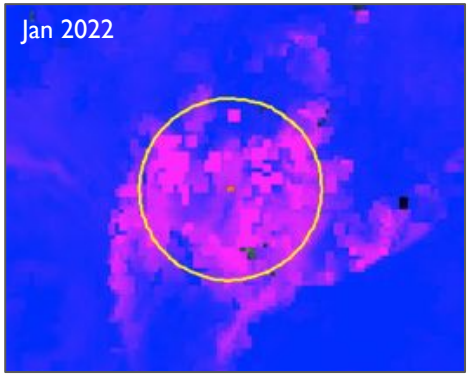
Feb 11, 2022

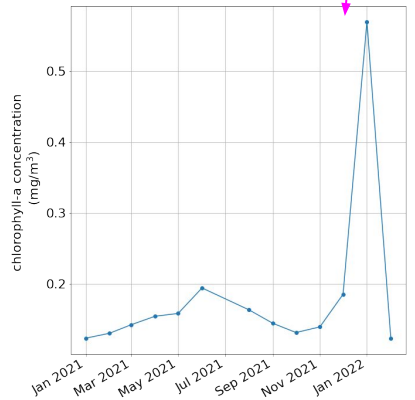


Work project 2 - Tonga satellite analysis

- Confirmation from a separate, independent satellite
  - lower spatial resolution, but greater sensitivity to phytoplankton spectra
- Consistent with previous finding, see large (historic) activity in Jan 2022, back to ‘normal’ in Feb.
- Brief nature of bloom suggests long-term damage to reefs *not expected*







Some extras

- Regularly participate in technical impact evaluation designs including sampling, analysis, bias mitigation discussions

- Designing python / ArcGIS-based Monte Carlo simulation software tool to evaluate environmental impact of various projects on Colorado wildlife

Final thoughts

- Certainly occasionally miss the fully-technical nature of physics research
- Work-life balance & pay is great in science policy
- Let's connect! Here's my LinkedIn and I'd be happy to have 1:1s as well.