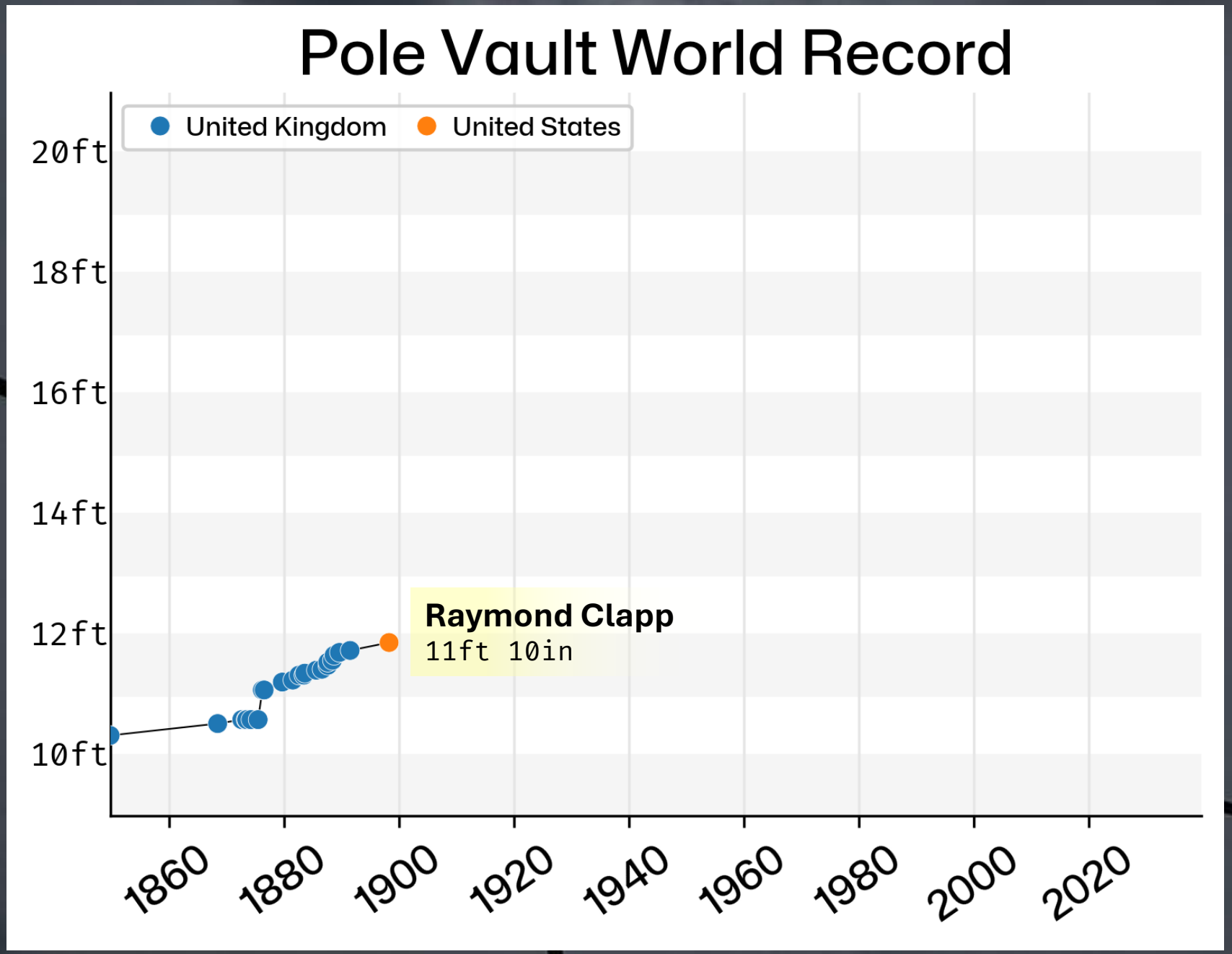
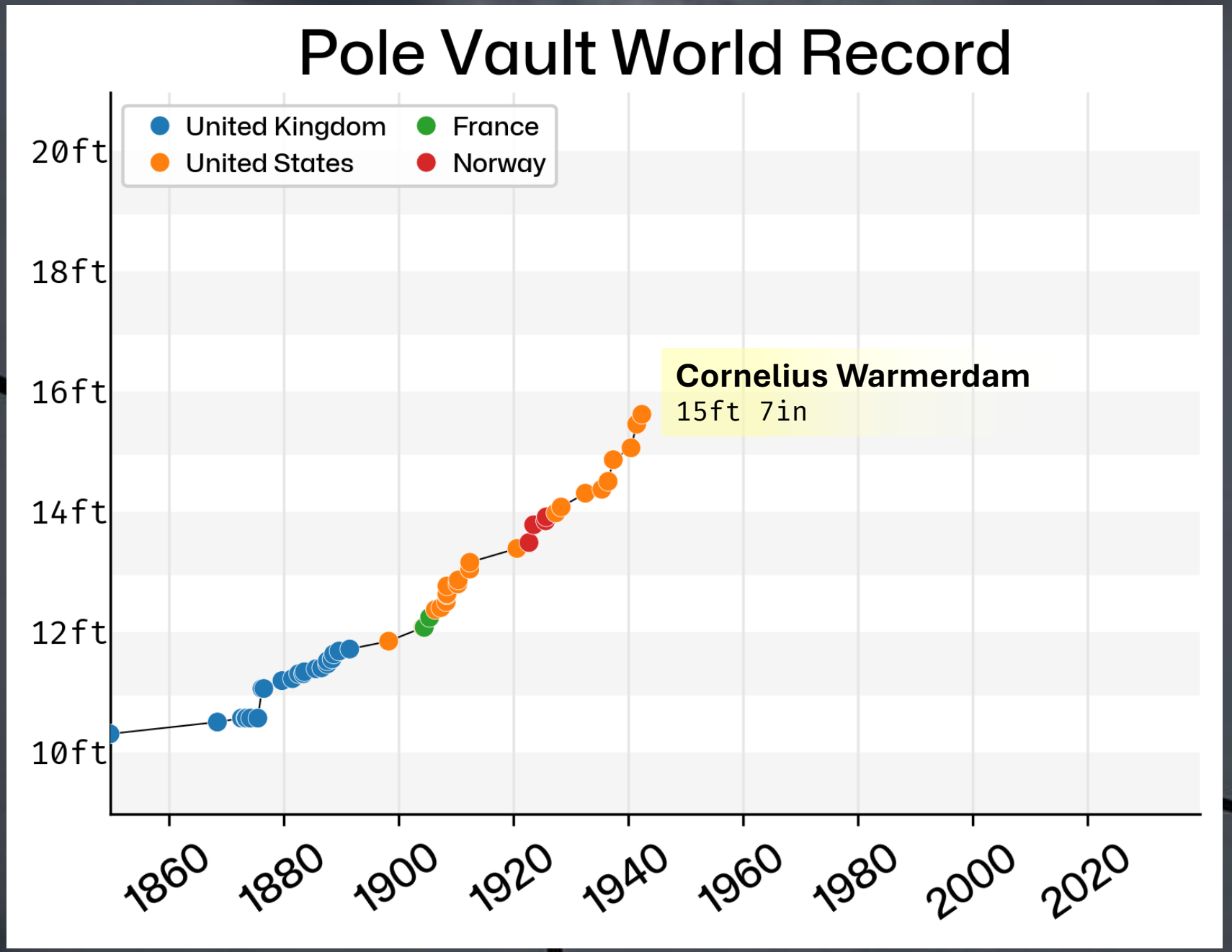
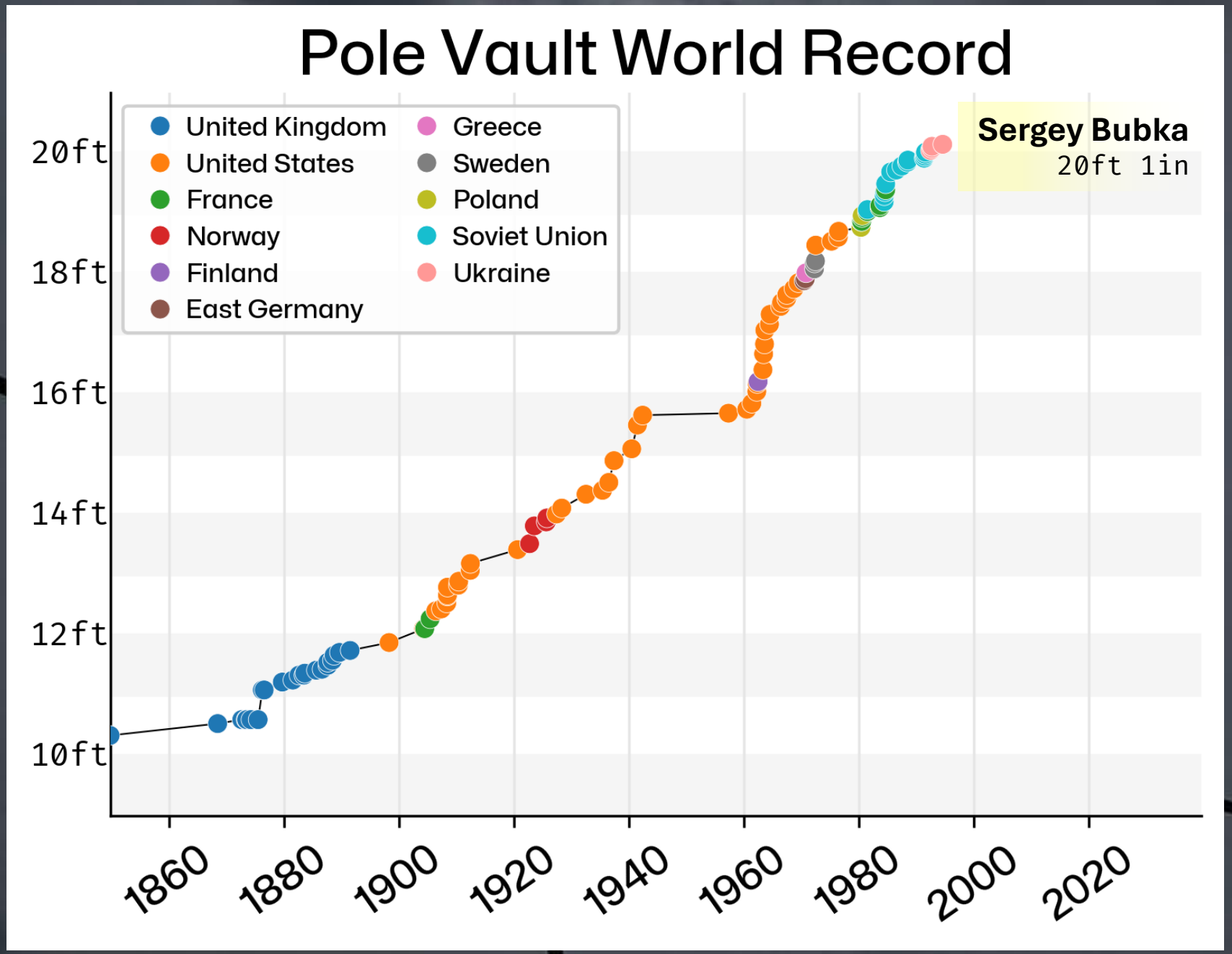
Russ DeSouza working with students

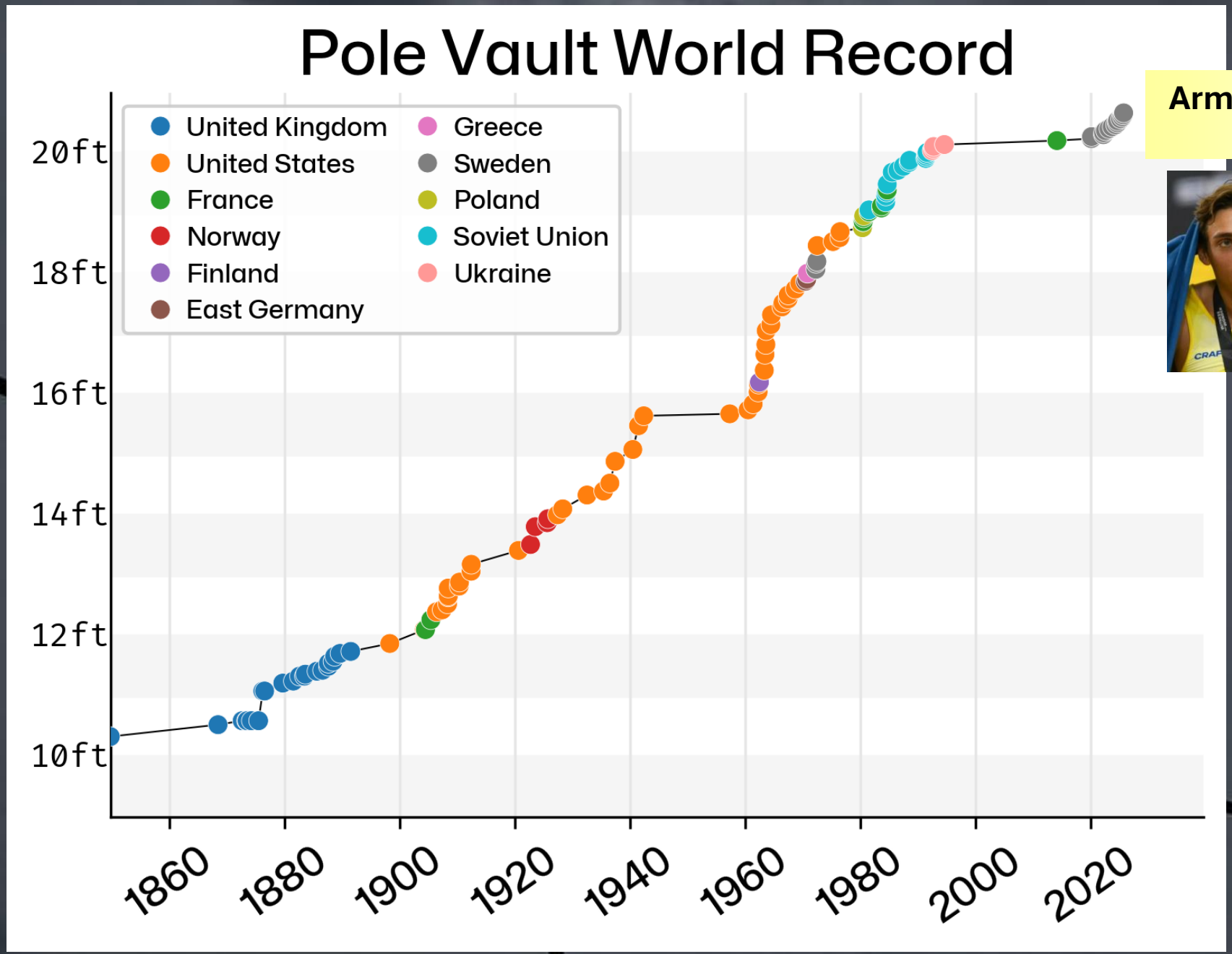
Photo: Gio JL Wikimedia Commons CC BY-SA 2.0


Pole Vault World Record
United Kingdom
United States
20ft
18ft
16ft
14ft
12ft
10ft
Raymond Clapp
11ft 10in
1860
1880
1900
1920
1940
1960
1980
2000
2020

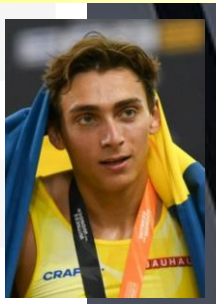

Pole Vault World Record
United Kingdom
United States
France
Norway
20ft
18ft
16ft
14ft
12ft
10ft
Cornelius Warmerdam
15ft 7in
1860
1880
1900
1920
1940
1960
1980
2000
2020


Pole Vault World Record
United Kingdom
United States
France
Norway
Finland
East Germany
Greece
Sweden
Poland
Soviet Union
Ukraine
Sergey Bubka
20ft 1in
20ft
18ft
16ft
14ft
12ft
10ft
1860
1880
1900
1920
1940
1960
1980
2000
2020

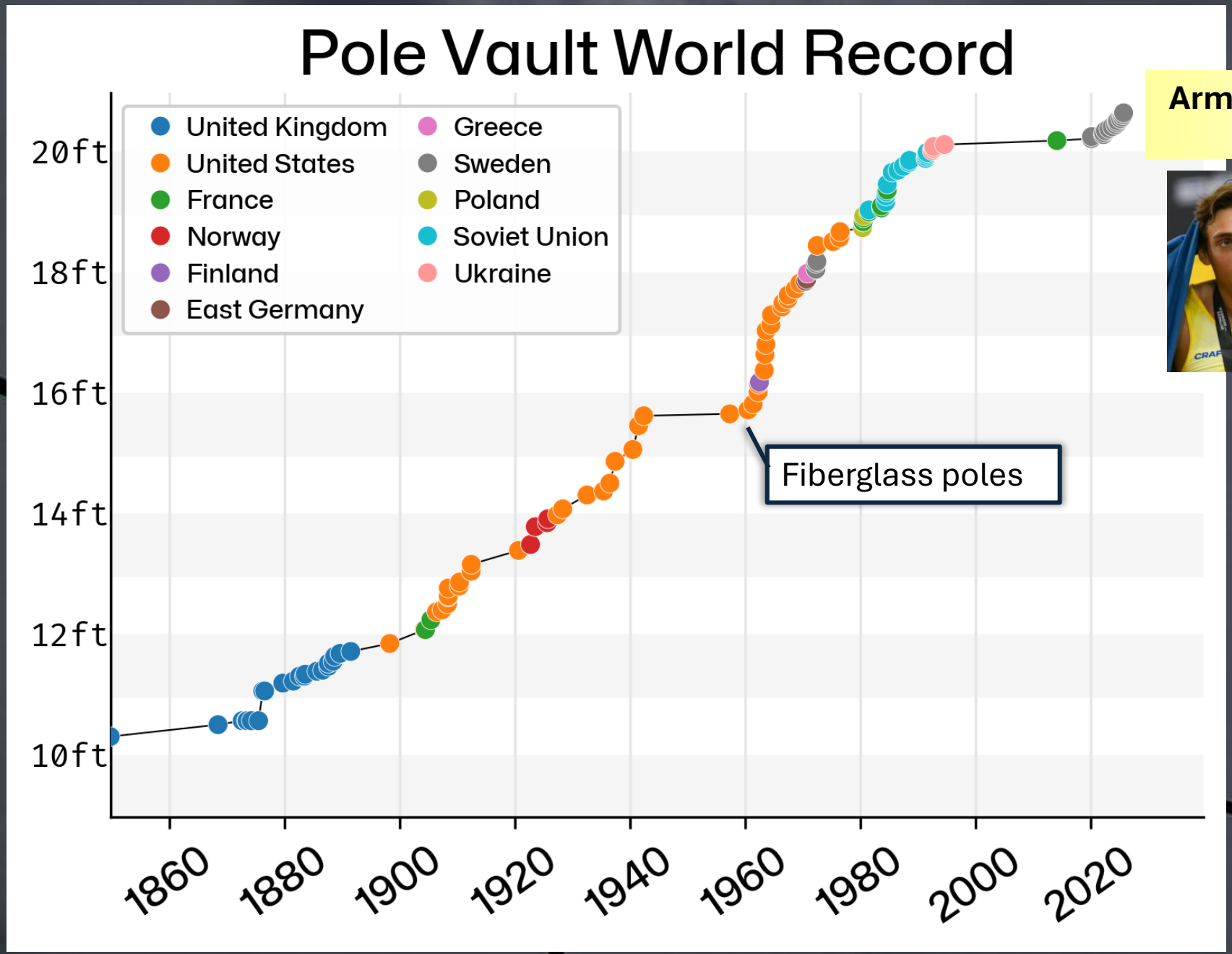
Pole Vault World Record



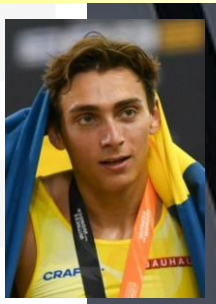
Armand Duplantis
20ft 8in



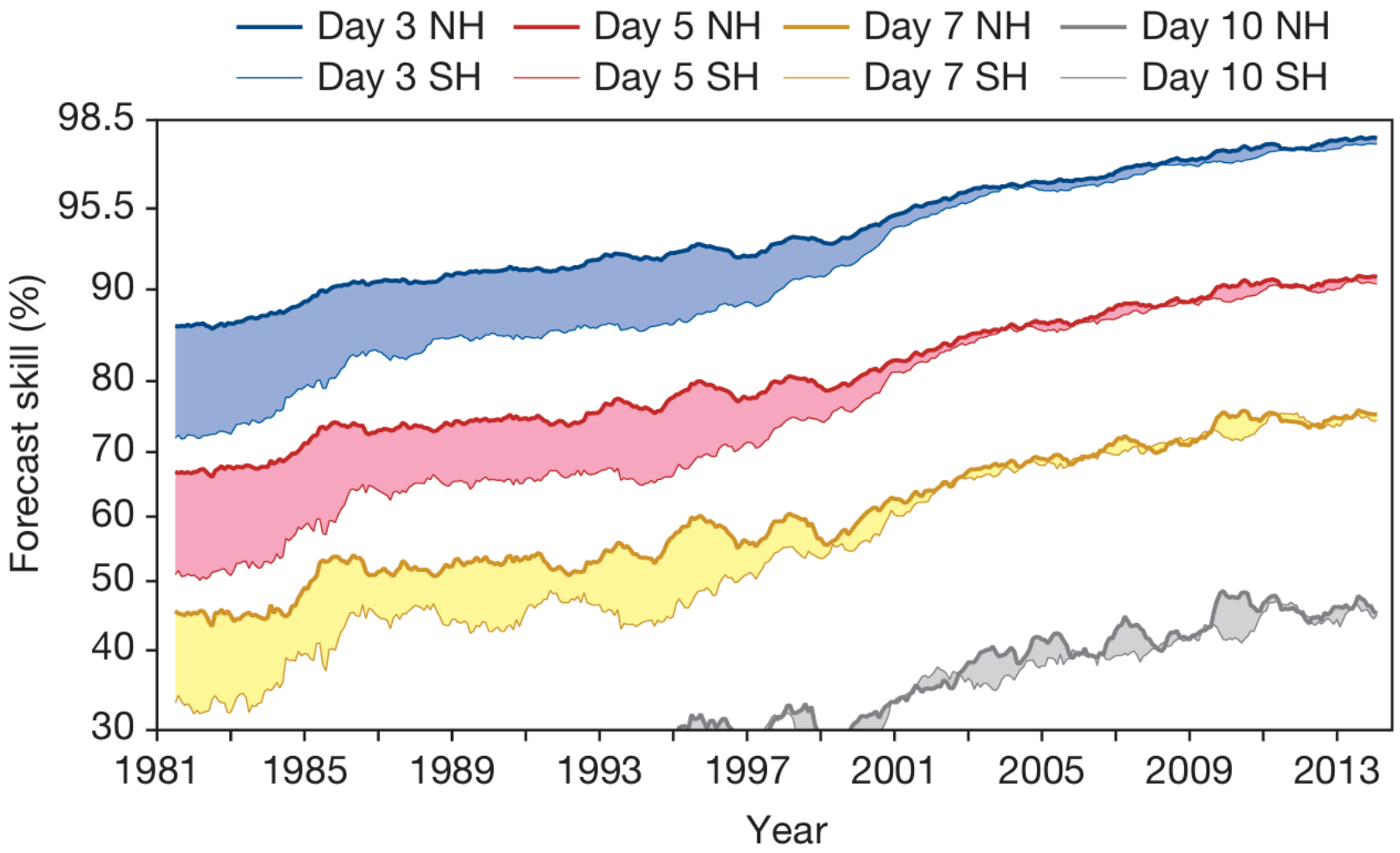
Pole Vault World Record



Armand Duplantis
20ft 8in



The quiet revolution of numerical weather prediction



Bauer et al. 2015

RAISING THE BAR

IN EARTH SCIENCE THROUGH EDUCATION, TOOLS, AND TRAINING

Brian Blaylock | September 2025

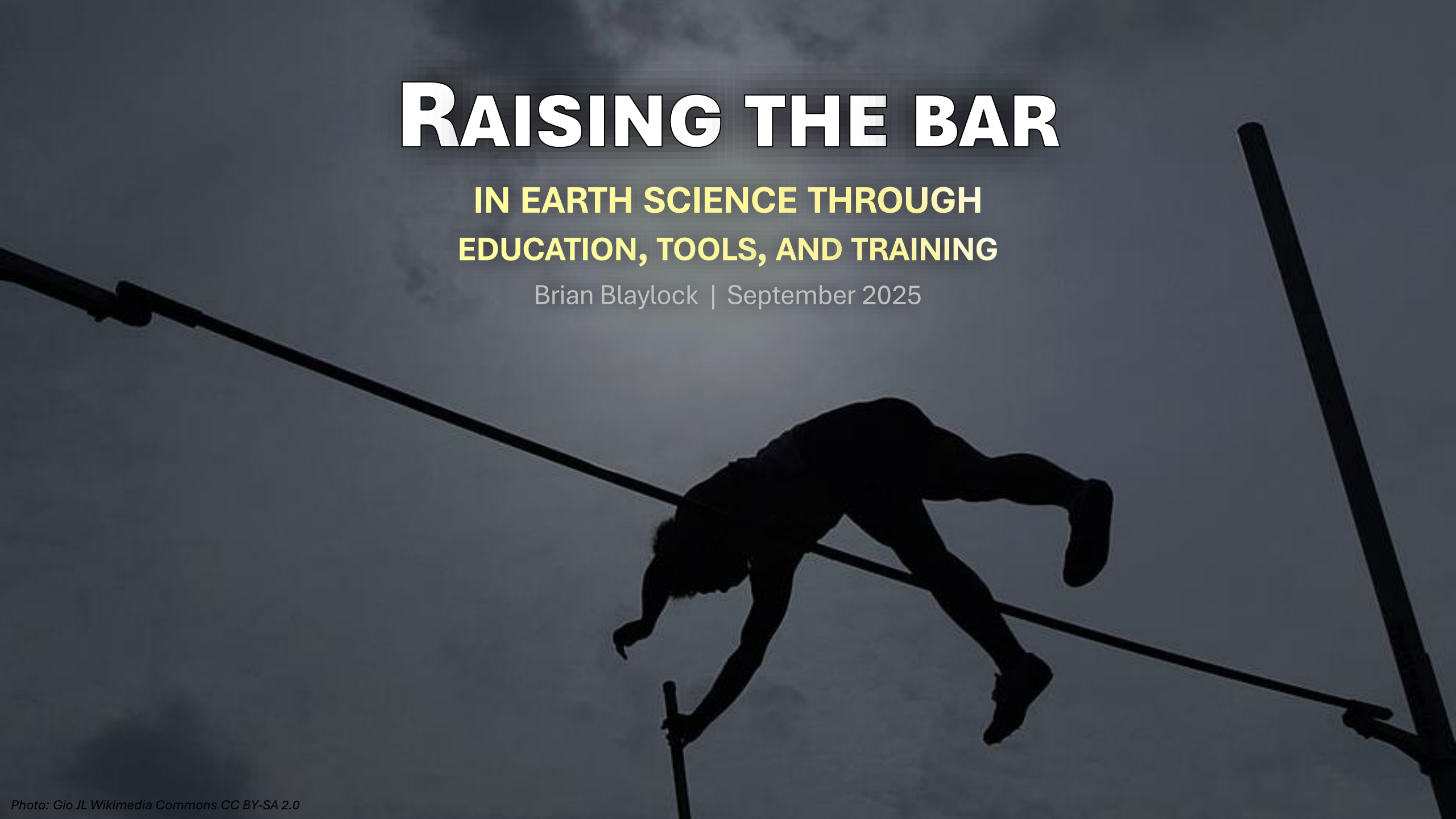


Photo: Gio JL Wikimedia Commons CC BY-SA 2.0

February 1993

Salt Lake City Tornado
August 11, 1999
METEOROLOGY DEPT.
THE UNIVERSITY OF UTAH

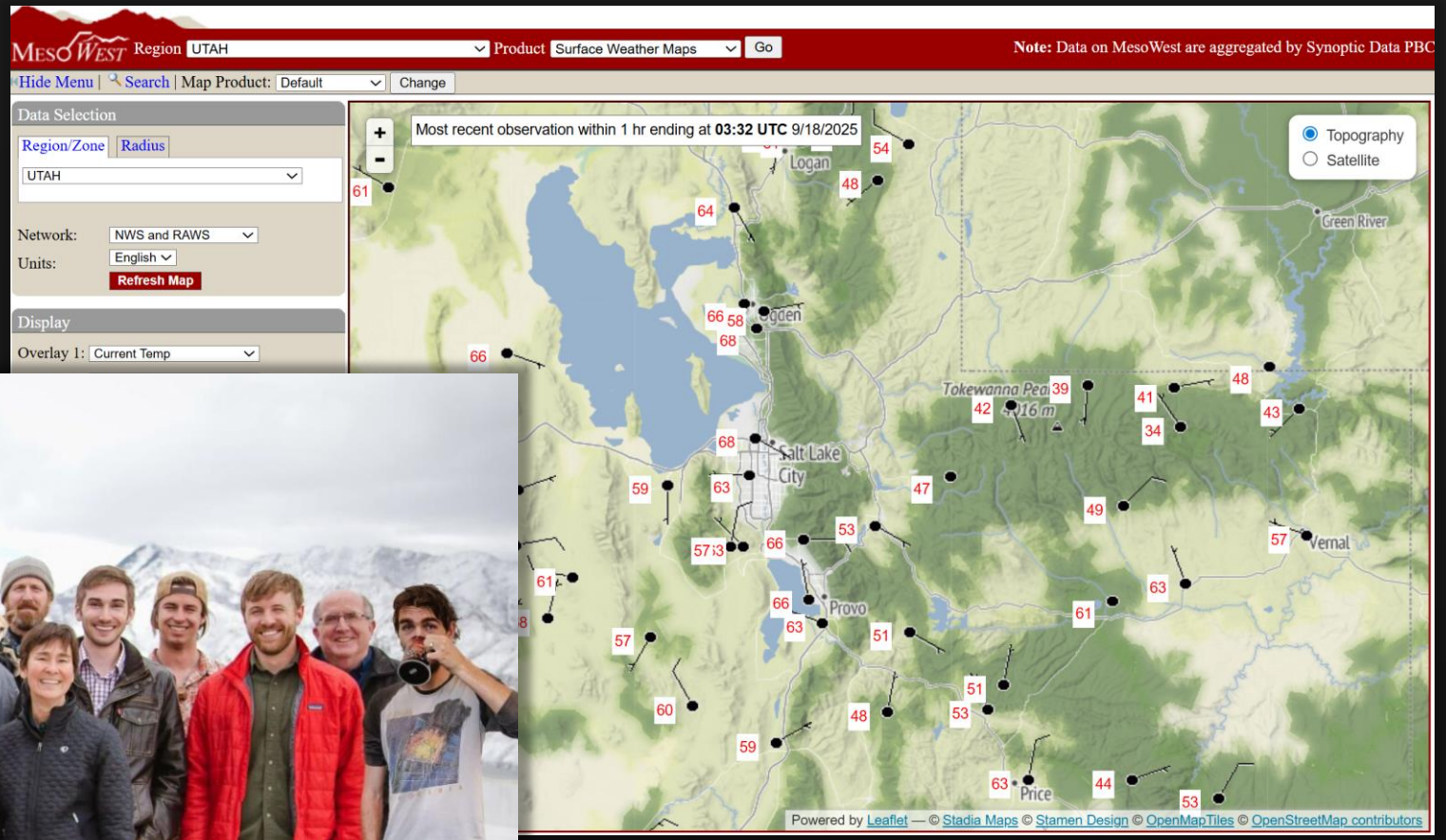
Doppler on Wheels
2011 - University of Utah

MATERHORN
2013

NASA Student Airborne Research Program
2013

Early research opportunities raises the bar

Working in John Horel's MesoWest research group influenced the way I approached my research



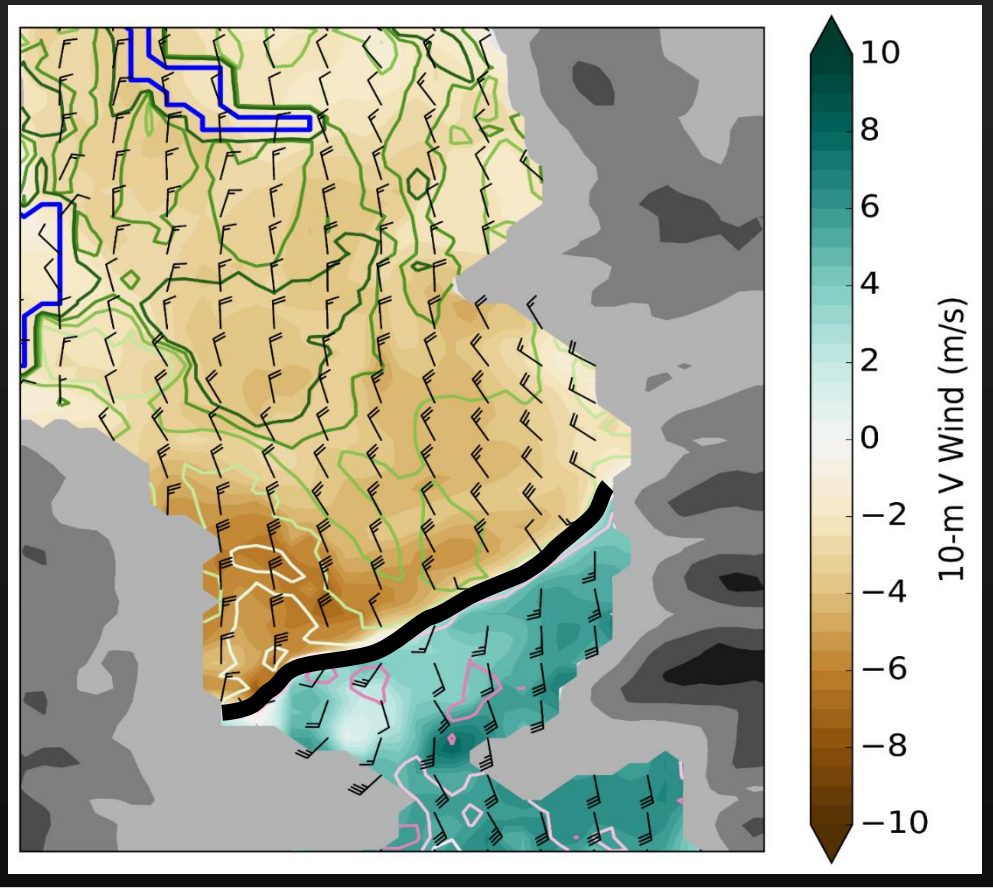
Collect and archive weather data
→ Build tools to access and use data
→ Make tools available to *everyone*

Mentorship and **teamwork** raises the bar

Great Salt Lake Ozone Study - 2015

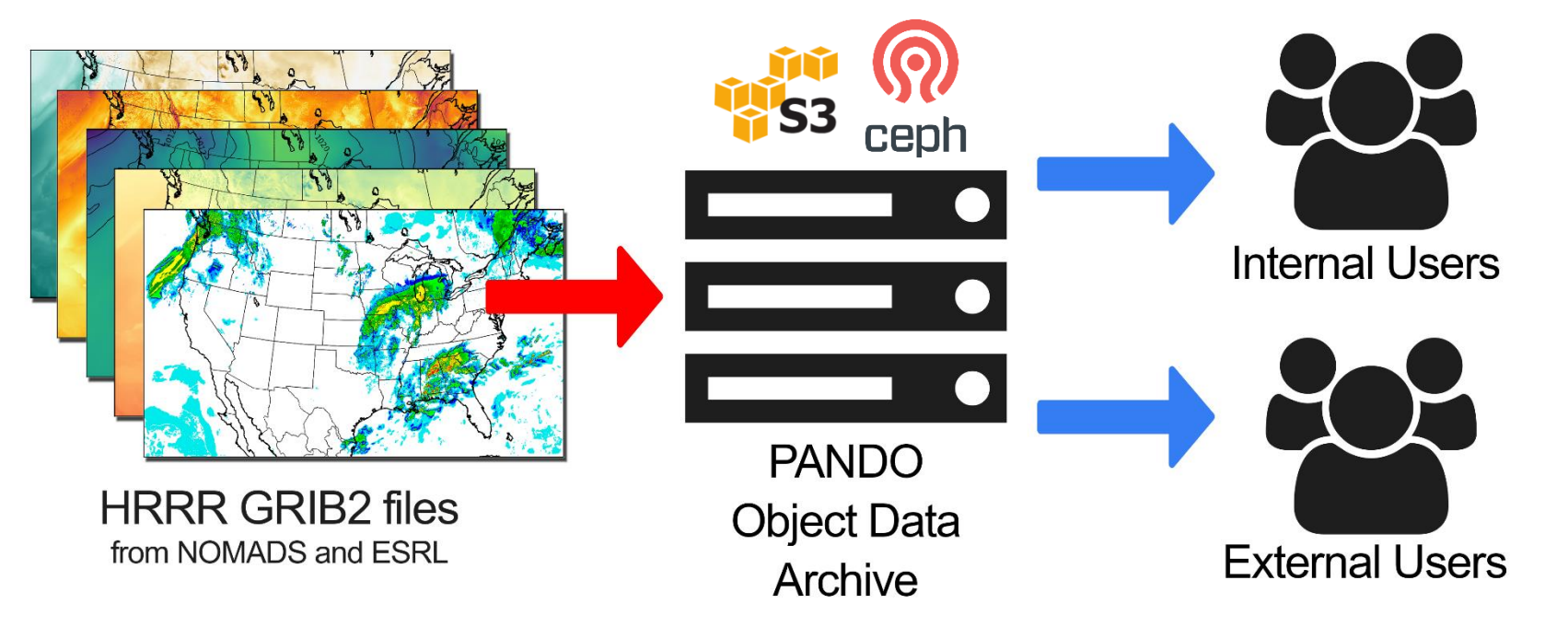
Objective: Explore physical processes that influenced ozone in the Salt Lake Valley

- Downloaded and archived HRRR
- Run WRF with HRRR boundary conditions.



Trying something new raises the bar

Created the first public HRRR archive



Cloud archiving and data mining of High-Resolution Rapid Refresh forecast model output

Brian K. Blaylock [a,*], John D. Horel [a], Samuel T. Liston [b]

Sharing data raises the bar

UNLOCKING THE POTENTIAL OF NEXRAD DATA THROUGH NOAA'S BIG DATA PARTNERSHIP

Steve Ansari, Stephen Del Greco, Edward Kearns, Otis Brown, Scott Wilkins, Mohan Ramamurthy, Jeff Weber, Ryan May, Jed Sundwall, Jeff Layton, Ariel Gold, Adam Pasch, and Valliappa Lakshmanan

NOAA's Big Data Partnership has facilitated unprecedented access to NEXRAD real-time and archive data, enabling cloud computing that is accessible, efficient, and innovative.

2015 - Big Data program (first with NEXRAD)
2019 – Open Data Dissemination Program
"Significant increases in data usage"

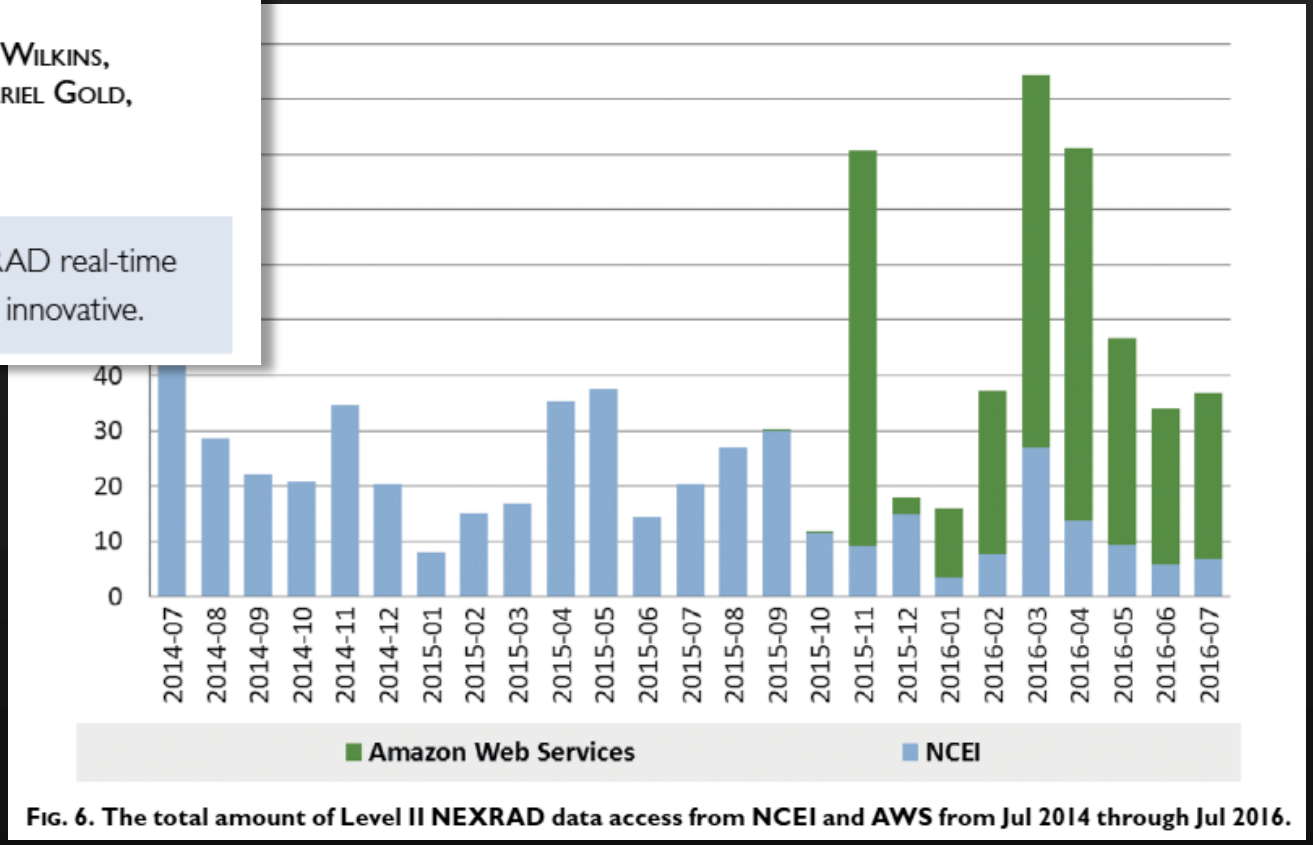
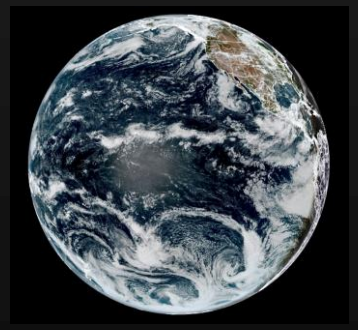
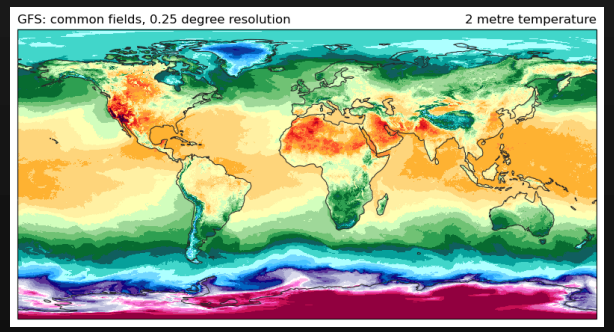


Fig. 6. The total amount of Level II NEXRAD data access from NCEI and AWS from Jul 2014 through Jul 2016.

Now over 150 NOAA datasets!





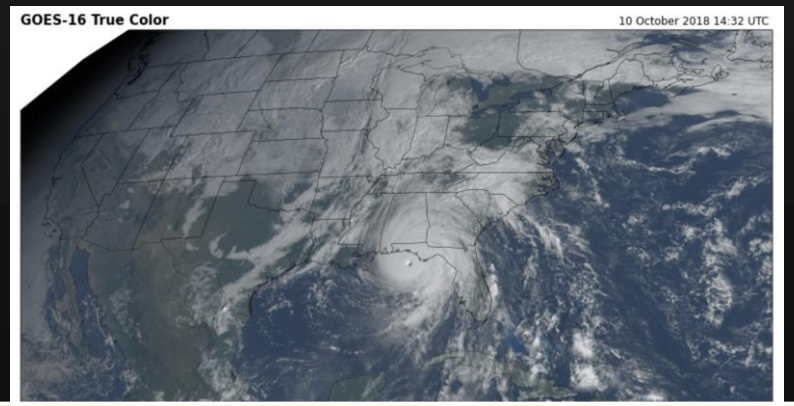
Expanding access raises the bar

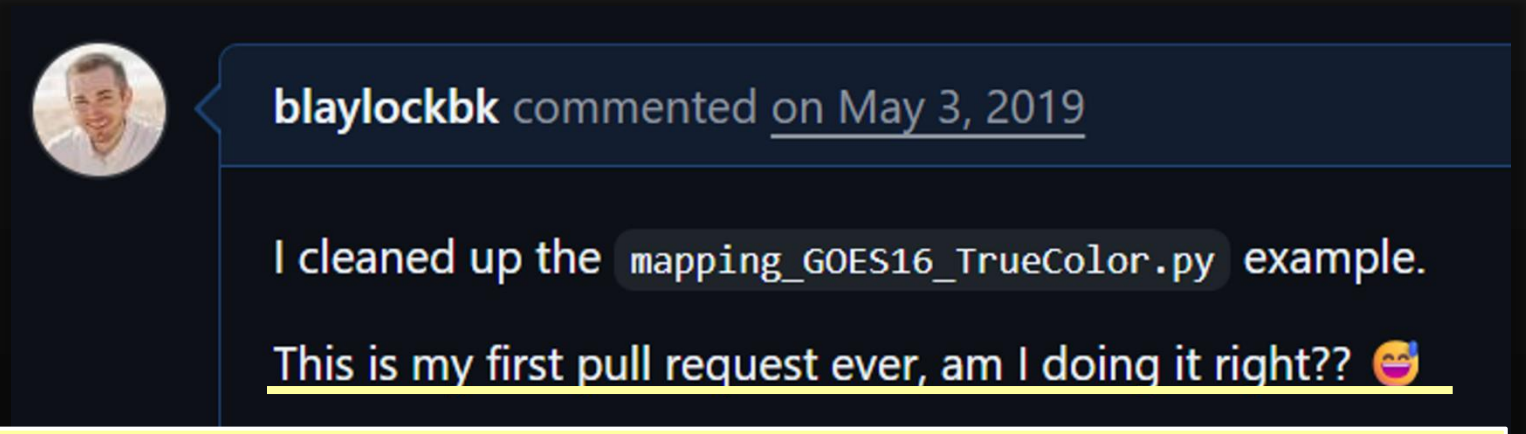
Unidata and me

2018 - Unidata Users Workshop: Reducing Time to Science: Evolving Workflows for Geoscience Research and Education

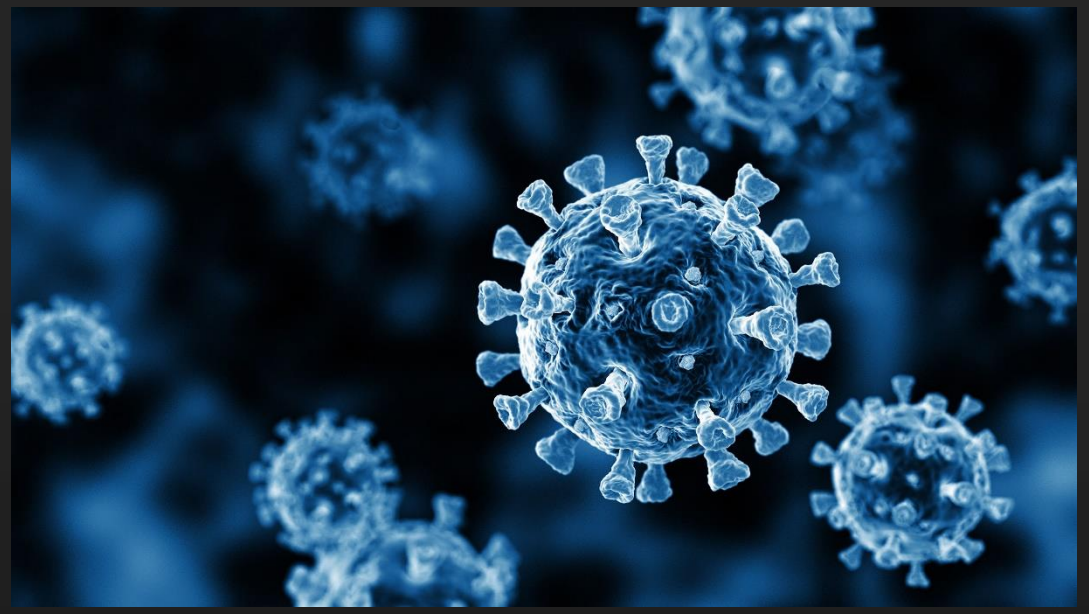
Julien Chastang invited me to add my GOES-16 plotting notebook to the Unidata Python Gallery PR#107

Presented work on HRRR archive.





Invitation to participate raises the bar



September 2020

hrrrb 0.0.1

```
pip install hrrrb==0.0.1
```

Herbie

MetPy Mondays

PROJECT PYTHIA

Training and examples raises the bar

Data Sources

NOMADS

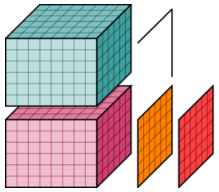
ECMWF Open-data

Azure

aws

Google Cloud Platform

Data Tools



xarray

cfgrib

pandas

matplotlib

dask

MetPy

polars

Developers raised the bar!

Data Sources

Data Tools

NOMADS

ECMWF Open-data

Azure

aws

Access Gap

How do I get the data?

xarray

cfgrib

pandas

matplotlib

```
FILE = "https://blah.blah.s3.blah.com/blah/blah.grib2"
tool.open_dataset(FILE)
```

URLs are not intended for human consumption

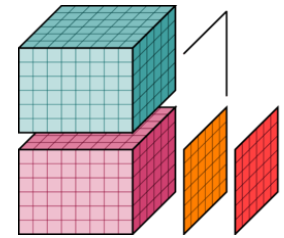
Data Sources

Data Tools

Find NWP data…

Herbie

…make it ready to use.



```
from herbie import Herbie
Herbie("2024-01-01", model='hrrr')
```

Goal: Help scientist spend less time discovering/wrangling data.

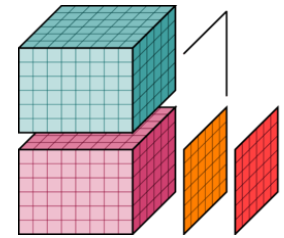
Data Sources

Data Tools

Find NWP data…

Herbie

…make it ready to use.



Find wx data…

SOUNDER PY — SOUNDING DATA RETRIEVAL TOOL FOR PYTHON

Siphon

GOES-2-go

kerchunck

DRpy

SynopticPy

etc.

…make it ready to use.

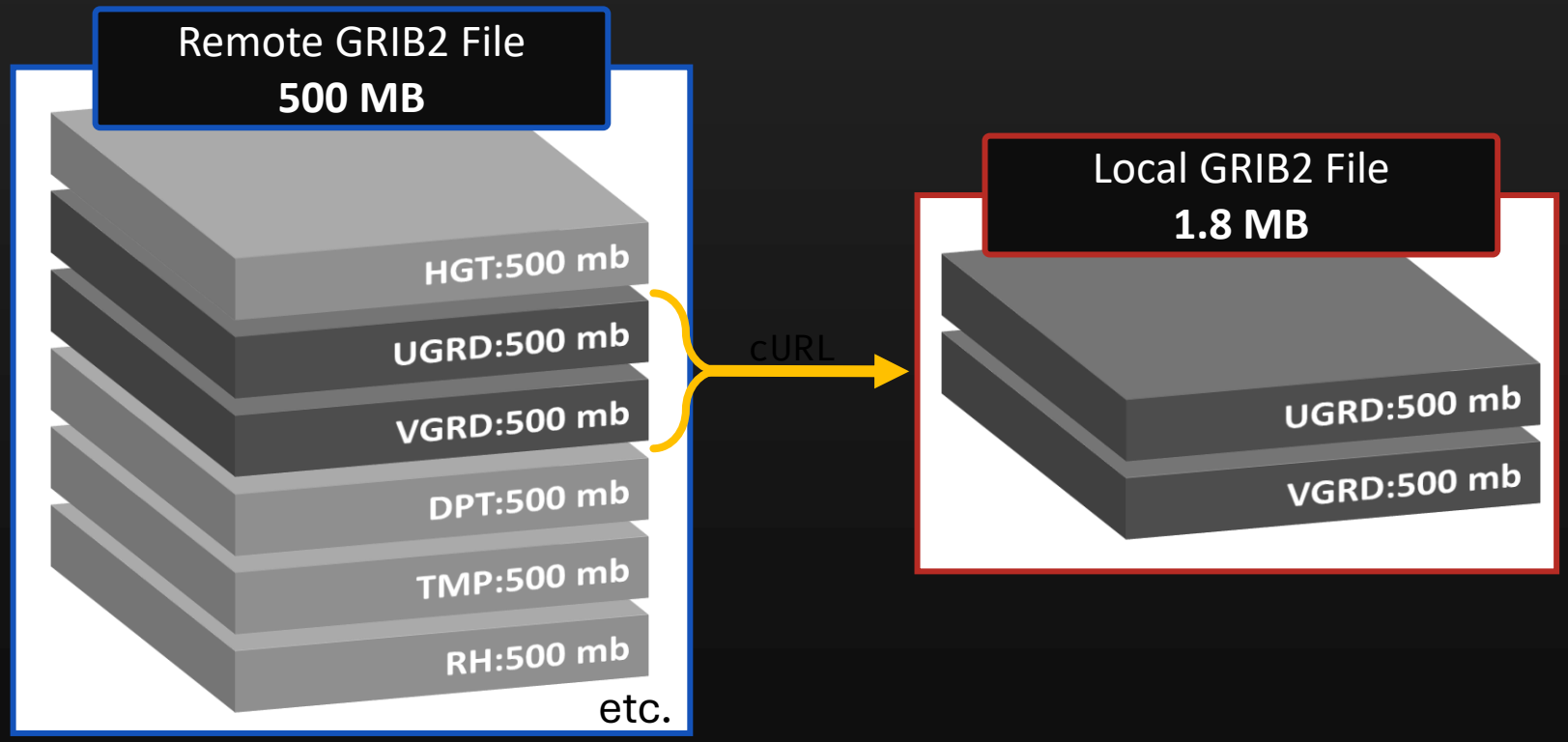
Goal: Help scientist spend less time discovering/wrangling data.

How Herbie Works

```
H = Herbie("2024-01-01 12:00", model="gfs")
H.download("[U|V]GRD:500 mb")
```

Herbie found this

https://noaa-gfs-bdp-pds.s3.amazonaws.com/gfs.20240101/12/atmos/gfs.t12z.pgrb2.0p25.f000

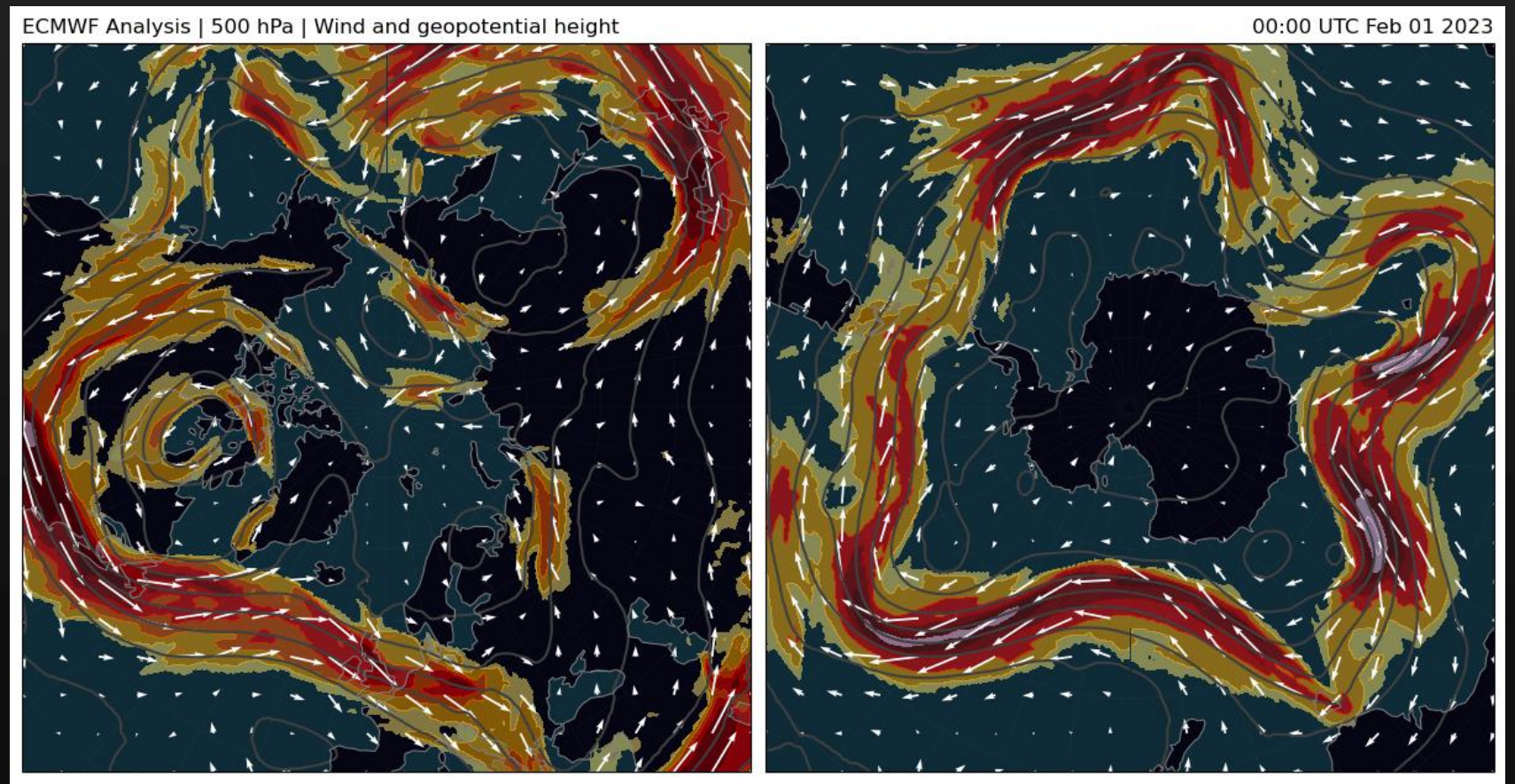


Thanks to **Chris Galli** for teaching me this

Only download the data you need; Subset file by individual GRIB message

Example: ECMWF 500 hPa wind analysis

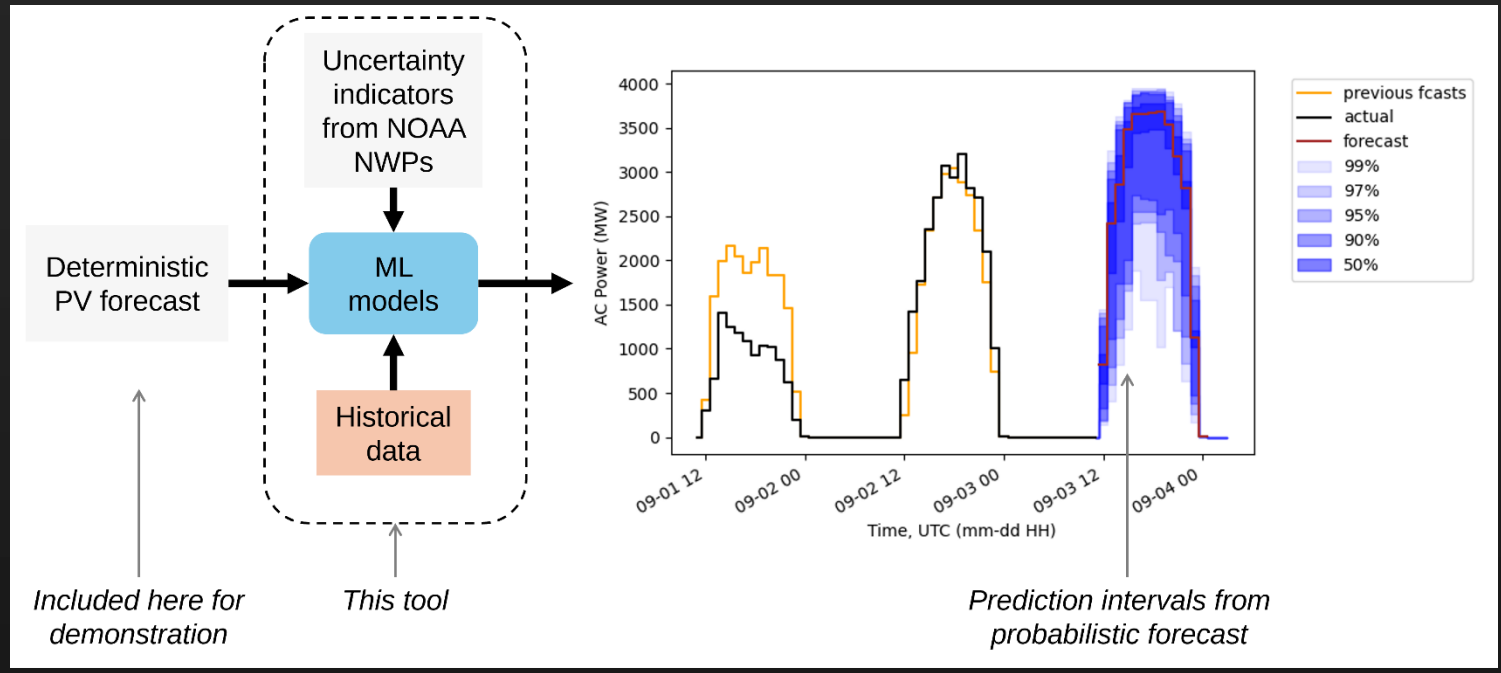
```
for date in DATES:
    H = Herbie(date, model="ifs", fxx=0)
    ds = H.xarray("[gh|u|v]:500 mb")
    make_wind_map(ds)
```

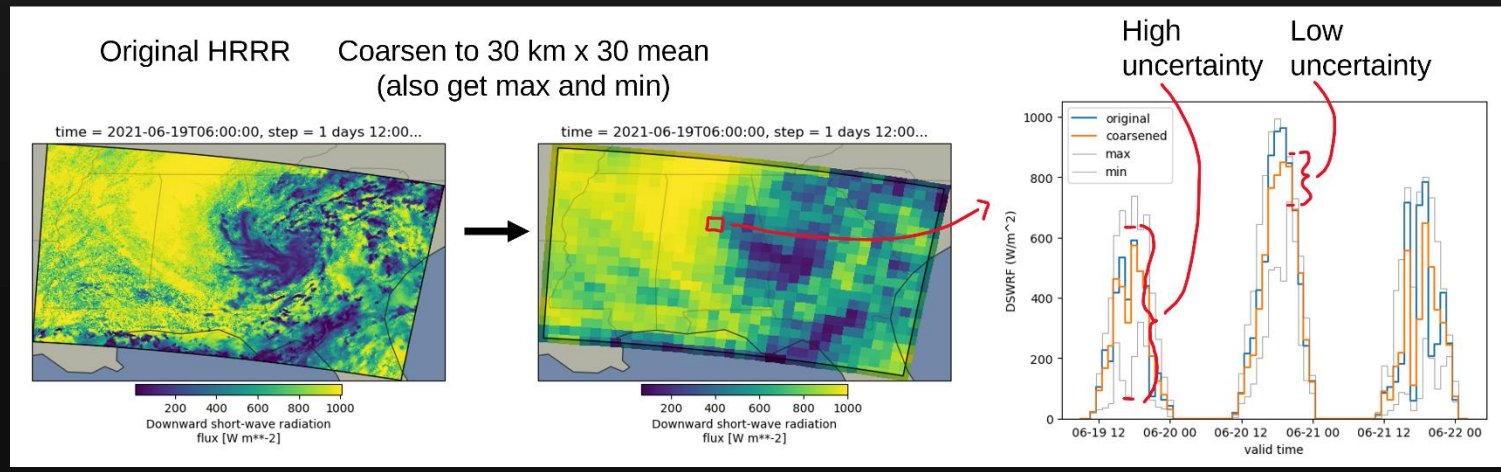


Who uses Herbie? Non-meteorologists

Solar Fleet Forecast Probability Tool by @williamhobbs

A tool for making a probabilistic power forecast for a fleet of solar plants using numerical weather prediction.



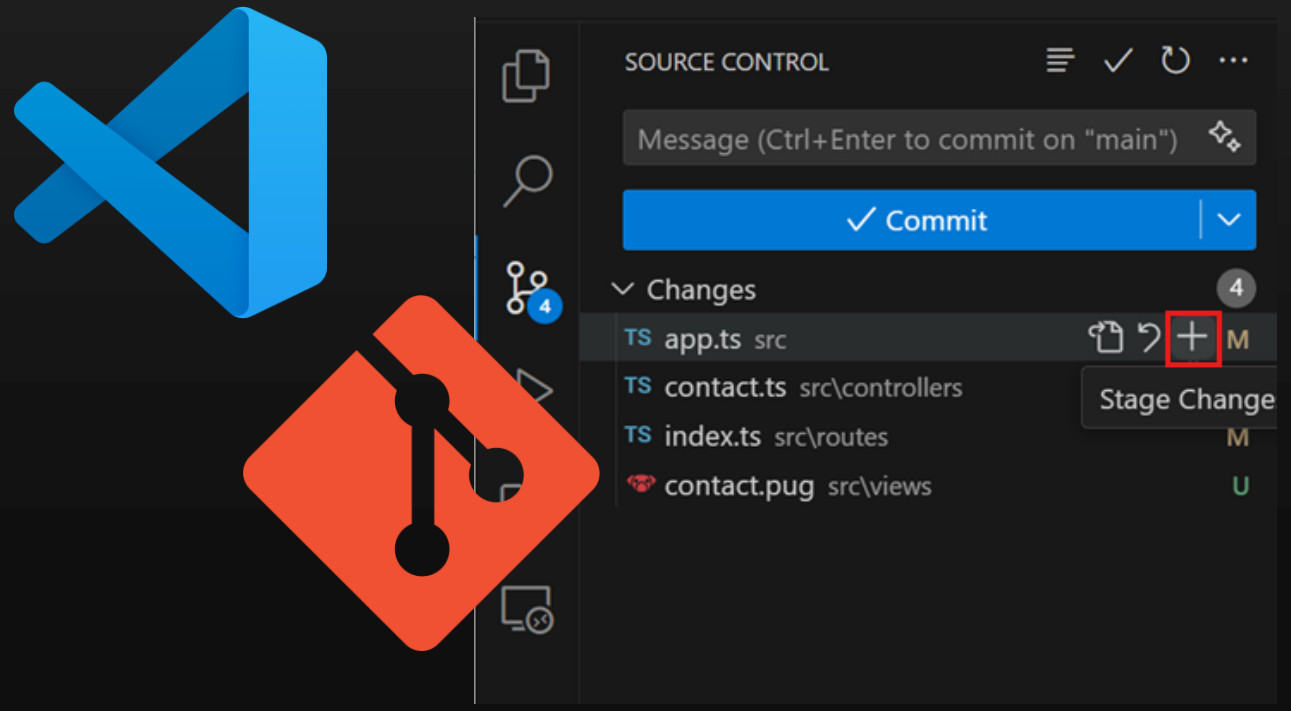


Raise the Bar by participating in Open Source

- ***Git is a highly desirable job skill.***
- Invest in quality documentation.
- You can have an “open source” attitude in *any* type of work.

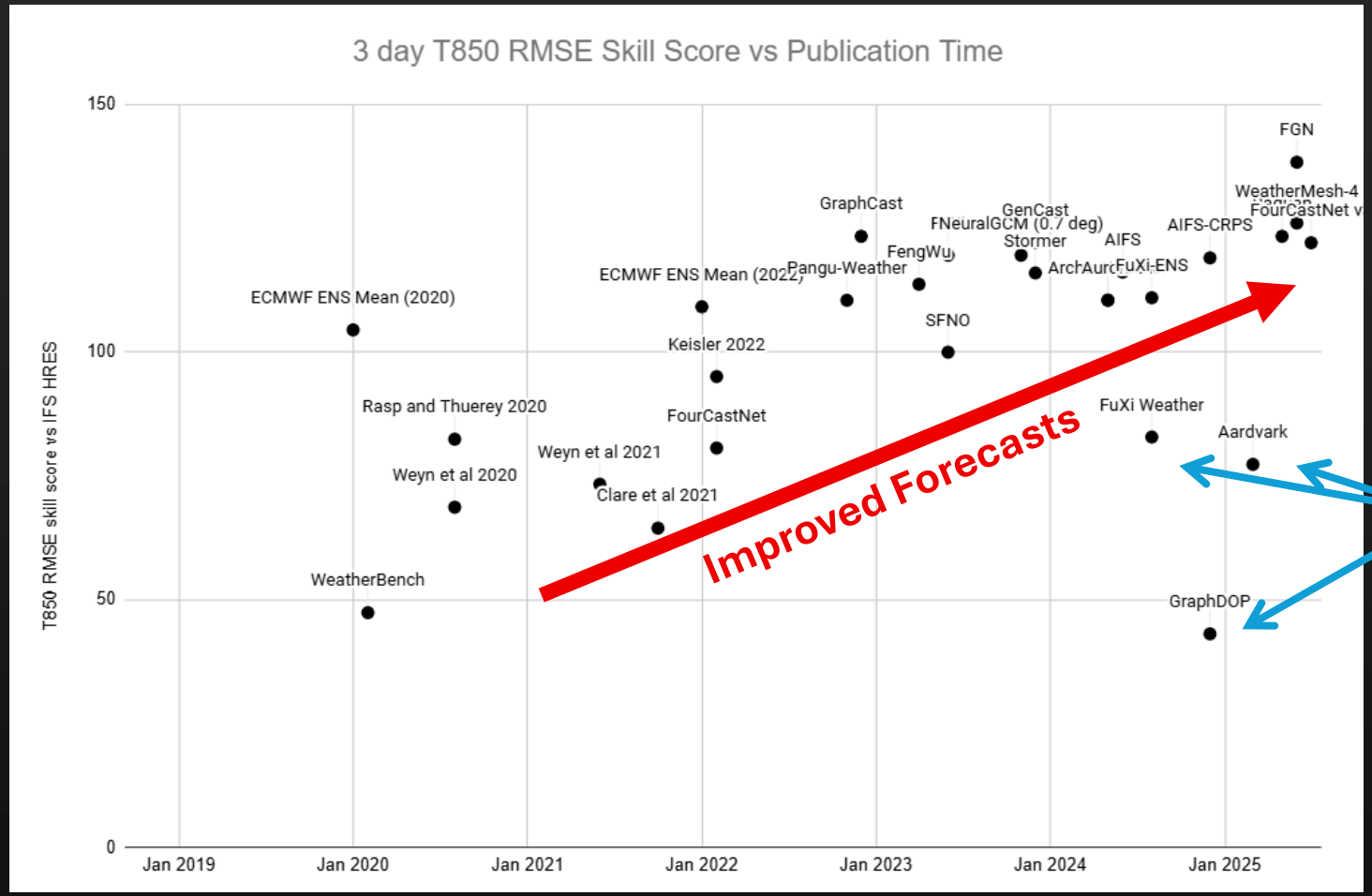
We need to teach git early and often.

Teaching git with the VS Code GUI is very effective



What’s new and exciting

Machine Learning Weather Forecasting



Stephen Rasp

Raising the bar again with
Analysis-ready data and advanced tools built in Python

Table Data in Parquet

Decades of meteorological observations converted from BUFR to Parquet.

<u>Why is this important?</u>

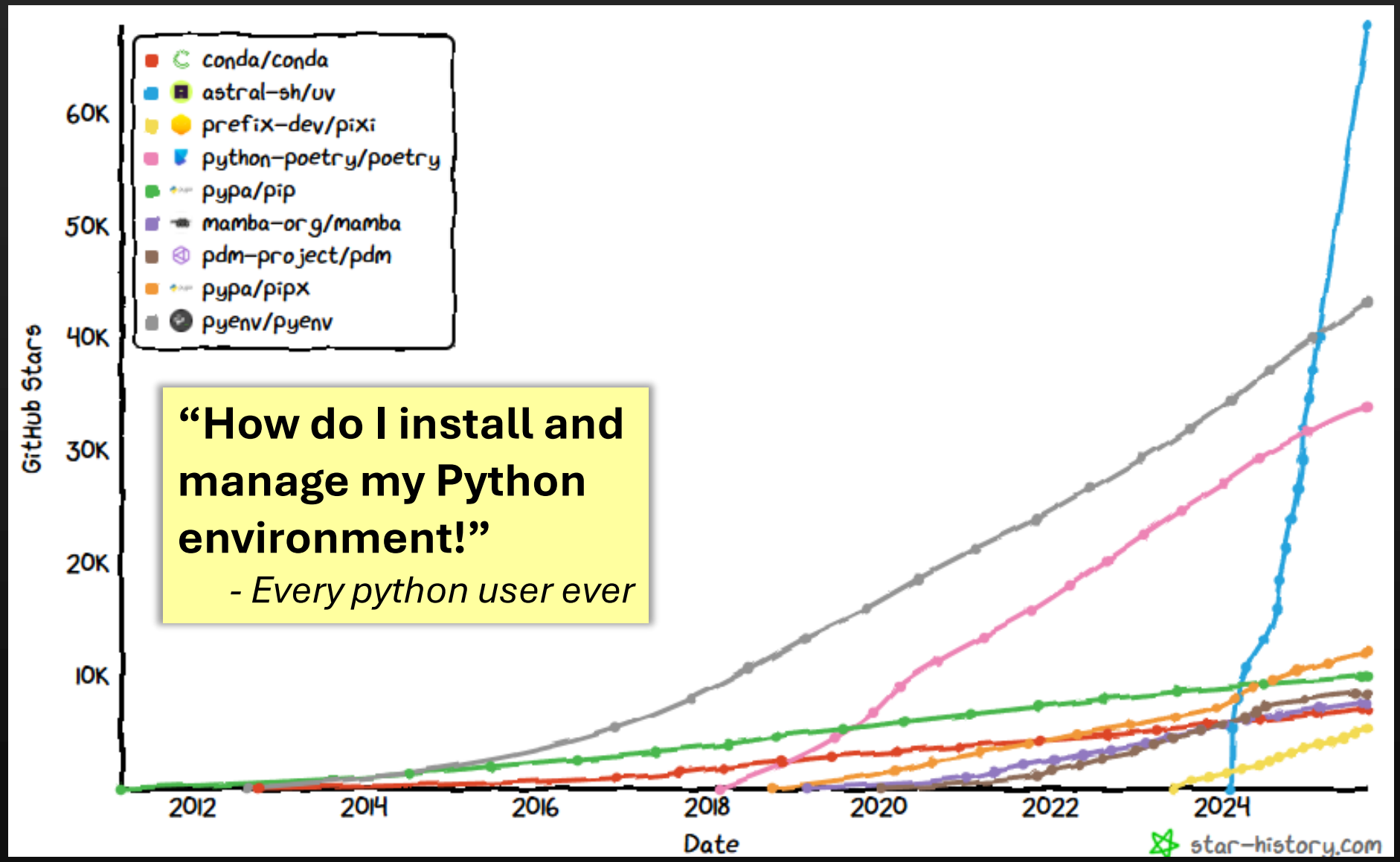
Analysis-ready data format

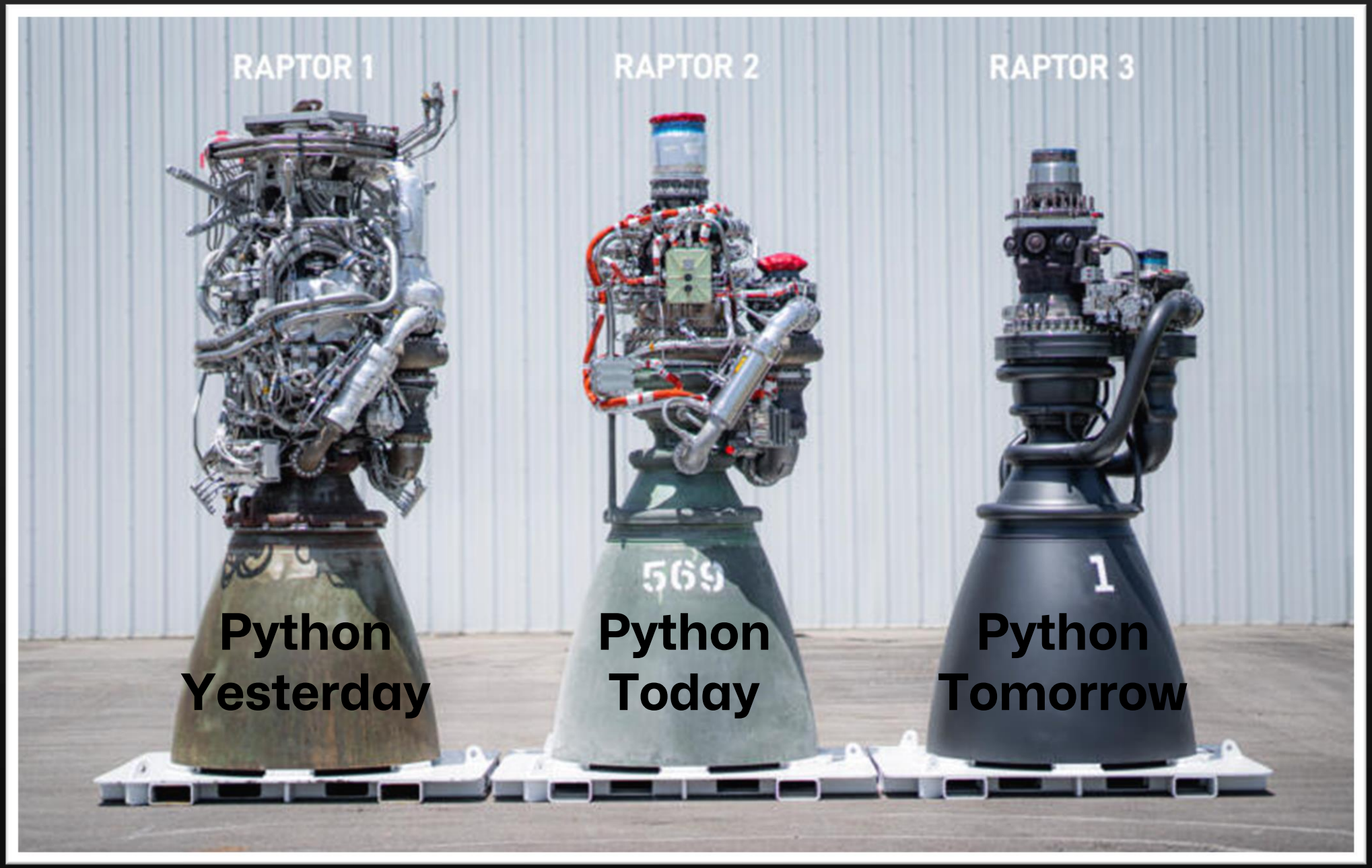
- Decoding BUFR is hard.
- Process data with modern tools (Polars).

Brightband

NNJA-AI

Advances in Package Management




RAPTOR 1
RAPTOR 2
RAPTOR 3
569
1
Python
Yesterday
Python
Today
Python
Tomorrow

Raise the bar

Provide early research opportunities

Invest in quality training and education

Be a mentor

Try something new

Share data *and* tools

Photo: Gio JL Wikimedia Commons CC BY-SA 2.0