

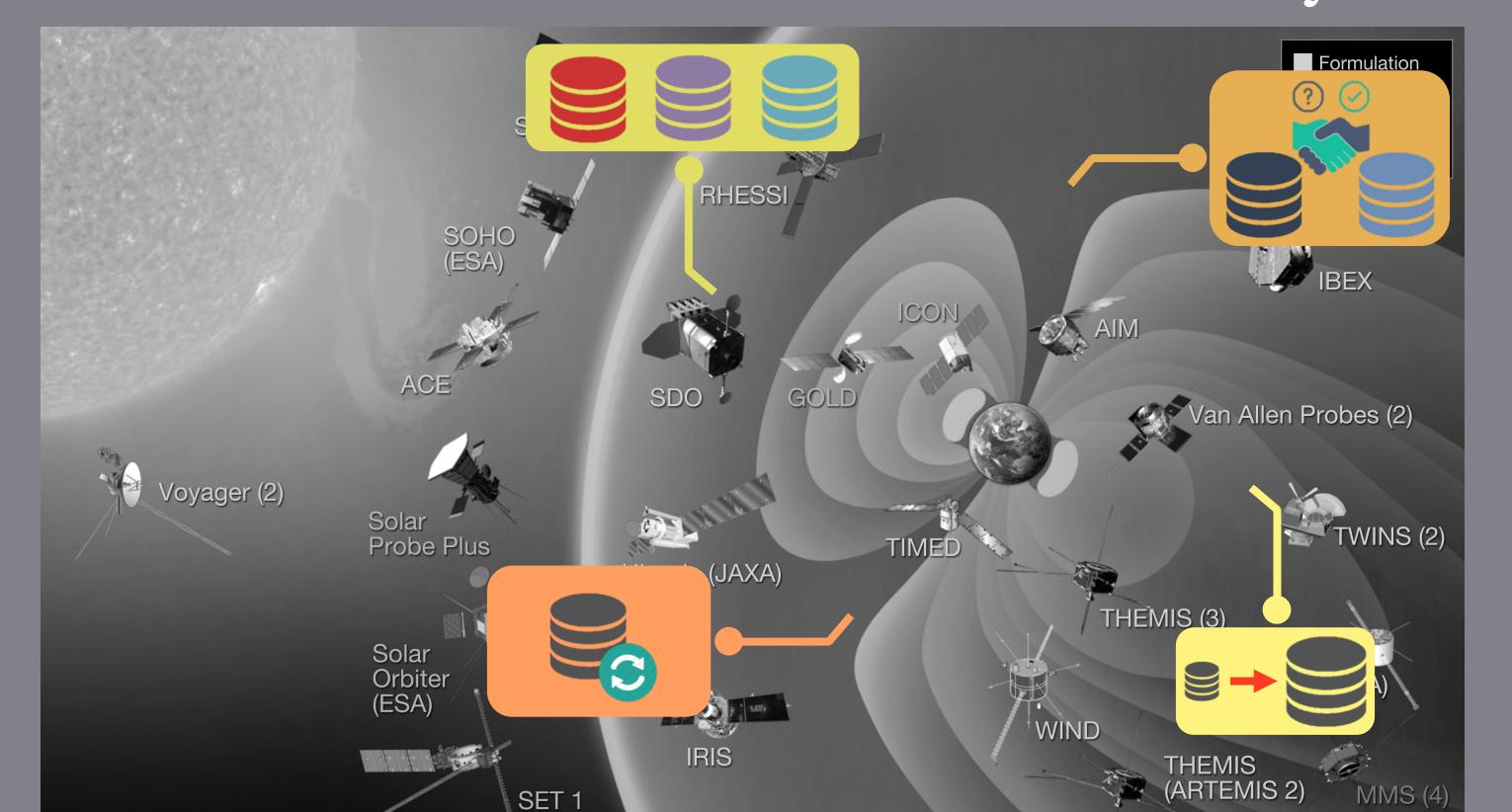
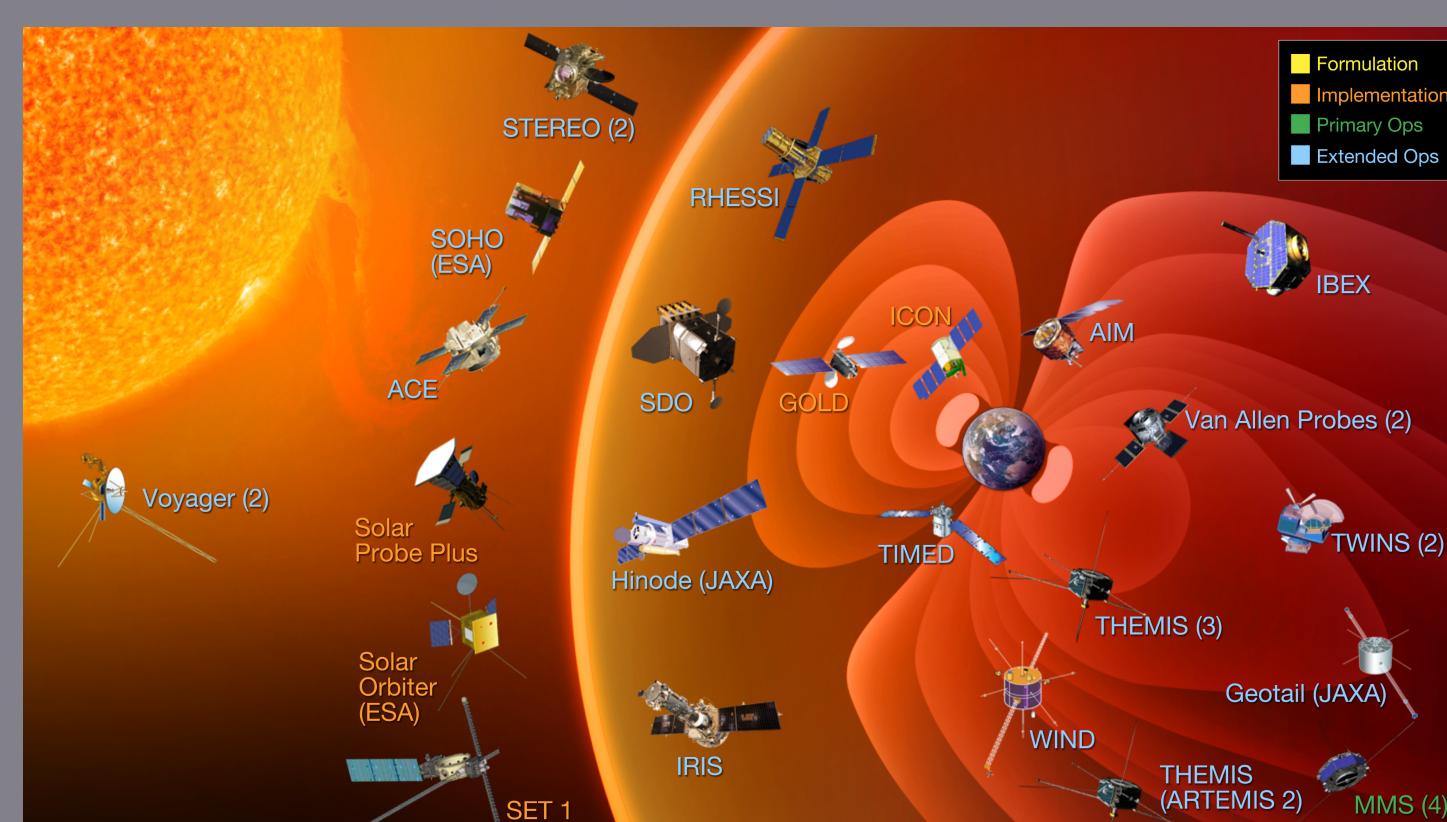
Ushering in a NEW FRONTIER in Geospace Through Data Science

Learn more, collaborate, and be a part of the New Frontier

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What is the current space science data landscape and why does it need data science?



'Big Data'...not just volume

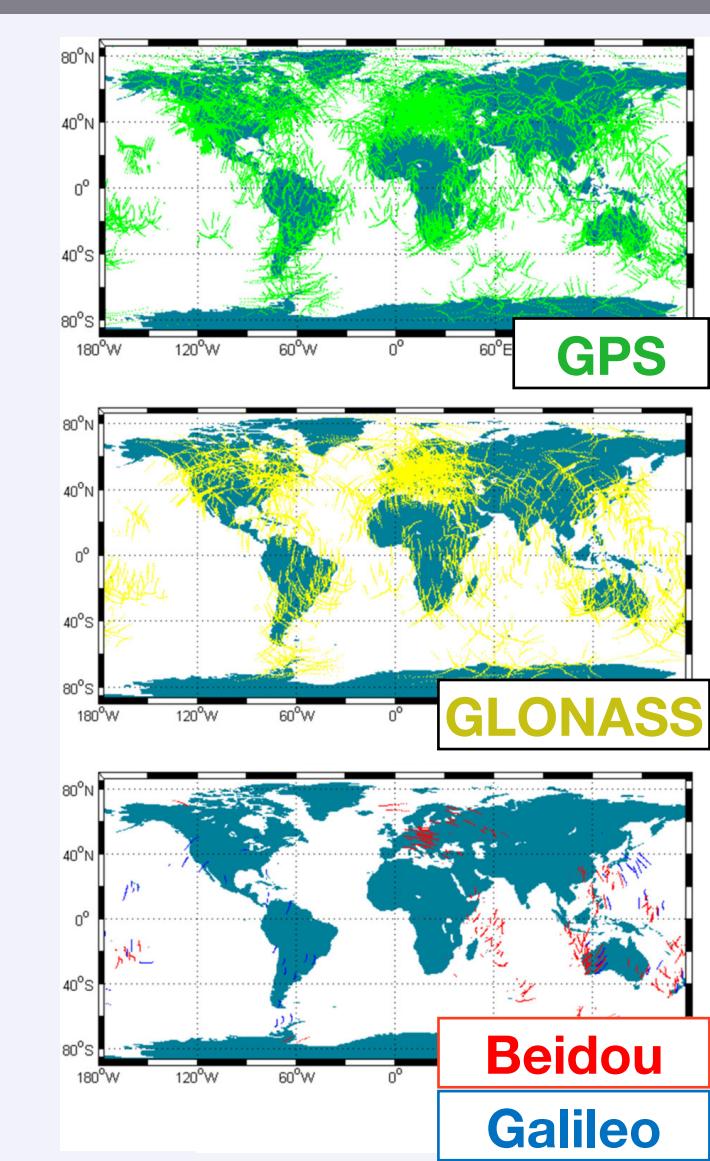
- Volume
- Variety
- Veracity
- Velocity

'Data Science' is...

• "Scalable architectural approaches, techniques, software and algorithms which alter the paradigm by which data are collected, managed and analyzed." – Dan Crichton, NASA JPL

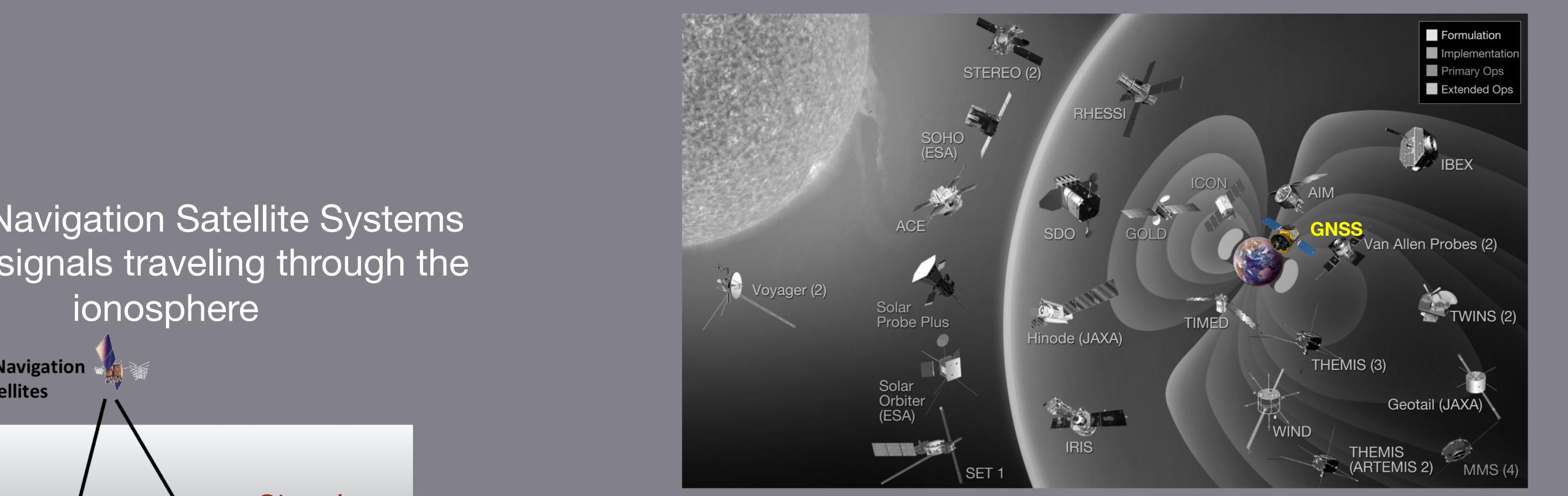
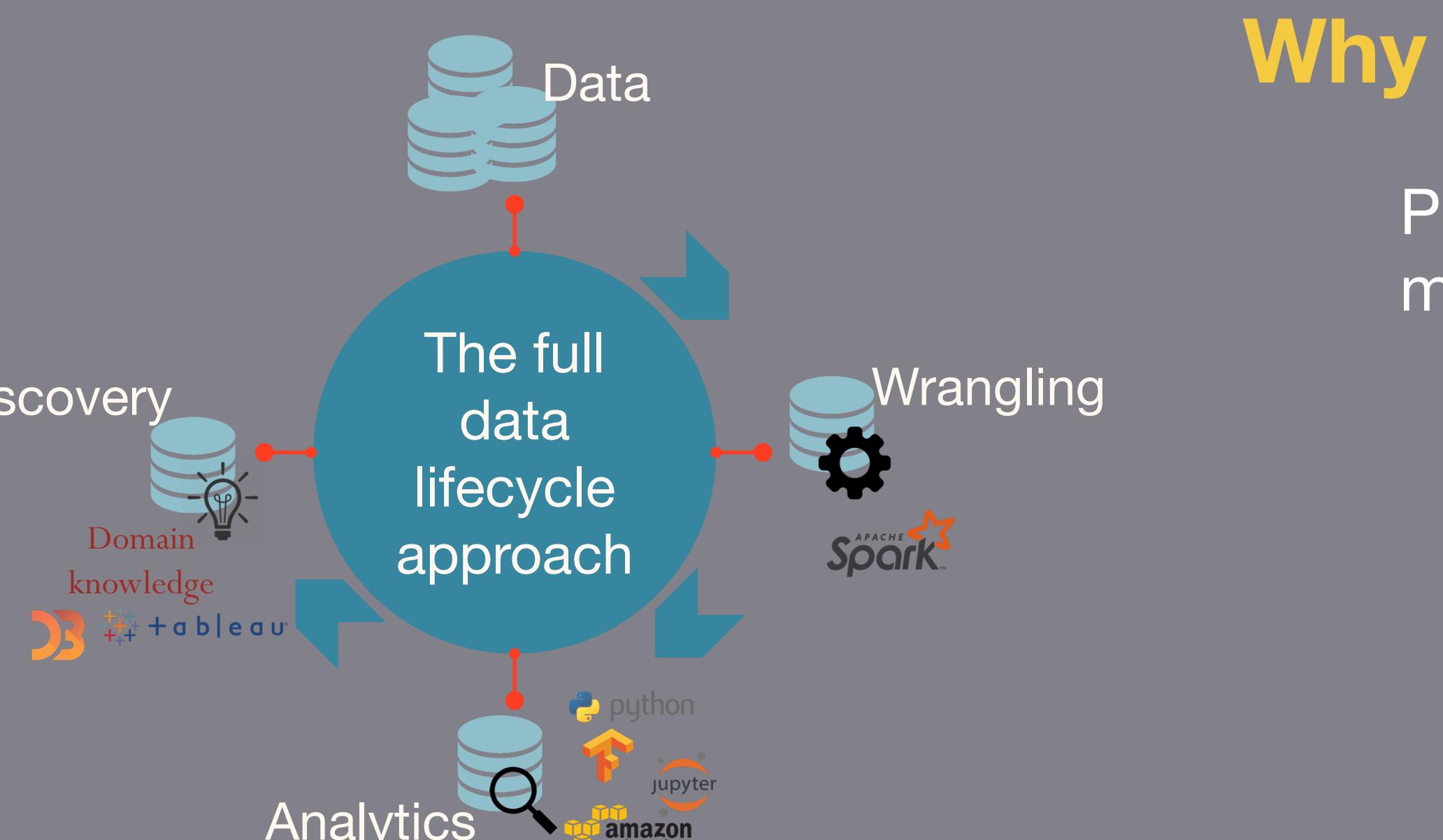
Opportunity:
Evolve traditional approaches
Embrace data science-driven discovery
Enable interdisciplinary work

These data are illustrative of challenges and opportunities of space science data



Single day of observation locations from GNSS signals

Total electron content (TEC) data, inferred from GNSS signal delays during passage through the ionosphere, provide critical information about the Earth's ionosphere at higher cadence and over a larger portion of the globe than any other single data set



Global Navigation Satellite Systems (GNSS) are among the most important systems sensitive to space weather, but are also one of the premier tools to facilitate new space weather understanding

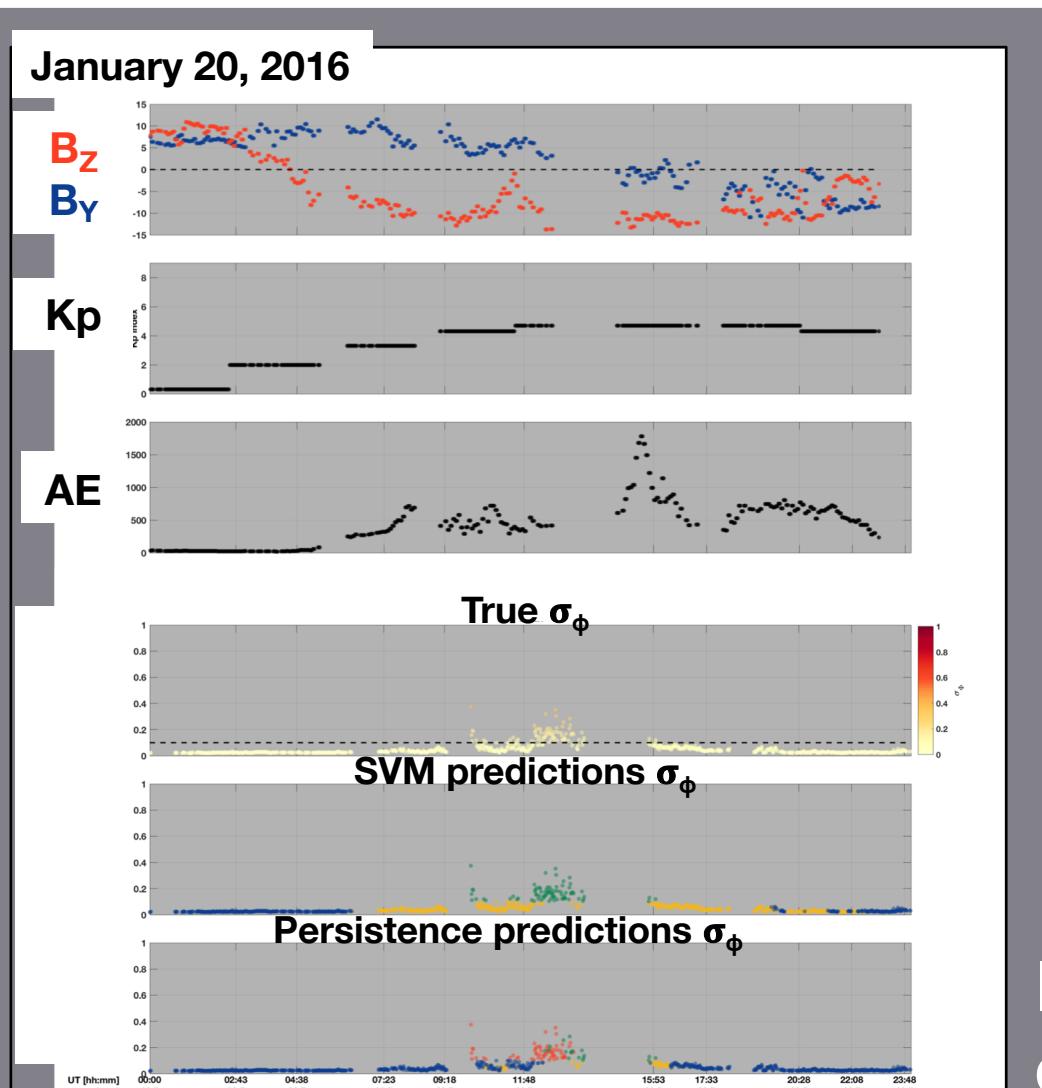
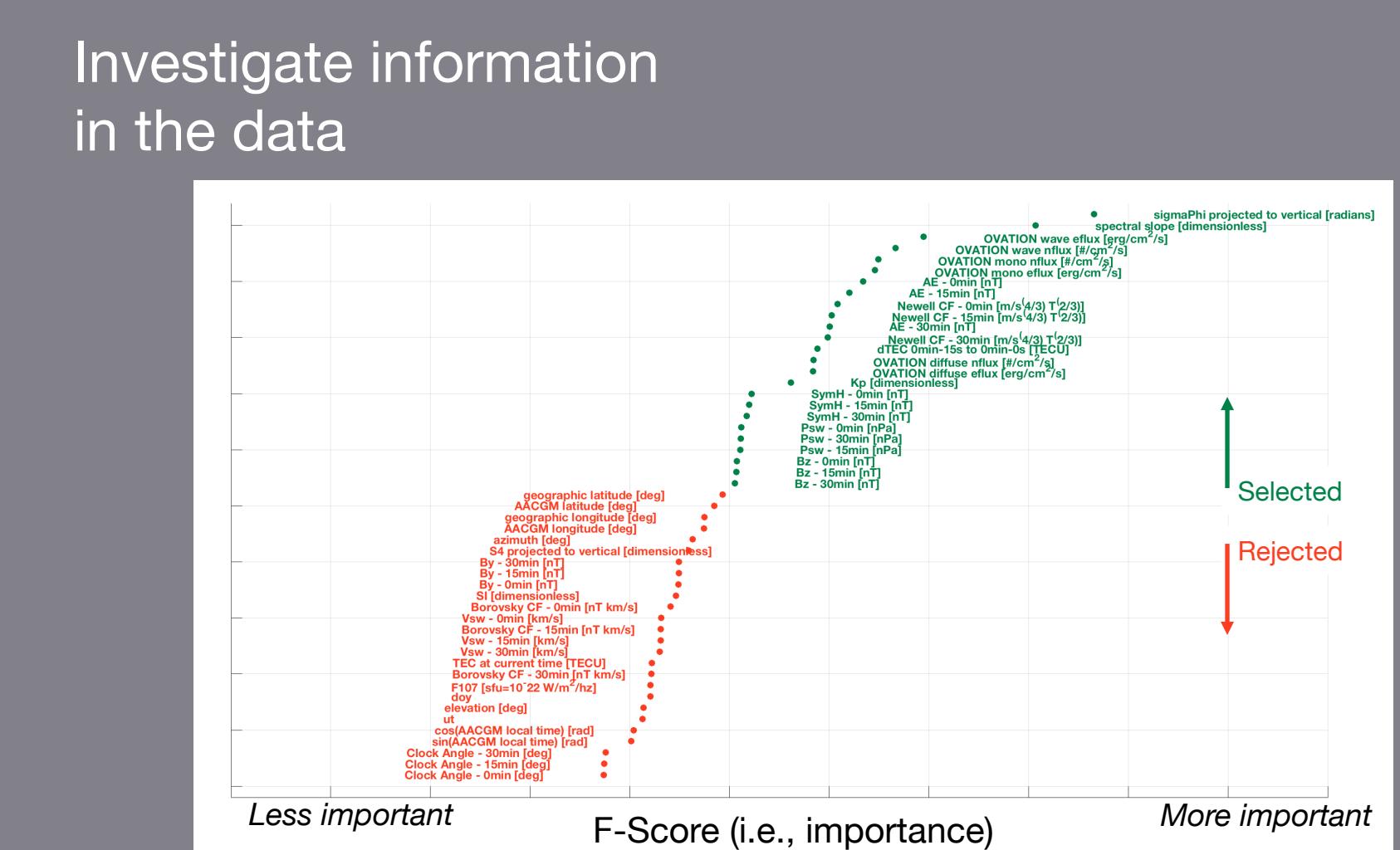
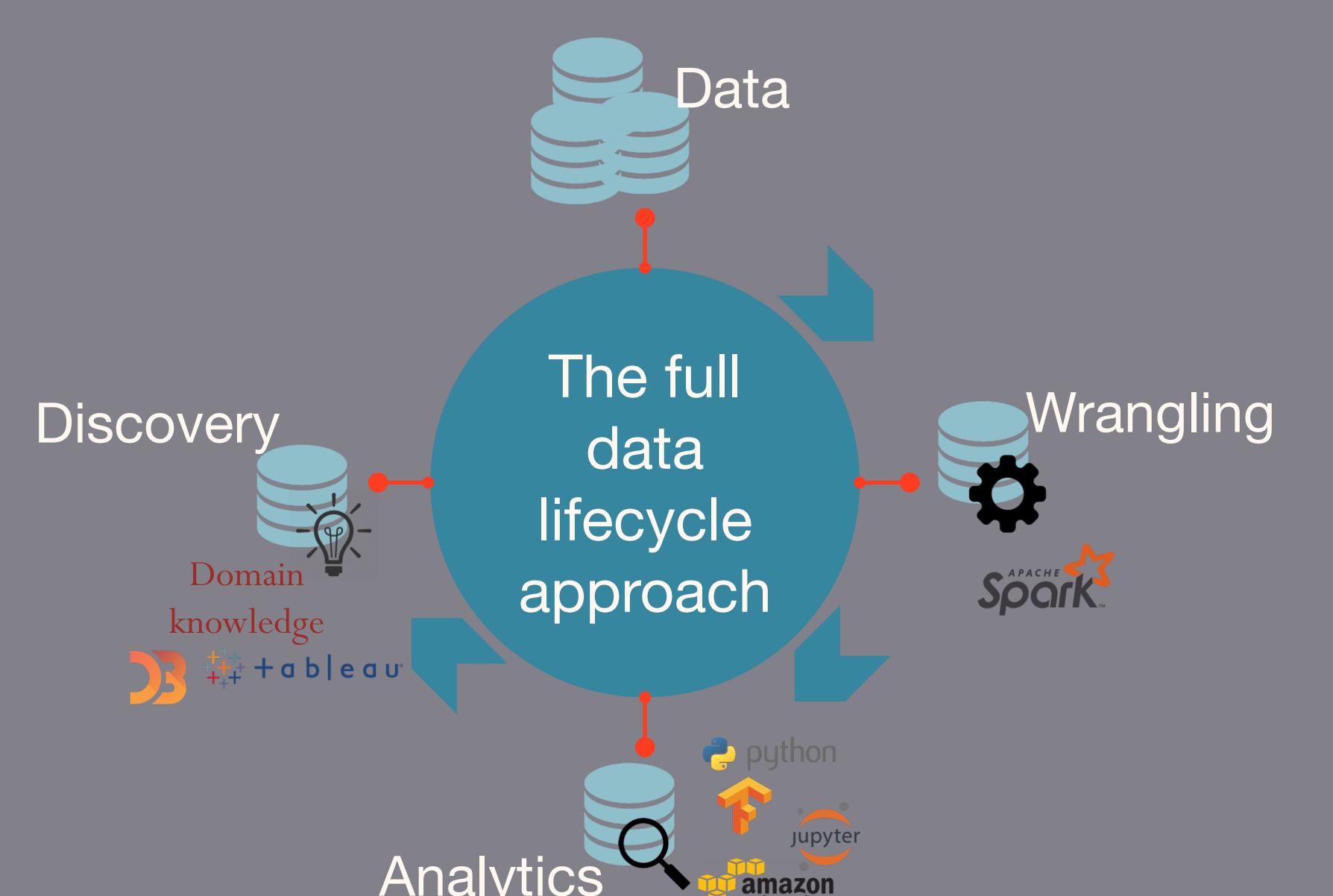
What if space science were an exploration, data-driven science?

What is the potential for big data technologies and machine learning to usher in a New Frontier in space science?

JPL Data Science Working Group Pilot Program



Machine Learning:
Know when and how to use
Investigate relationship to physics
Understand the model (i.e., explainability)



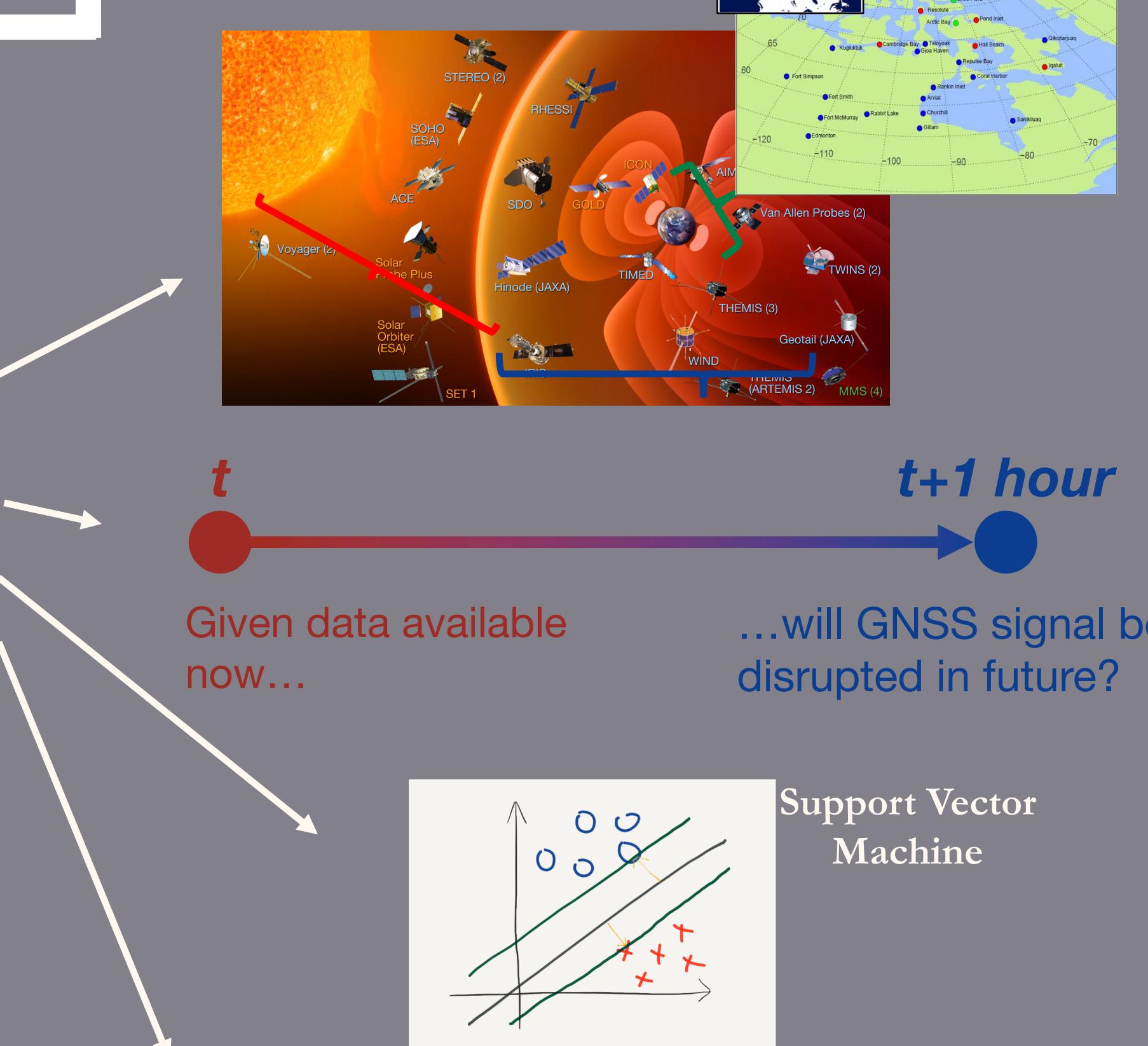
Why machine learning?

Problems well-suited to machine learning:

- Classification
- Event detection
- Segmentation
- Clustering
- Prediction
- Recommendation

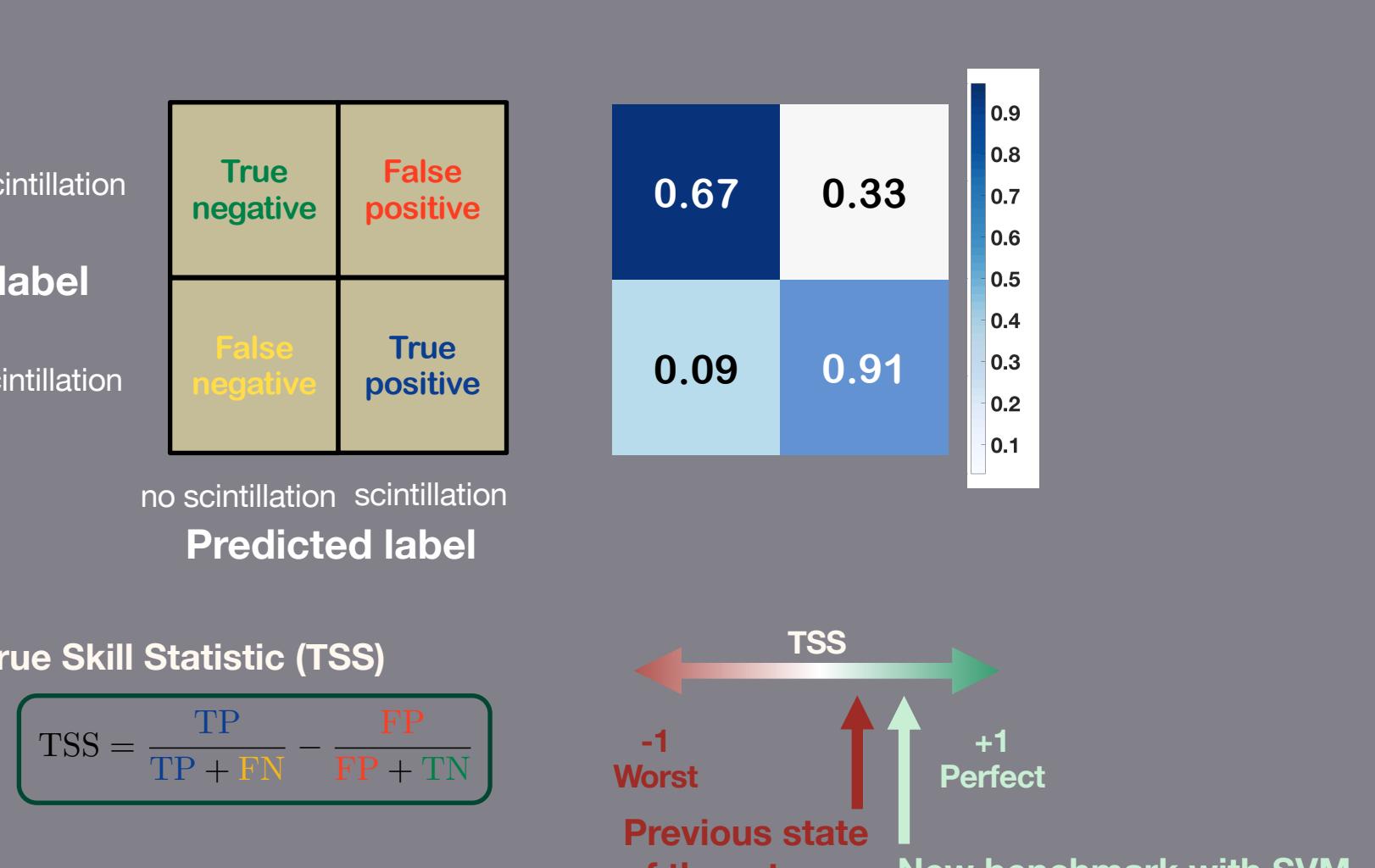
Steps to successful machine learning:

1. Obtain data
2. Define predictive task
3. Choose ML algorithm
4. Understand the model



Evaluation & Explanation

- Integrate data-driven and domain knowledge
- Obtain new physical insight
- Improve the models



Ambitious pilot projects:
Be radically interdisciplinary
Explore massive space of cutting-edge data science-driven approaches
Utilize innovative data science tools and technologies

What does this mean across the space sciences?

Key trends for the New Frontier:
Be radically interdisciplinary
Understand the models
Be open by default

Opportunities through constantly evolving data landscape

Compelling use cases

Methods for progress

Machine learning + traditional approaches

The New Frontier