



TRILLIUM USA

[FDLXHELIO.ORG](https://fdlxhelio.org)

AI Inference products, foundation models and multi-domain approaches to NASA Heliophysics.

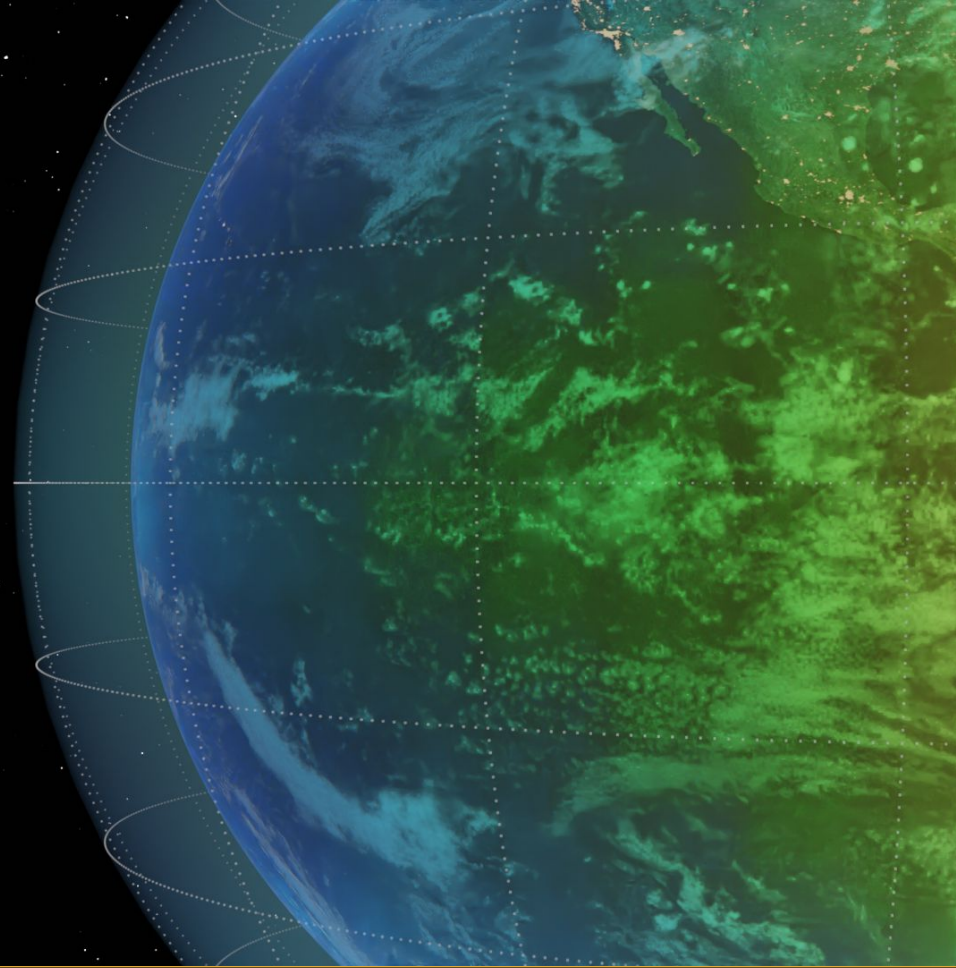
4th Eddy Symposium

James Parr, CEO, Trillium Technologies

Anne Spalding, US Program Director, Trillium Technologies

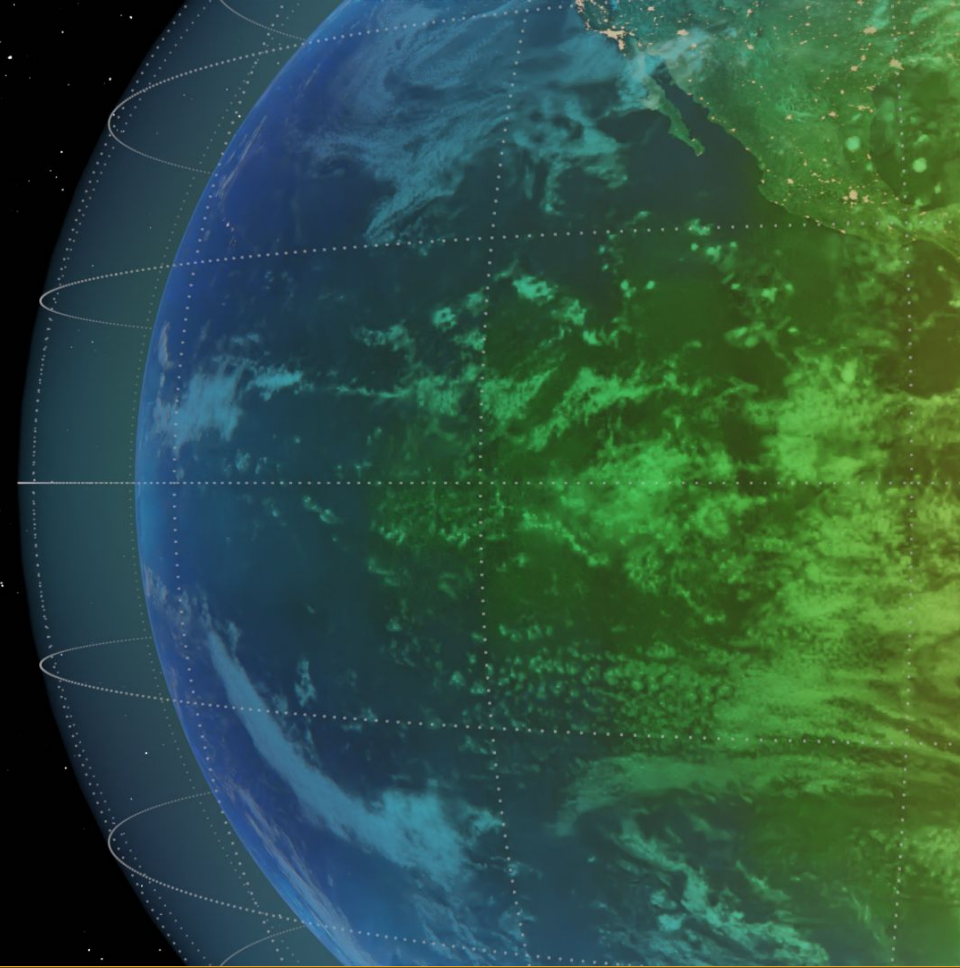
Google Cloud  NVIDIA

**AI is changing how we
do science.**



**AI is changing how we
do science.**

AI is also changing! (fast!)



AI capabilities already here...



Rapid Awareness
Insight from Space



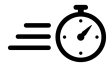
Lucid
Compelling visualizations.



Integrated Systems
Space data + Finance +
Health



'What if?' & 'What next?'
Explore decision scenarios and impact.



Ultra-speed
Predictions in seconds.



Open and Democratic
Accessible anywhere, by all.



Knowledge Store
Expertise on built in.



Adaptive
Learning, improving



Why?
Predictions explained.

1. Physics-Informed ML

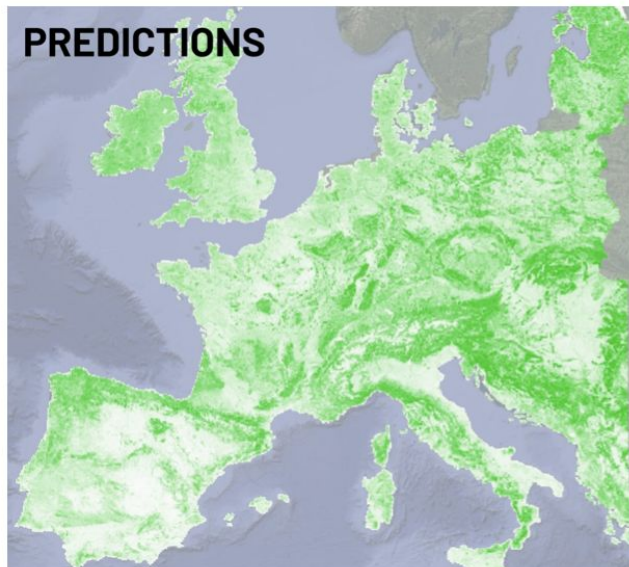
Physics informed ML promises to hugely accelerate simulations of Earth systems, while better incorporating real-world data and the modelling of systems on a wide range of scales.

2. Transformer Models

This active area of development includes Large Language Models (LLMs) and Vision Transformers (ViTs), which are revolutionising the way humans interact with machines, giving machines human-like capabilities.

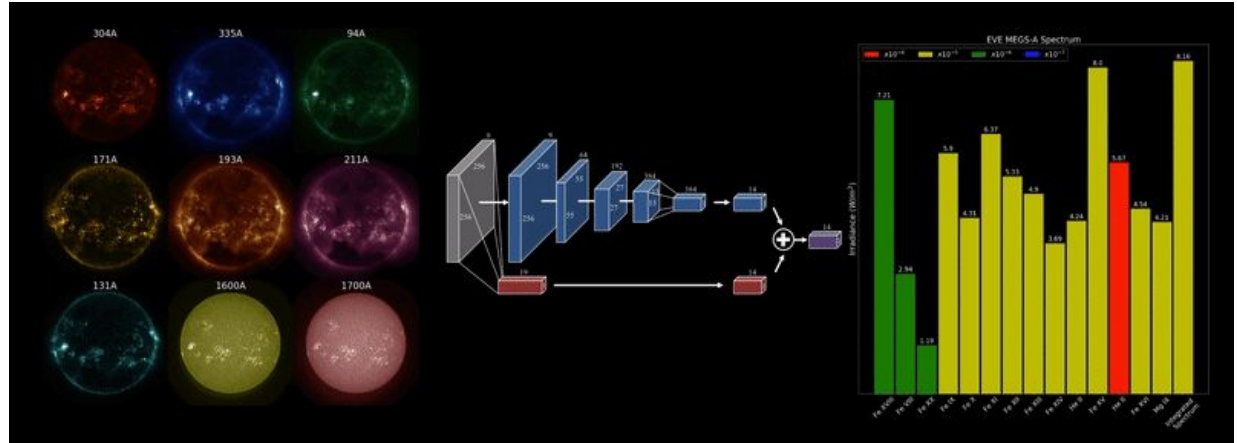
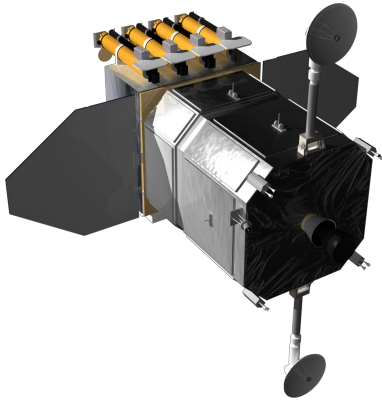
3. Foundation Models


Foundation models are large models that generalise well and can be adapted to different tasks. They are expensive to pre-train but promise to democratise AI and lower the cost of participation.



FDL's SAR Foundation Model precursor extracts vegetation cover from SAR with just 1% of the labels needed for supervised methods.

Can we replace Megs-A with a virtual instrument?





Welcome to the FDL-X SDO Live Virtual EVE Demo. This app is designed to showcase the capabilities of the FDL-X SDO computational platform.

Please Select Date Range

Start Date
2017/09/26

End Date
2017/09/27

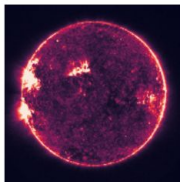
Analyze Data

Data Download
Virtual EVE Irradiance

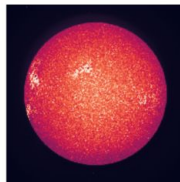
Download button!

AIA Data

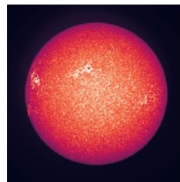
131A



1600A



1700A



171A



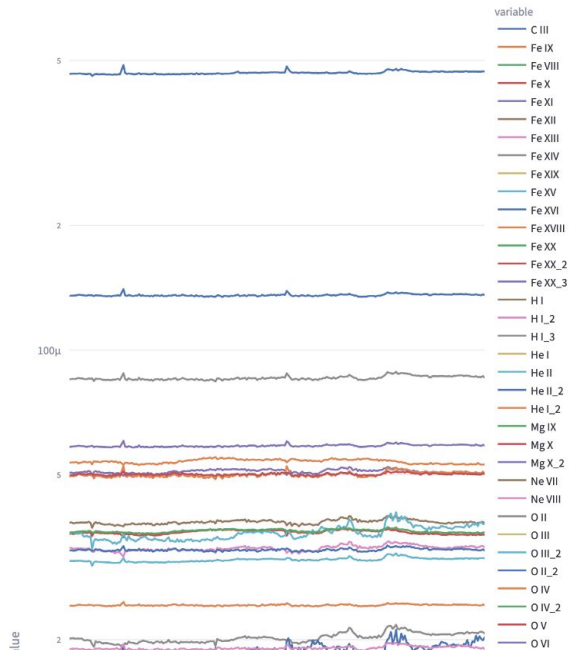
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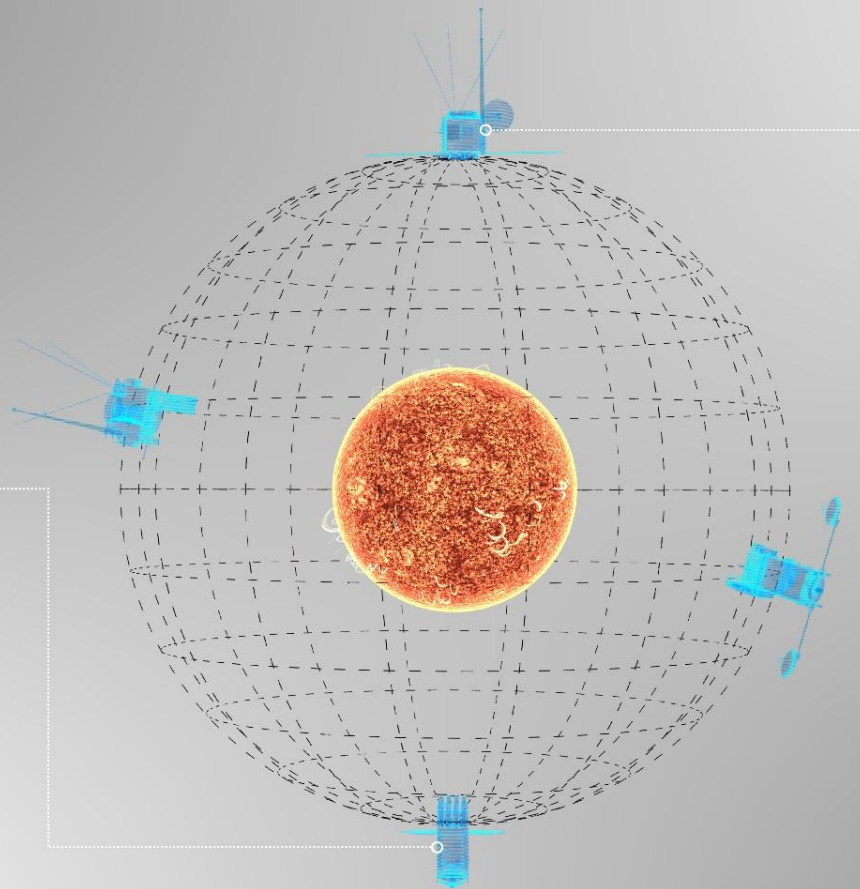
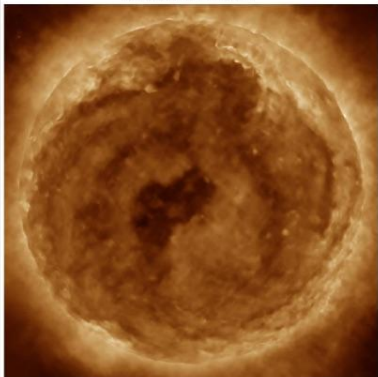
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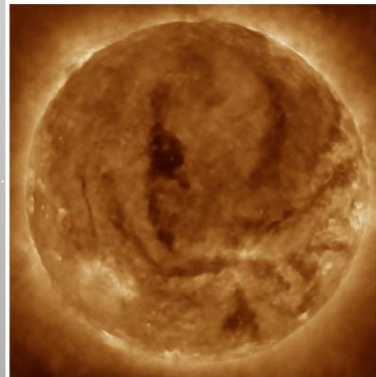
Virtual EVE Irradiance

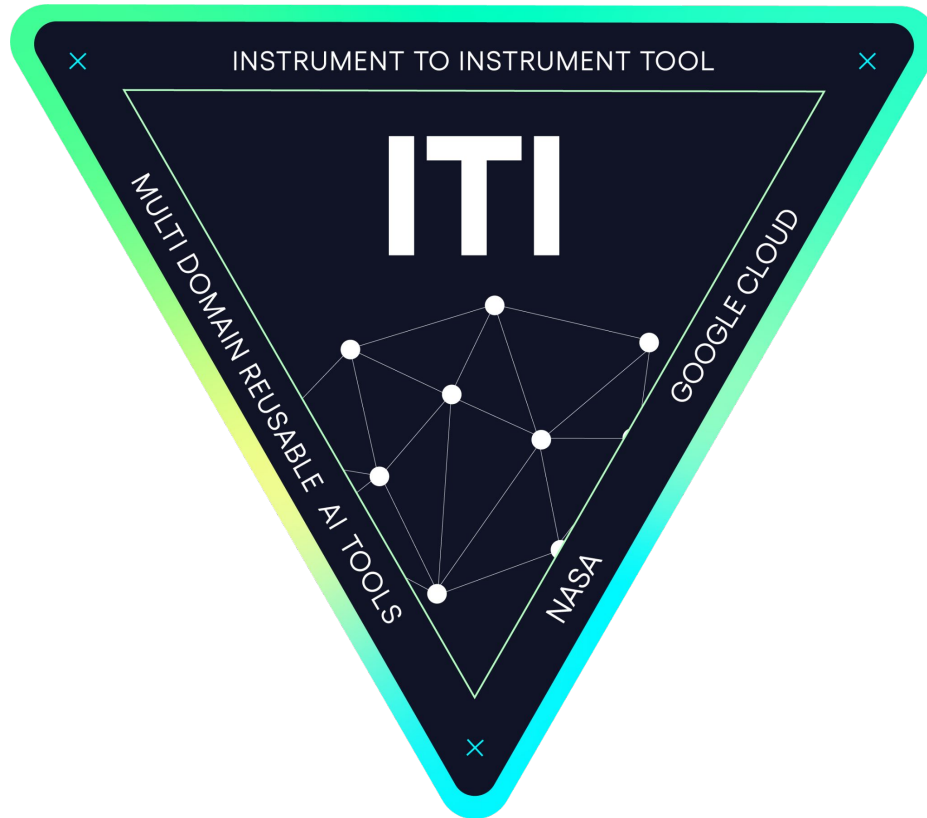


SUN SOUTH POLE

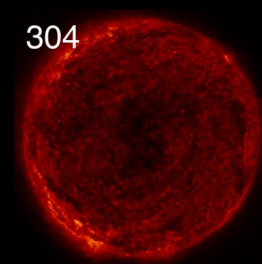
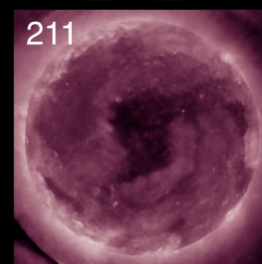
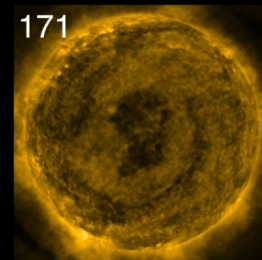
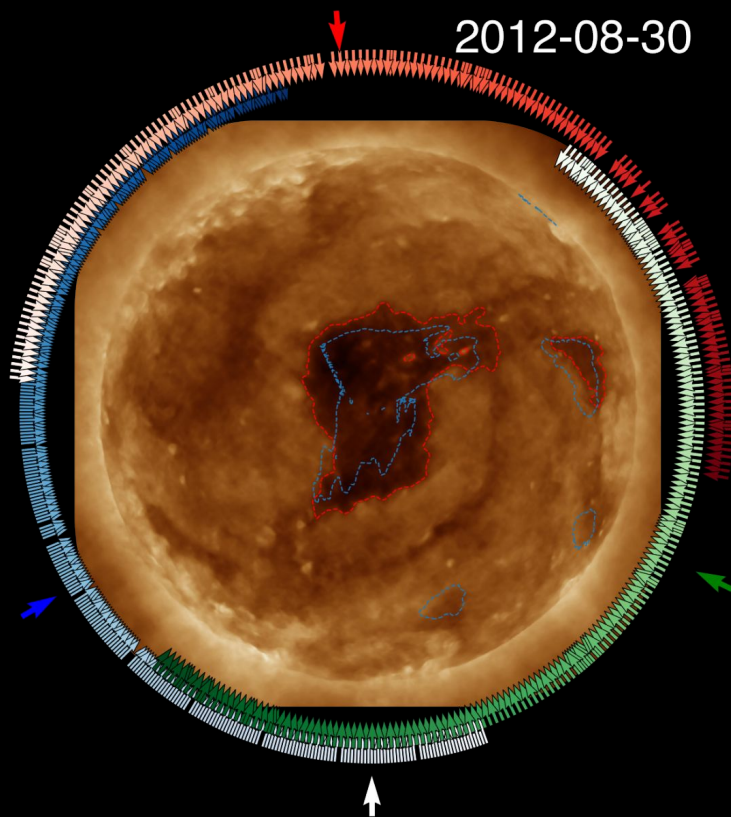
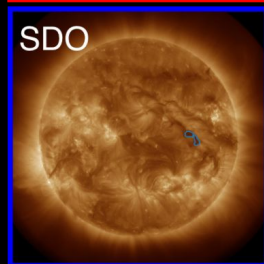
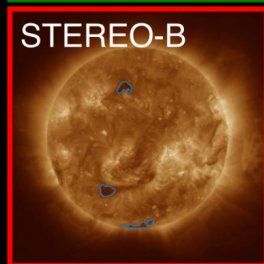
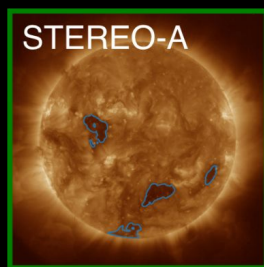


SUN NORTH POLE





A complete image of the solar south pole



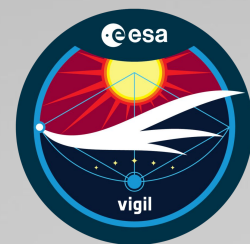
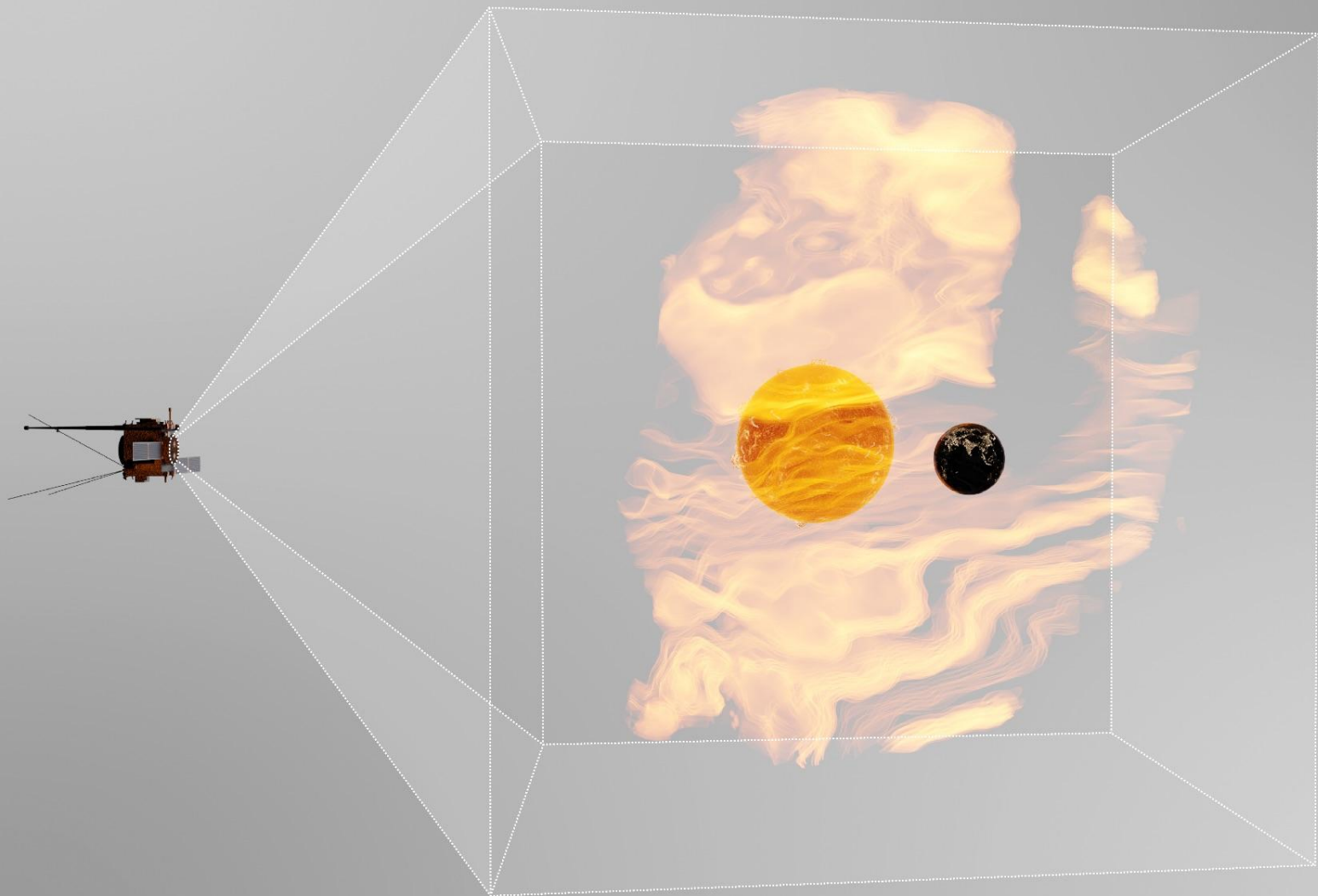


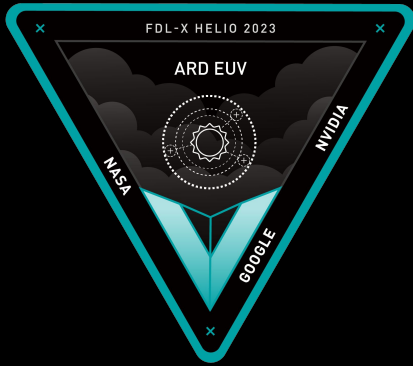
Input Images

NVIDIA NGP
Instant NeRF

Neural Radiance Fields (NeRFs)



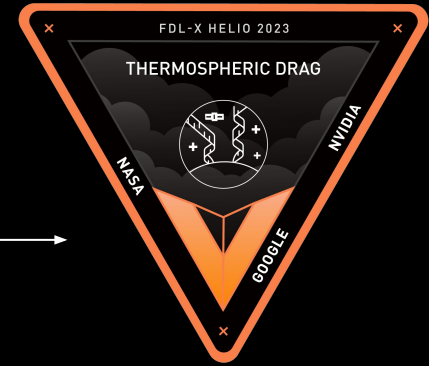




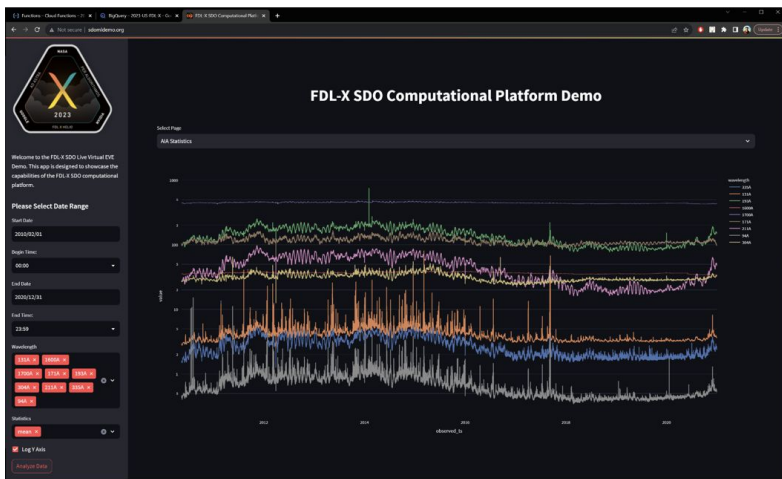
Can we create an
EUV data product?



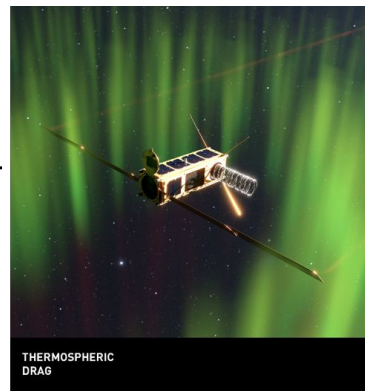
Can we understand
geoeffectiveness on
a regional level?



Can we better understand
the importance of EUV on
thermospheric drag?



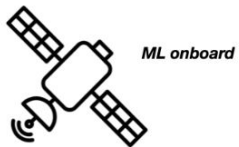
Live ML inference engine for EUV irradiance.



ML Inference products

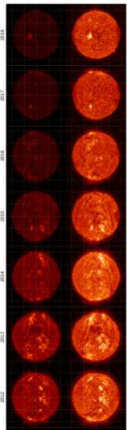


Zero-emission AI services



ML onboard

ML AUGMENTED
DATA PRODUCTS



Compression

Real-time 
Historical




FOUNDATION MODELS
E.G. IBM / NASA S2

Radically reduced labels

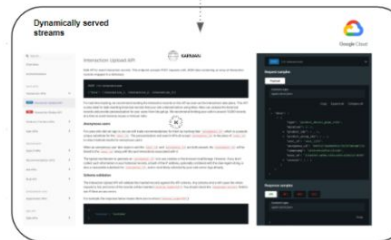


Developer
Education

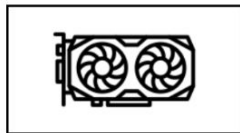
Control
Speed / \$ 

API Engine

Authentication key

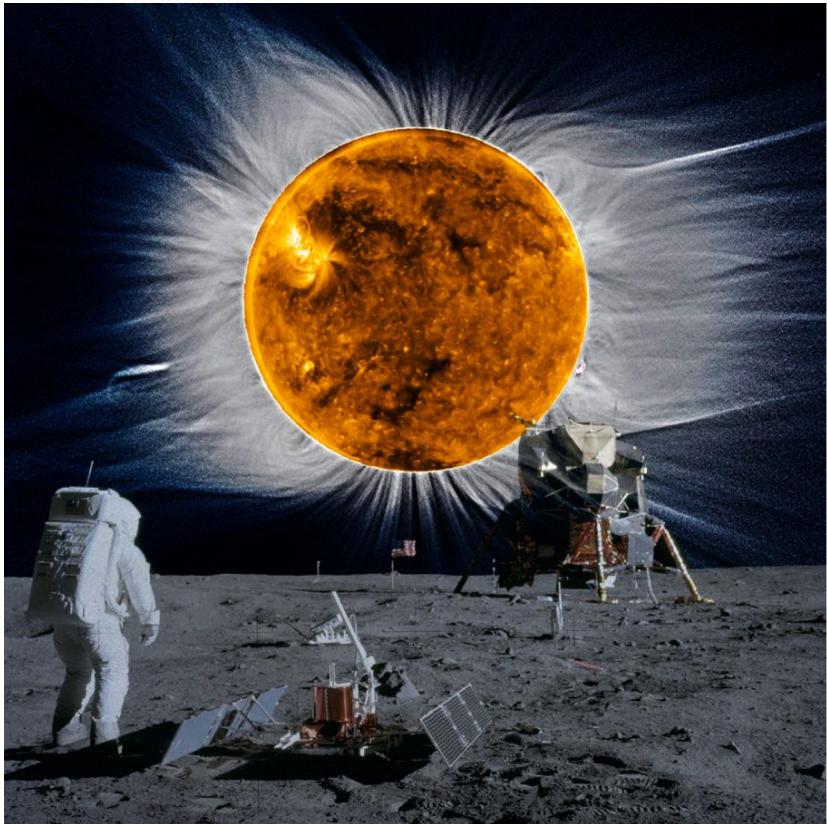


INFERENCE
PRODUCTS



Dedicated GPUs
at ground stations





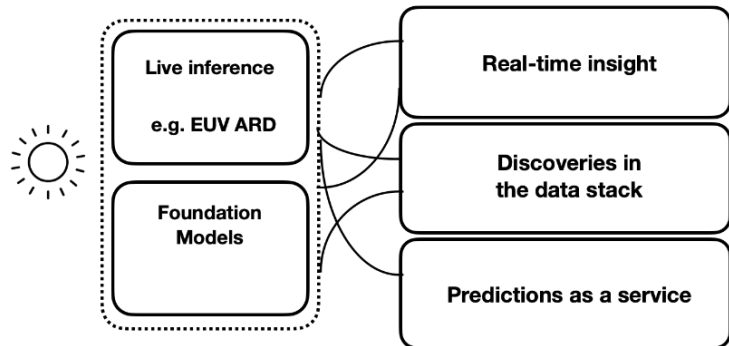
NASA

FDL X

HELIOSPACE

Direction A: “AI Platforms”

What is enabled by live services and multi-modal Foundation models?

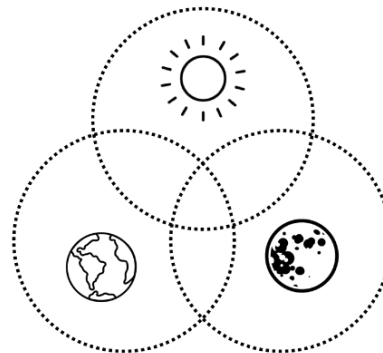


e.g. Could we ground truth EUV anywhere in the solar system?

Could we stack more predictive services into a common API?

Direction B: Multi-domain integration

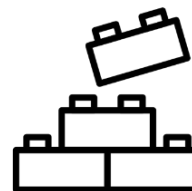
What gets unlocked by exploring opportunities between domains?



The power of multi-domain approaches

Exploring the interconnectedness of causal phenomena.

AI + cloud computing is changing the nature of research products



AI research products from different domains can be clipped together like Legos

e.g. Can we better understand the effects of solar radiation on Astronauts?

**FDL-X combines integrated AI pipelines, machine learning and domain science across heliophysics challenges.
Please join us for presentations from all three teams.**



Multiscale
Geoeffectiveness
Forecasting using
SHEATH and DAGGER

Vishal Upendran
Tuesday 2:25 PM



Improving
thermospheric drag
modeling with EUV
images: an FDL-X 2023
project

Tom Berger
Wednesday 1:45 PM



AIA is All You Need:
SDO MEGS A&B
virtualization via
Convolutional Deep
Learning

Daniel Gass
Tuesday 2:15 PM

A Scientific Cloud
Computing Platform for
Ingestion and
Processing of SDO Data

Manuel Indaco
Wednesday 2:10 PM

THANK YOU!

Learn more at [FDL.AI](https://fdl.ai)

Thank you to our partners