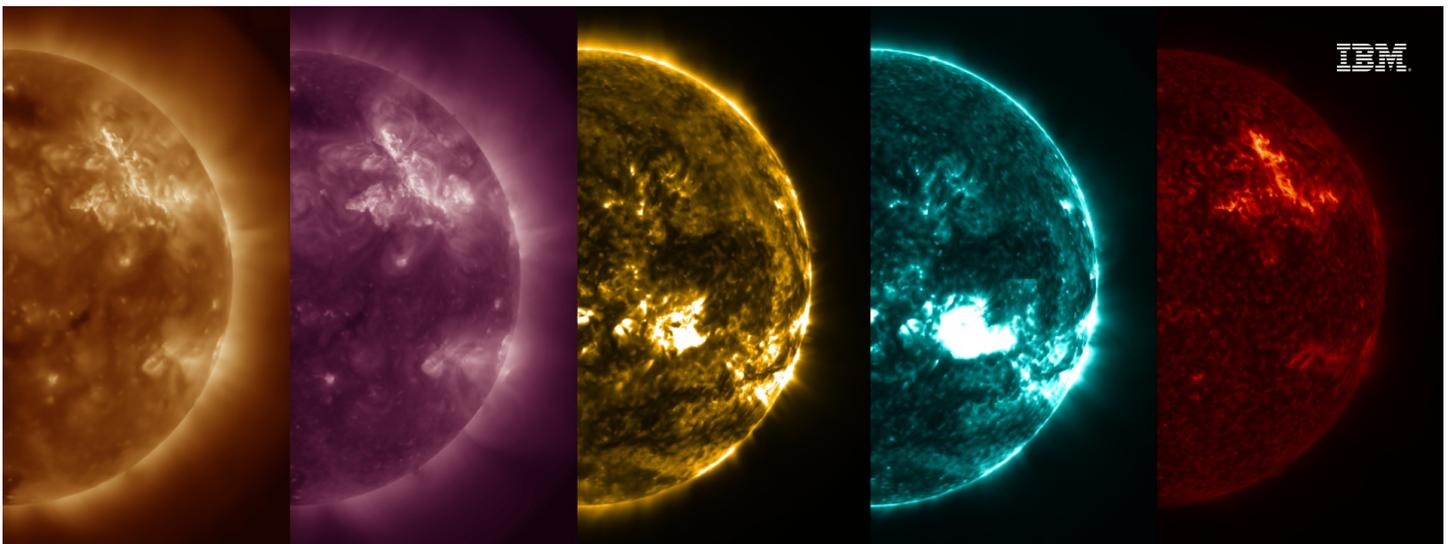


## IBM and NASA Release Groundbreaking Open-Source AI Model on Hugging Face to Predict Solar Weather and Help Protect Critical Technology

The first heliophysics AI foundation model trained on high resolution solar observation data offers insights into the Sun's dynamic surface, helping plan for solar weather that can disrupt technology on Earth and in space

Openly available on Hugging Face, the model was built to speed up scientific discovery and democratize AI for the global research and technology community

Researchers also release the largest known curated heliophysics dataset to advance data driven space weather research



YORKTOWN HEIGHTS, N.Y., Aug. 20, 2025 /PRNewswire/ -- IBM (NYSE: [IBM](#)) and NASA today unveiled the most advanced open-source foundation model designed to understand high resolution solar observation data and predict how solar activity affects Earth and space-based technology. Surya, named for the Sanskrit word for the Sun, represents a significant advancement in applying AI to solar image interpretation and space weather forecasting research, providing a novel tool to help protect everything from GPS navigation to power grids to telecommunications from the Sun's ever-changing nature.

The Sun may be [93 million miles away](#), but its impact on modern life is immediate and growing. Solar flares and coronal mass ejections can knock out satellites, disrupt airline navigation, trigger power blackouts, and pose serious radiation risks to astronauts. With humanity's increasing dependence on space-based technology and plans for deeper space exploration, accurate solar weather prediction has become critical.

As humanity's technological dependence grows, so does our vulnerability to space weather. According to [a systemic risk scenario created by Lloyd's](#), the global economy could be exposed to losses of [\\$2.4 trillion](#) over a five-year period, with the expected loss of \$17 billion from the threat of a hypothetical solar storm. [Recent solar events](#)<sup>1</sup> have already demonstrated the risk, disrupting GPS services, forcing flight diversions, and damaging satellites. The effects of solar storms can cause:

- Damage to satellites, spacecraft and/or astronauts that are stationed beyond Earth
- Loss of satellite hardware, damaging solar panels and circuits

- Impact to airline travel, due to navigational errors and potential risk of radiation for airline crew and passengers
- Lowered food production as agriculture can be impacted by disrupted GPS navigation

The implications include both academic research and operational preparedness. The new model will provide tools to help experts plan for solar storms, which can disrupt the Earth's technological infrastructure.

"Think of this as a weather forecast for space," said **Juan Bernabe-Moreno, Director of IBM Research Europe, UK and Ireland**. "Just as we work to prepare for hazardous weather events, we need to do the same for solar storms. Surya gives us unprecedented capability to anticipate what's coming and is not just a technological achievement, but a critical step toward protecting our technological civilization from the star that sustains us."

Traditional solar weather prediction relies on partial satellite views of the Sun's surface, historically making accurate forecasting extremely difficult. Surya addresses this typical limitation by training on the largest curated high resolution [heliophysics dataset](#). This dataset is designed to help researchers better study and evaluate critical space weather prediction tasks. Examples of these tasks, which Surya has been tested on, include predicting solar flares, the speed of solar winds, solar EUV spectra prediction and the emergence of active regions on the Sun.

In early testing, researchers report achieving a [16 percent improvement](#) in solar flare classification accuracy, which researchers report as a very substantial improvement compared to previous methods. In addition to the binary solar flare classification task, Surya is built to visually predict solar flares for the first time, providing a high resolution image of where the flare is predicted to occur up to two hours out.

The [technical challenges](#) were immense. Surya was trained on nine years of high-resolution solar observation data from NASA's Solar Dynamics Observatory. These solar images are 10 times larger than typical AI training data, requiring a custom multi-architecture solution to handle the massive scale while maintaining efficiency. The result is a model with unprecedented spatial resolution that can resolve solar features at scales and contexts not previously captured in large-scale AI training workflows.

"We are advancing data-driven science by embedding NASA's deep scientific expertise into cutting-edge AI models," said **Kevin Murphy, chief science data officer at NASA Headquarters in Washington**. "By developing a foundation model trained on NASA's heliophysics data, we're making it easier to analyze the complexities of the Sun's behavior with unprecedented speed and precision. This model empowers broader understanding of how solar activity impacts critical systems and technologies that we all rely on here on Earth."

Surya is part of a broader effort at IBM to embrace generative and automated approaches that empower algorithms to be discovered, tested, and evolved at scale. Surya is one example of how IBM is positioning AI not just as a tool, but as a driver of scientific discovery. By releasing Surya on [Hugging Face](#), IBM and NASA are democratizing access to advanced tools for understanding and forecasting solar weather and scientific exploration. Researchers worldwide can now build upon this foundation to develop specialized applications for their regions and industries.

This model is part of a larger collaboration between IBM and NASA to use AI technology to explore our planet and solar system. It joins the [Prithvi family](#) of foundation models, which includes a geospatial model and a weather model. Last year, IBM and NASA released the [Prithvi weather model](#) on Hugging Face for scientists and the broader community to develop short- and long-term weather and climate projections.

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<sup>1</sup> *Interplanetary Causes and Impacts of the 2024 May Superstorm on the Geosphere: An Overview – IOPscience. Interplanetary Causes and Impacts of the 2024 May Superstorm on the Geosphere: An Overview, Hajra, Rajkumar, Tsurutani, Bruce Tsatnam, Lakhina, Gurbax Singh, Lu, Quanming, Du, Aimin.* <https://iopscience.iop.org/article/10.3847/1538-4357/ad7462/meta>

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