

NICT operational Space Weather models using satellite data

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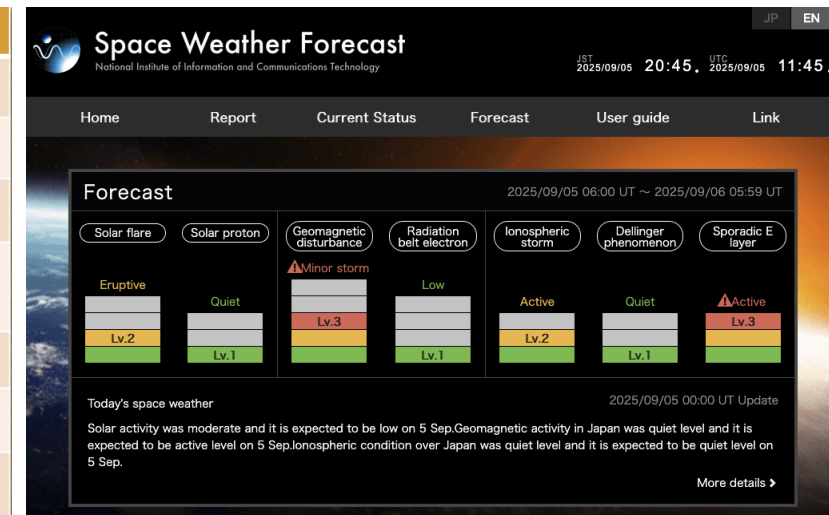


- Space weather forecast project started in Communications Research Laboratory (predecessor of NICT) in 1988 (evolving radio propagation alert operation since early 1950s').
- Current 24/7 operation of space weather forecast started on 1 December 2019.

- 7 Space weather forecasts
- Solar flare
 - Solar proton
 - Geomagnetic disturbance
 - Radiation belt electron
 - Ionospheric storm
 - Dellinger phenomenon
 - Sporadic E-layer



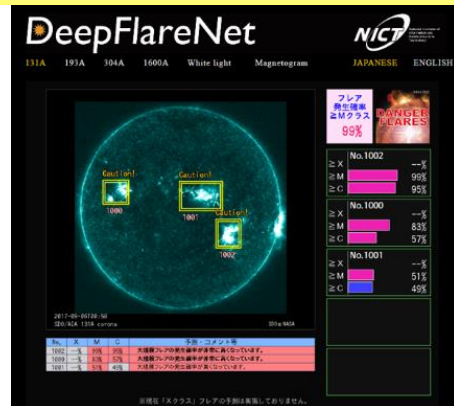
	24-hour operation
Operation date	365days/year
Operation time	24 hours
Ursigram (UGEOA)	06:00-07:00UTC
Daily report	00:00-01:00UTC and 12:00-13:00UTC (Twice a day)
Weekly report	12:00-13:00UTC on Friday
Alert	Every time
Inquiry time	24 hours



Operational Space Weather models in NICT

- NICT operates several models using such as AI and global simulation for the purposes of internal use for space weather forecast operation or user web application.
- Most of these models are based on the real-time satellite observation data as inputs.

AI-based solar flare prediction (DeFN)



SDO HMI magnetogram

SDO AIA EUV images

GOES X-ray

Real-time observations

GOES Protons

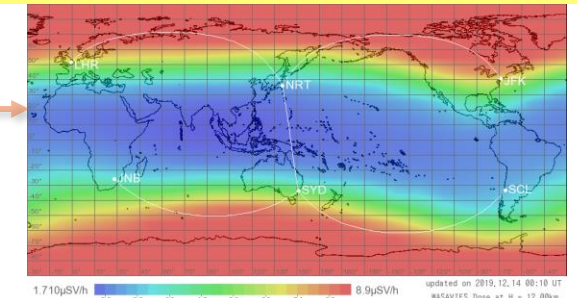
GOES Electrons

New data from SWFO-L1

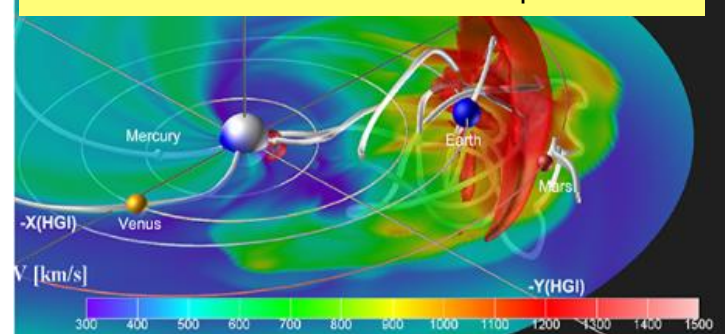
Corona images

Solar wind

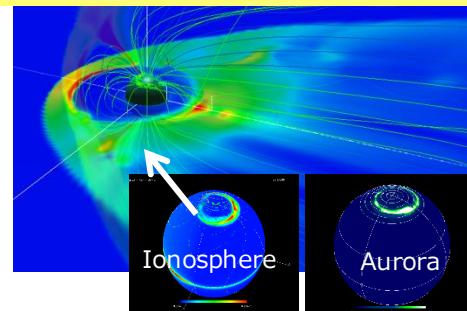
Aviation dose assessment (WASAVIES)



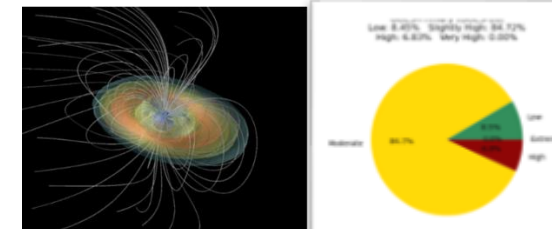
Inner heliosphere simulation (SUSANOO) for solar wind and CME arrival prediction



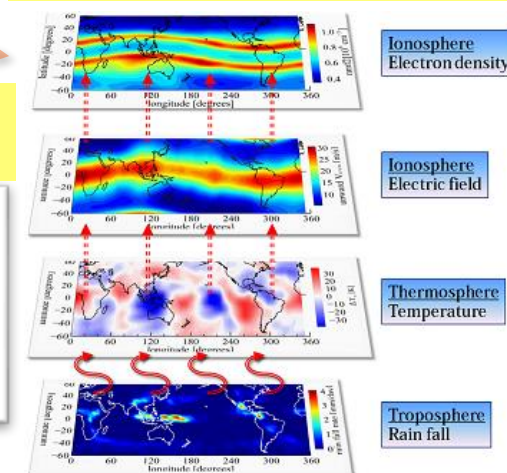
Magnetosphere simulation (REPPU)



AI-based radiation belt electron fluence prediction (Rade-AI)



Ionosphere simulation (GAIA)



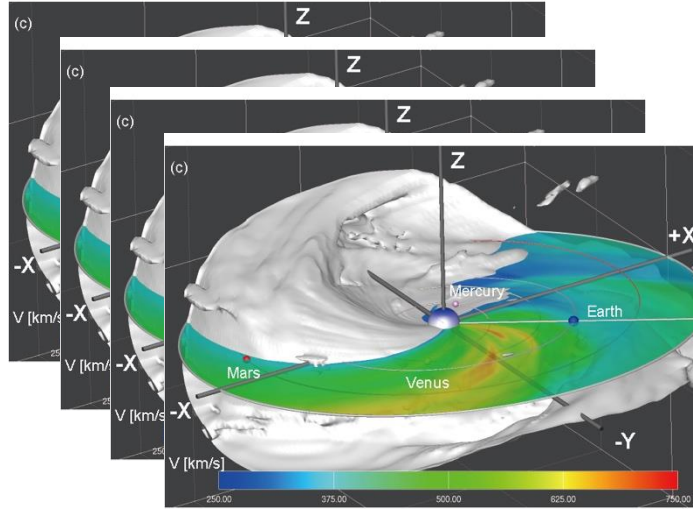
2025/9/21

SWFO-L1 Mission Pre-launch Science Meeting

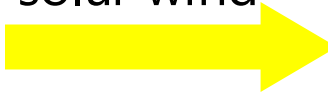
CME arrival prediction system using SUSANOO

Operation in August 2022

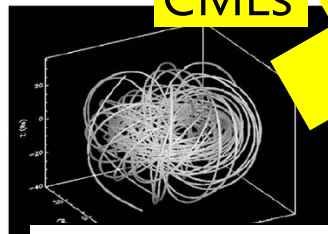
SUSANOO-SW (4 models)



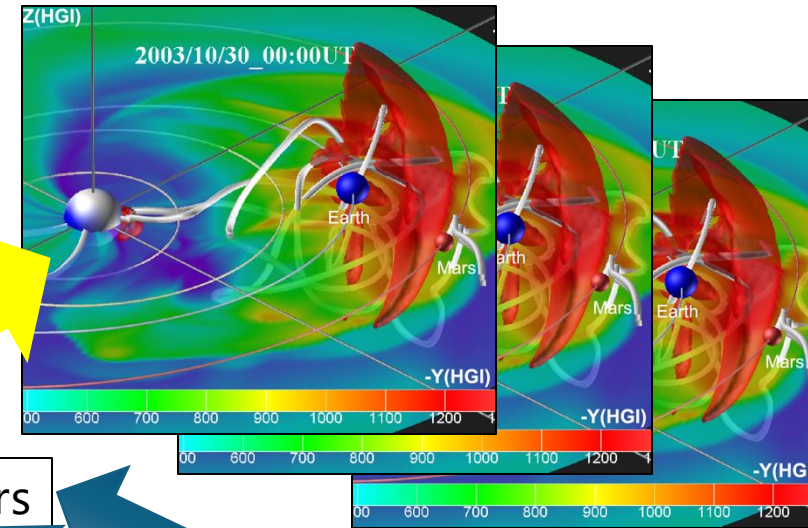
Background solar wind



CMEs

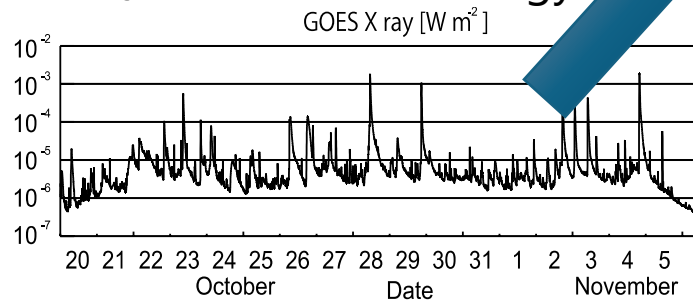


SUSANOO-CME



GOES X-ray flux

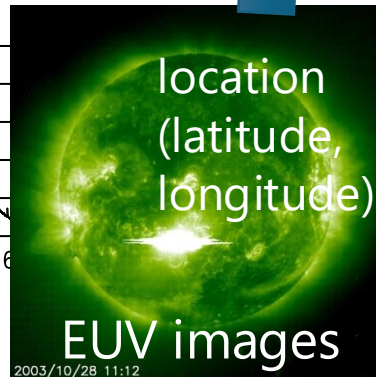
start time, energy



CME parameters

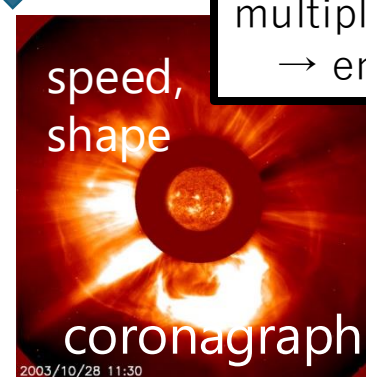
location
(latitude,
longitude)

EUV images



speed,
shape

coronagraph

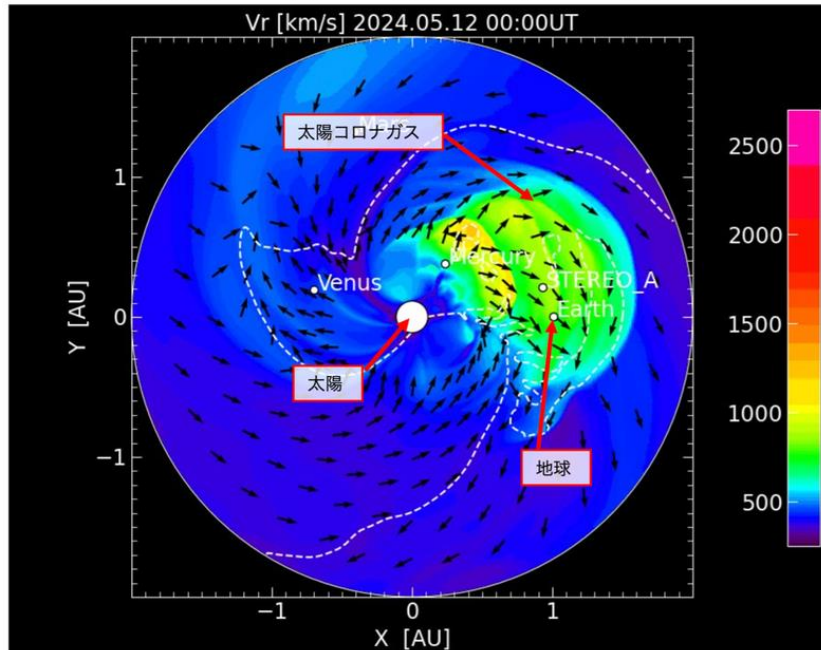
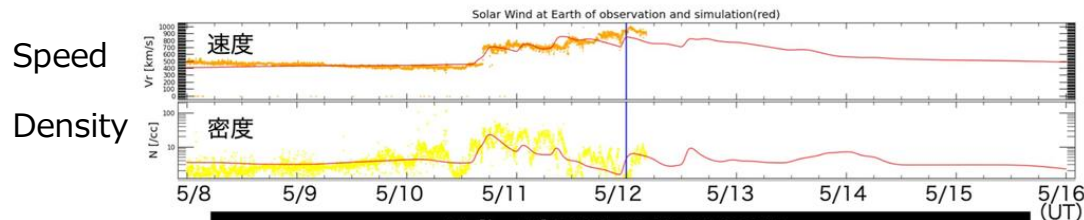


Uncertain parameters :
multiple cases
→ ensemble simulation

Shiota & Kataoka 2016
Shiota & Yashiro 2021

CME arrival prediction system using SUSANOO

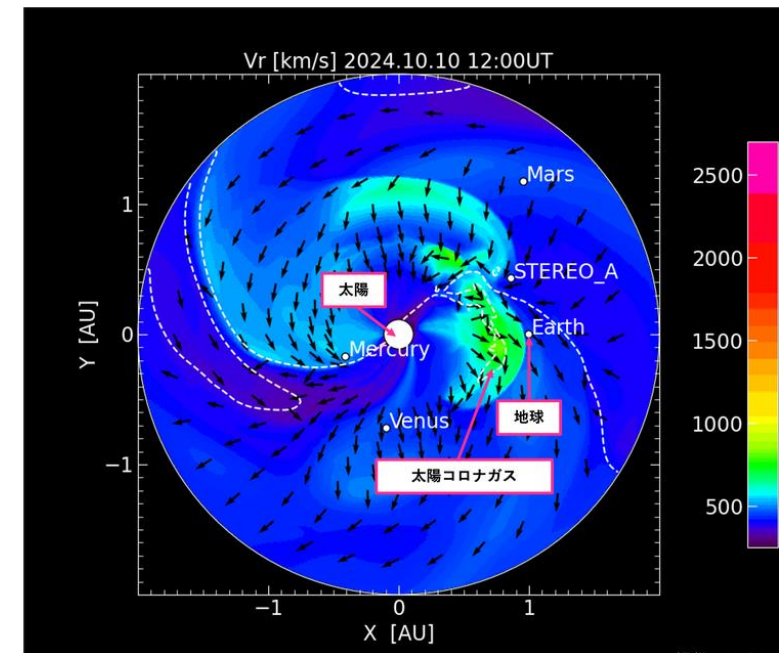
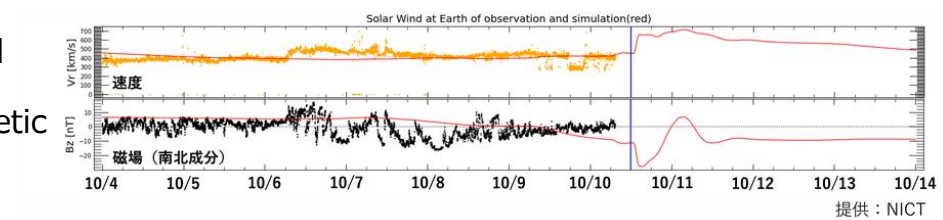
- The prediction results were released in the space weather forecasts of powerful magnetic storms in May and October 2024.



<https://swc.nict.go.jp/report/topics/202405101630.html>

Speed

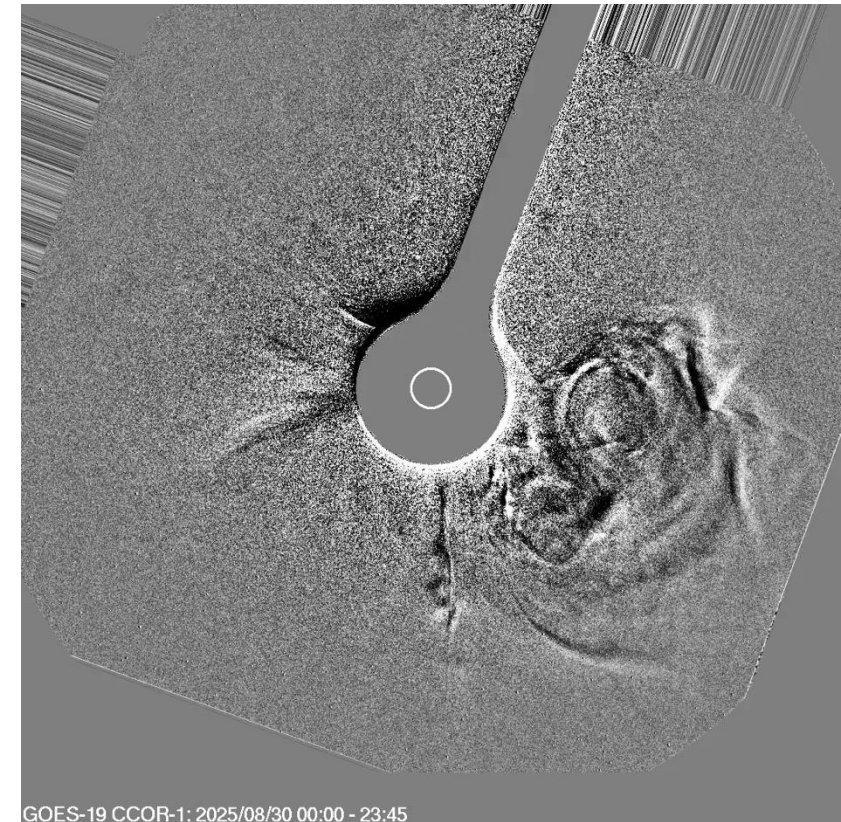
Magnetic field



<https://swc.nict.go.jp/report/topics/202410091600.html>

Use of GOES/CCOR1 data at NICT

- A new coronagraph instrument Compact Coronagraph (CCOR1) aboard GOES-19 launched June 2024.
- The operational release of real-time CCOR1 data began in April 2025.
- We started to create real-time CCOR1 differential images (as shown in right) since the beginning of June 2025 for use in the space weather forecast operation.
- We plan to expand the function of the CME prediction system using CCOR1 differential images in addition to LASCO C2 and C3.
- In the future we plan to use differential images of CCOR2 aboard SWFO-L1 as well.



GOES-19 CCOR-1: 2025/08/30 00:00 - 23:45

Ground station of SWFO Antenna Network

- A new 7.3m diameter parabolic antenna was constructed at Kashima Space Technology Center, NICT in March 2023.
- This antenna is dedicated to real-time receiving of SWFO-L1 observation data as an international partner of SWFO Antenna Network (SAN).
- Coordination between NICT and NOAA to establish a system for receiving and transferring the SWFO-L1 data has been ongoing since 2024.

(NICT also has been a member of real-time solar wind net (RTSWNet) since ACE observation started.)

Kashima Space
Technology Center, NICT



Visit of NOAA representatives to
Kashima antenna station Sep. 2024



- NICT operates [several models based on the real-time satellite observation data](#) using such as AI and global simulation are automatically operated for use in the space weather forecast operation. Particularly important observation (coronagraph and solar wind) in the satellite observation will be updated by SWFO-L1.
- [A CME arrival prediction system using the MHD simulation SUSANOO has been in operation since 2022](#). The prediction results were released in the space weather forecasts of powerful magnetic storms in May and October 2024.
- At NICT, [CCOR1 differential images have been used in the space weather forecast operation since June 2025](#). We plan to use CCOR1 differential images in the CME prediction system and CCOR2 differential images as well in the future.

We express our deep appreciation for the real-time data provision and we sincerely look forward to the successful launch of SWFO-L1 as an international partner of SAN.