

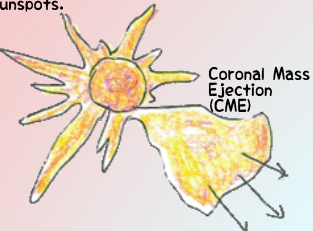
Space Weather

宇宙天気

(* In this poster, SWx means space weather.

Solar Flares

The most explosive phenomena in the heliosphere. Flares occur over sunspots.



Put on special glasses to look at the sun.
With a special filter for solar observation.
Don't look at the Sun!

Predicted economic loss caused by a Carrington-class flare.

Country, Region	Min \$B	Max \$B
USA, Canada	128	164
UK, Scandinavia	29	37
Europe	103	132
Japan	41	54
Australia	7	9

International Space Environment Service (ISES) with 20 member countries @2020



There was a flare! What about SWx from now on!
What's the Space Weather tomorrow?



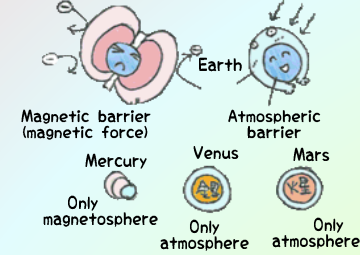
In Japan, only NICT belongs to ISES, and it observes & predicts solar flares, geomagnetic storms and ionospheric disturbances.

NICT Space Weather Center
(Web: swc.nict.go.jp)
Please use the query form in the SWC web page.



Barriers of Planets

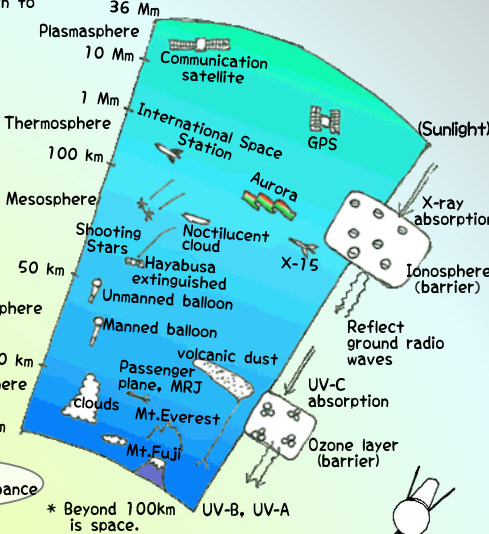
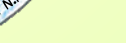
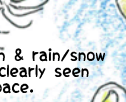
The Earth is protected by two barriers !!



Human space activity started in 1957, designated the International Geophysical Year, when the satellite Sputnik 1 was launched. Then, the first Japanese satellite, Ohsumi, was launched in 1970. Now, as space applications become popular, the risk of space weather affecting our social infrastructure is increasing, making space weather forecasting an increasingly important task.

First satellite launched in 1957
Sputnik 1
Start of Space Activity & Space Applications

The Russian dog Laika was the first creature to go into space. Unfortunately, she could not return to Earth.



Geostationary orbit satellite ATS-1 in 1966. SWx affects geostationary orbit satellites.

Broadcasting/communication satellites in 1966. SWx affects satellite communications.

more than 300 satellites
Saturn V in 1969.

Apollo 11 arrived at the moon. Landing & souvenir of moon stones.

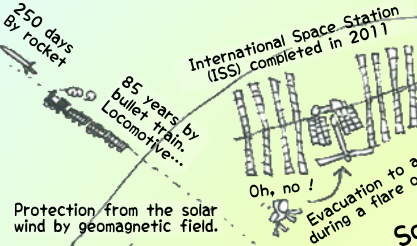
Luna 1 reached the moon in 1959.

Aurora: Charged particles from the outer space collide with the atmosphere, emitting chemical luminescence.

Colors of the aurora
Scarlet: Oxygen atoms (O) at a high altitude.
Green & White: Oxygen atoms at a low altitude.
Pink & Blue: Nitrogen molecules (N₂) at a low altitude.

SWx affects positioning.
Decrease in positioning accuracy
Pioneer 10 A letter to ETI

International cooperation to observe the South Pole in International Geophysical Year. Japan built the Syowa station.



Social Impact

Charged particles from the outer space precipitate into the atmosphere at around the North/South Poles, causing aurora emission.

Risk of radiation exposure of pilots & cabin crew.
Atmospheric heating by UV and X-rays.

Plasma bubble
HF radio communication interrupted.
GPS, Car navigation systems

Ship navigators
BS broadcasting & communications.
BS antenna

Confirmation of ridge & plate tectonics from space
Typhoon & rain/snow clouds clearly seen from space.

Loss of lock
Noise
Control tower

Space shuttle launched in 1981
Research on re-entry became popular.
Breaking and loss of balance of satellites owing to atmospheric friction.

1961 Yuri Gagarin Astronaut space activity
1963 Ms. Valentina Tereshkova Woman astronaut

Goal here!
This route leads us to our goal...

North Pole
Polar bear
Aurora
Weak magnetic barrier at North Pole.
Ozone hole at polar regions.

Passenger plane
Air force
Amateur radio com.
Roger
What?
Large-scale Power outage
Transformer broken
High current

Mobile Phone
Hello!
beep-beep
Shop
We're lost!

BS broadcasting & communications.
BS antenna

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Designer: N.N., C.T., F.T., T.T.