



Grant-in-Aid for Scientific Research on Innovative Areas (2015-2019), MEXT, Japan

Project for Solar-Terrestrial Environment Prediction



THE BRIDGE OVER DEATH VALLEY

-- ASPECT AND PRESENT RESULTS OF PSTEP --

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Relation of Needs-Seeds in Space Weather

Solar Terr. Phys.

SWx the social needs

Sun

IPS

Magnetosphere/Ionosphere influence

Social hazard/needs

Coronal Hall

High speed solar wind

Disturbance of magnetosphere

Increase radiatoin

Satellite anomary

Hazard to satellite operation

Plasma cloud

Increase of high energy particle

Human radiation

Hazard to human activity in space

CME/CIR

X-ray

Disturbance ionosphere

Ionization of lower ionosphere

Increase of electron density

Increase of ionospheric

Expanding upper atmosphere

Ground conductivity distribution

Disability of GNSS

Hazard to telecom, broadcast

Hazard to positioning

Soalr flare

Increase of high energy particle

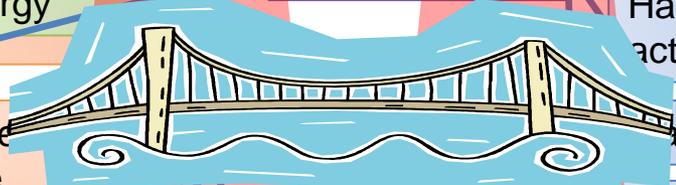
Academic institutes

Change the satellite orbit

Hazard to power line



Study of unknown process



Valley

Valley



society

SWx becomes Indispensable information for their task

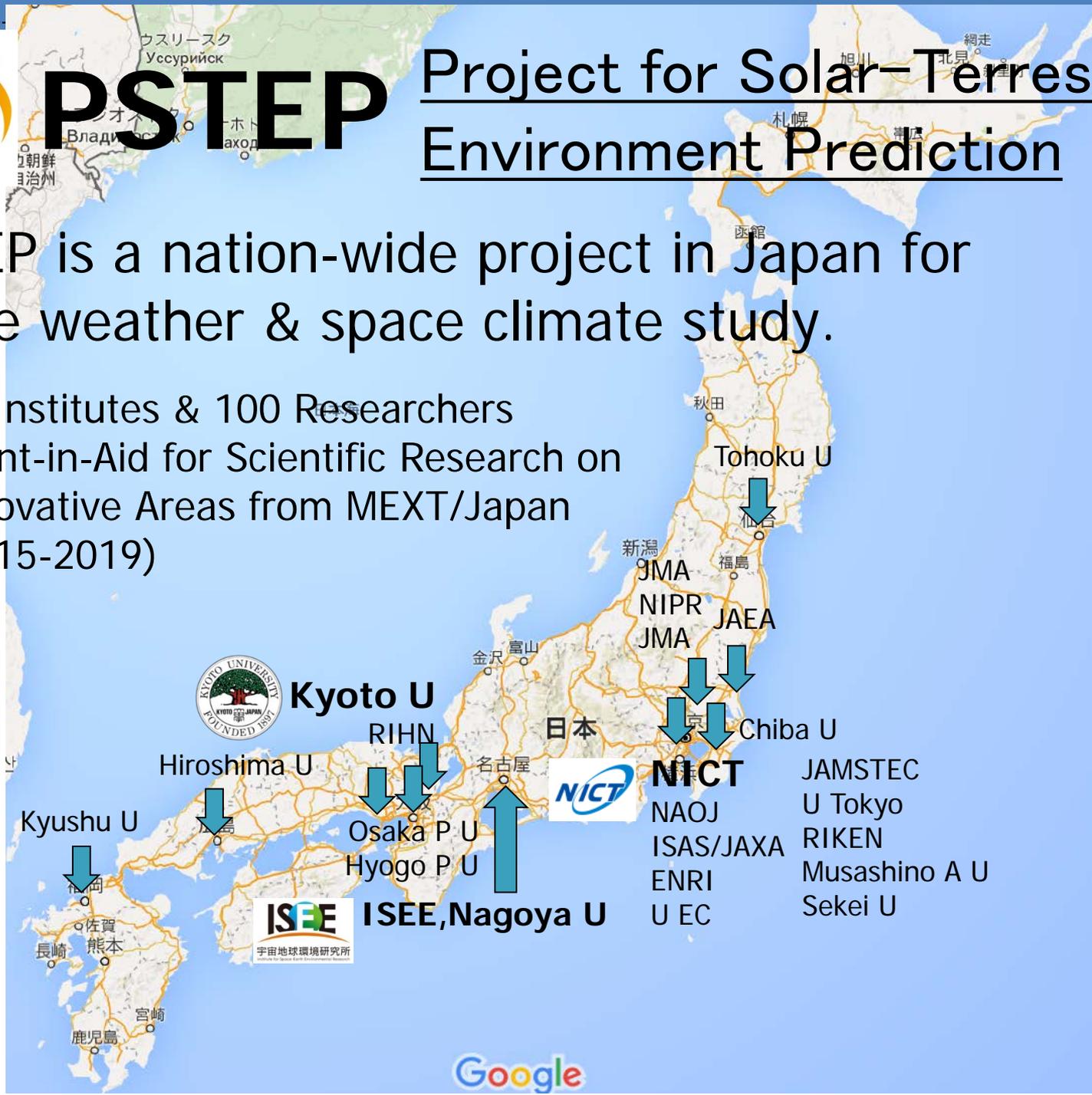


PSTEP

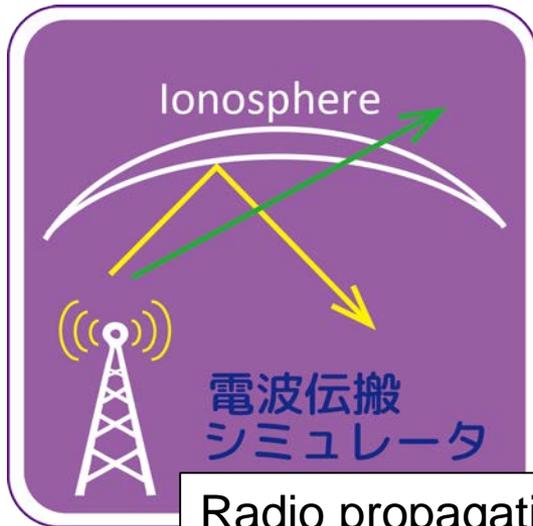
Project for Solar-Terrestrial Environment Prediction

PSTEP is a nation-wide project in Japan for space weather & space climate study.

- 20 Institutes & 100 Researchers
- Grant-in-Aid for Scientific Research on Innovative Areas from MEXT/Japan (2015-2019)



Product to be created



Radio propagation simulator



Human radiation estimation system



GIC hazardous warning system



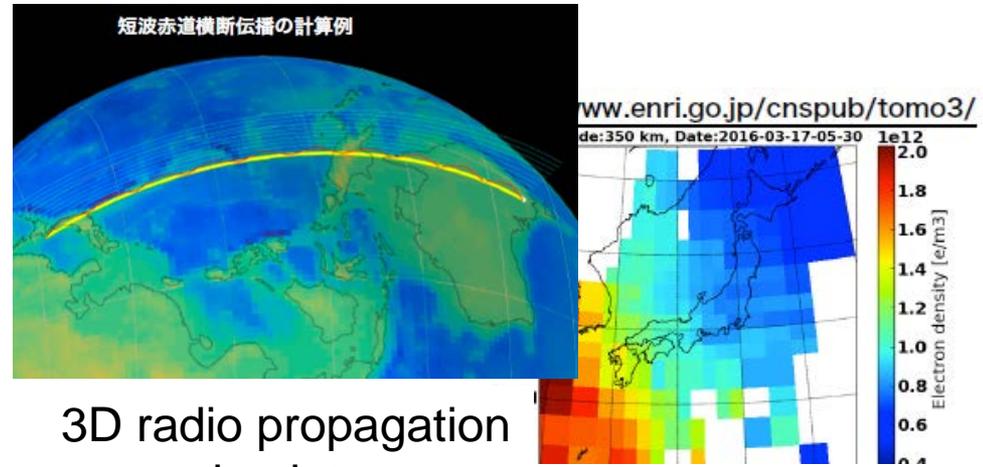
“Taylor-made Space weather” satellite Warning system



Developing Radio Propagation model

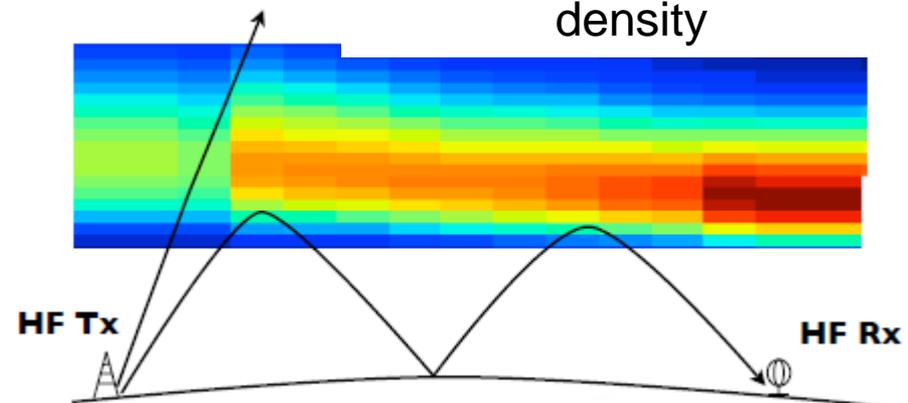
Radio propagation model is necessary to notice the usability of HF, VHF and GNSS at a particular point. We develop a new 3D radio propagation model “HF-START”

- The fundamental structure of radio propagation parameter for HF has completed. Validations of the model comparing with observational results are to be executed.
- The model for GNSS is planned to be build cooperated with CNES, France.
- Real time radio propagation model is to be possible by connecting the 3D tomography technique build by Kyoto Univ.



3D radio propagation simulator

3D distribution of ionospheric electron density



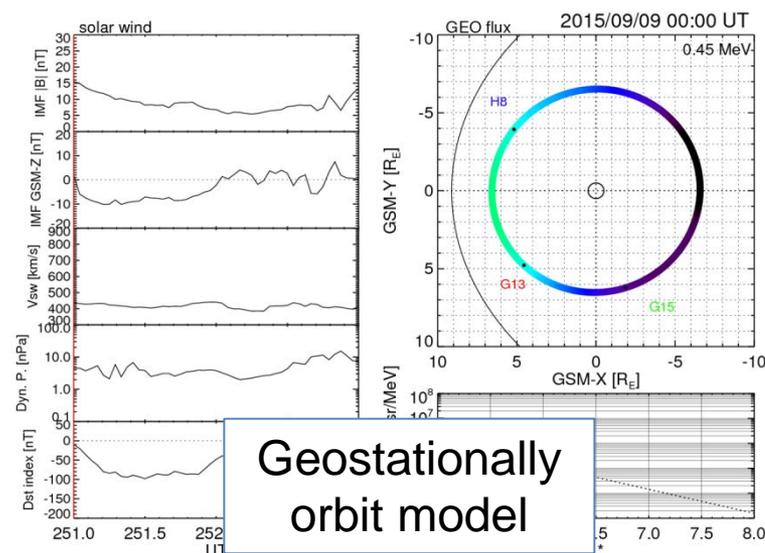
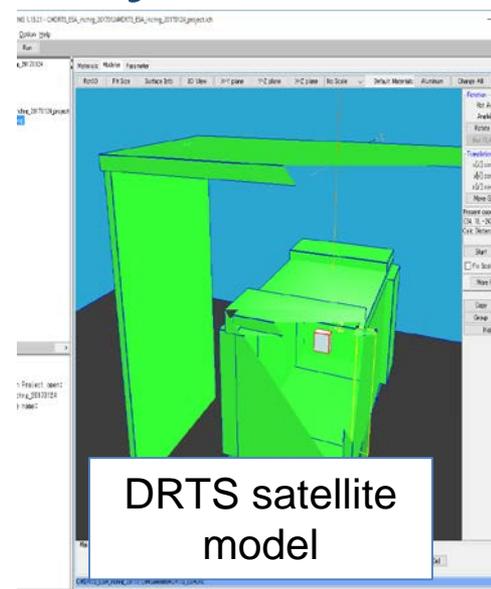
Example of real time radio propagation model



Developing Satellite anomaly model

“Taylor made space Weather” is the project to develop a magnetosphere model including satellite shape and material. The present status of the model named “SECURES” is as follows.

- As a real time monitoring of radiation belt, we opened a database of HIMAWARI. Now calibration with comparing the result with other satellite (GOES).
- JAXA is developing numerical satellite model of DRTS.
- NICT is developing a model for estimating high energy particle distribution along the geostationally orbit.

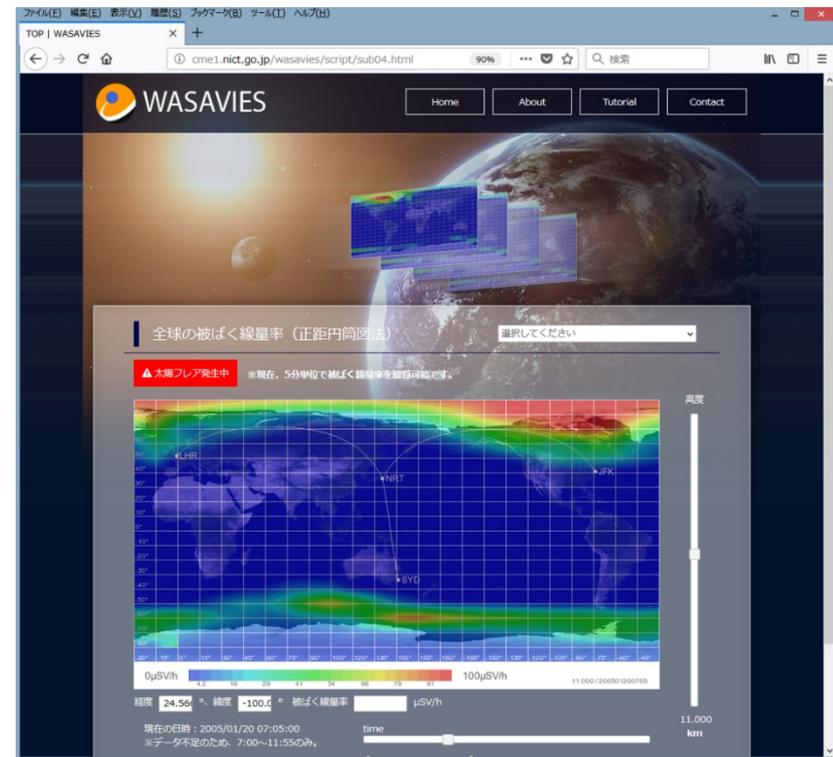


Geostationally orbit model



Purpose of Estimation system of human exposure

- Initial purpose
 - Is to establish the system for providing the present radiation level in the airplane when the large proton event is occurred to happen to the GLE events.
- Final goal
 - Is to develop the system to provide the forecast of temporal variation of human radiation in the airplane with several hours from the event occurred.
 - And to develop the system to estimate the nowcast and forecast of human radiation in ISS

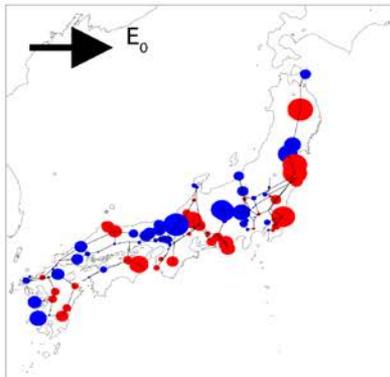




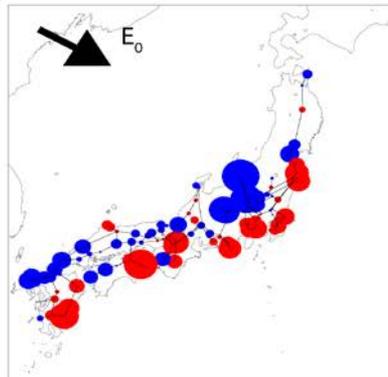
Power line hazardous system

- We have been discussing with electric power companies for hearing their needs and the specification of their system.
- We calculated the estimated Geomagnetically induced current in Japan including the effect of ocean and complicated ground composition. The results show quite a high electric field and current near the coast in which there are many power plants.

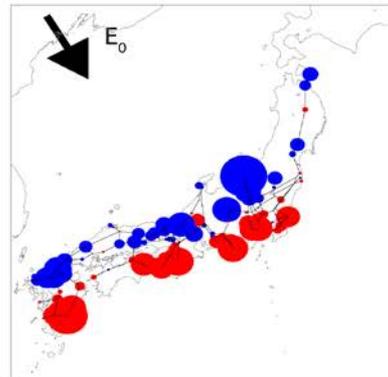
(e) 3D ground structure ($\theta=0^\circ$)



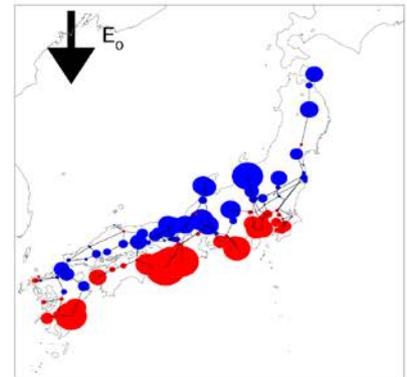
(f) 3D ground structure ($\theta=30^\circ$)



(g) 3D ground structure ($\theta=60^\circ$)



(h) 3D ground structure ($\theta=90^\circ$)



● 1 A

Input: Sheet current: 0.02 A/m with a period of 100 s

Preparing hazardous map against SWx events

It is necessary to prepare a Japanese original “hazardous map” for preparedness of SWx extreme events.

Expected structure

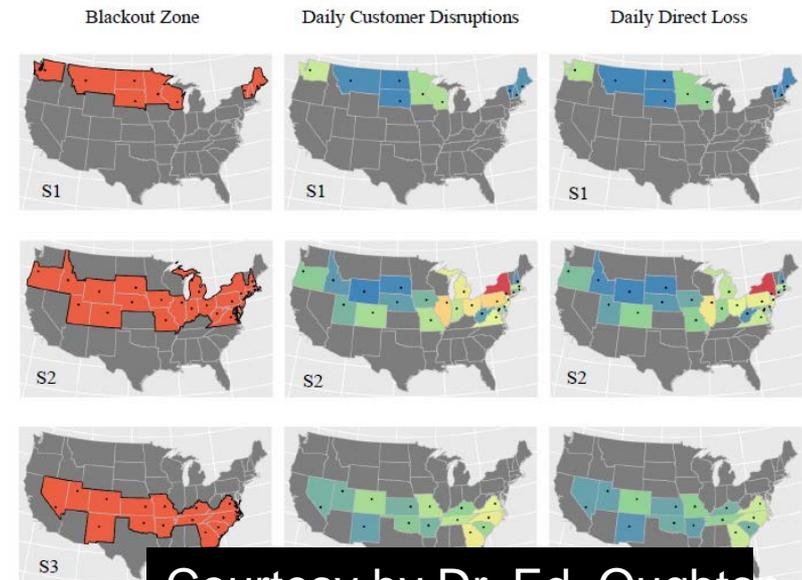


completed

Issue to be solved

Adopt the Risk management method to SWx social impact in Japan.

We just start to discuss it with experts of risk management researchers.



Courtesy by Dr. Ed. Oughto

Establishing Space Weather user committee

- NICT has been communicating with the Space Weather users in the framework of Space Weather users forum more than 10 years.
- In addition to the activities, we established Space Weather user committee under the framework of PSTEP for detailed communication with users requirements



Summary

- Now society needs information of the social impact on Space Weather event, however studies of quantitative estimation are not enough.
- The action of PSTEP aims to provide useful information to the society. We are developing products, quantitative estimation as “Hazardous Map” and communicate with users via “Space Weather user committee.”
- The action of “UNISPACE+50” and international cooperation for preparedness of extreme Space Weather are same direction of PSTEP stream.
- We hope to discuss new framework for Space Weather research cooperation in this meeting.

SWx impact on power grid

