

Recent domestic activities and NICT's efforts toward the advancement of space weather forecast

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In recent years, the use of space has been rapidly advancing in the business sector, such as precise GNSS navigation, commercial small satellite constellations, and commercial space travel, while solar activity has been gradually increasing, with the first X-class solar flare in Solar Cycle 25 occurring in July 2021. Under these circumstances, various countries and international organizations have been studying the impact of space weather phenomena on social infrastructure and how to respond to them. The Ministry of Internal Affairs and Communications (MIC) "Council for the advancement of space weather forecast" has been held in Japan since January 2022, and its report was released in June. The WG on space weather alert criteria, which was established under the council, has been discussing new alert types and criteria, and the first Japanese worst-case scenario of extreme space weather phenomena". In this presentation, an overview of this report and related efforts by NICT will be reported.

Key Words: space weather forecast, alert criteria, worst-case scenario

1. Introduction

In recent years, the use of space has been rapidly advancing in the business sector, such as precise GNSS navigation, commercial small satellite constellations, and commercial space travel, while solar activity has been gradually increasing, with the first X-class solar flare in Solar Cycle 25 occurring in July 2021. The importance of space weather forecasting is increasing in preparation for disasters caused by large-scale space weather phenomena, such as the Carrington Event of 1859. Under these circumstances, various countries and international organizations, including the United States, the United Kingdom, and South Korea, have been studying the impact of space weather phenomena on social infrastructure and how to respond to them.

In Japan, "Council for the advancement of space weather forecast" was established in the Ministry of Internal Affairs and Communications (MIC) in January 2022¹⁾ to discuss about this topic. "Working group on space weather alert criteria" was established under the council to study new alert types and criteria for several fields taking into account the social impact of space weather, and to study the first Japanese worst-case scenario for extreme space weather events.

2. Report of the council

Extreme space weather phenomena such as huge solar flares may cause anomalies in social infrastructure such as communications, broadcasting, positioning, satellites, aeronautical radio, and electric power, and may have a significant impact on socioeconomic activities.

For this reason, the first Japanese "Worst-Case Scenario of Extreme Space Weather Phenomena" was studied in the WG. In the scenario, extreme space weather events occurring once per 100 years or less

was assumed. Some of the worst-case scenarios are listed below:

- Communications and broadcasting are intermittently disrupted, causing socioeconomic disruption.
- Satellite positioning accuracy deviates by up to several tens of meters. Collision accidents with drones and other vehicles occur.
- Aircraft and ship operations are suspended worldwide. Significant disruptions to schedules and plans.

The report proposes that space weather phenomena should be considered as a real risk and the need for crisis management for the nation as a whole. Recommendations for crisis management at the national level were proposed in the following categories:

- Future Observation, Analysis and Forecasting
- Reinforcement of the alert system
- Impact on Social Infrastructure and Effective Response
- Strengthening academic research, human resources and communities, and international collaboration
- Expected Role of NICT

3. Summary

The advancement of space weather forecasting in Japan was reported in "Council for the advancement of space weather forecast" in June 2022. Based on this report, NICT plans to take necessary researches and actions, such as researches toward the actual operation of the new space weather alert criteria established by the WG.

References

- 1) https://www.soumu.go.jp/main_content/000813249.pdf