Toward Establishing the Global Space Weather Warning System

ISHII Mamoru
National Institute of Information and Communications (NICT) Technology, Japan
Institute for Space-Earth Environment Research (ISEE),
Nagoya University, Japan

“Global Space Weather Warning System”…

Should be the ultimate goal of operational space weather service

Drawn by Gemini with the words “Extreme Space Weather”

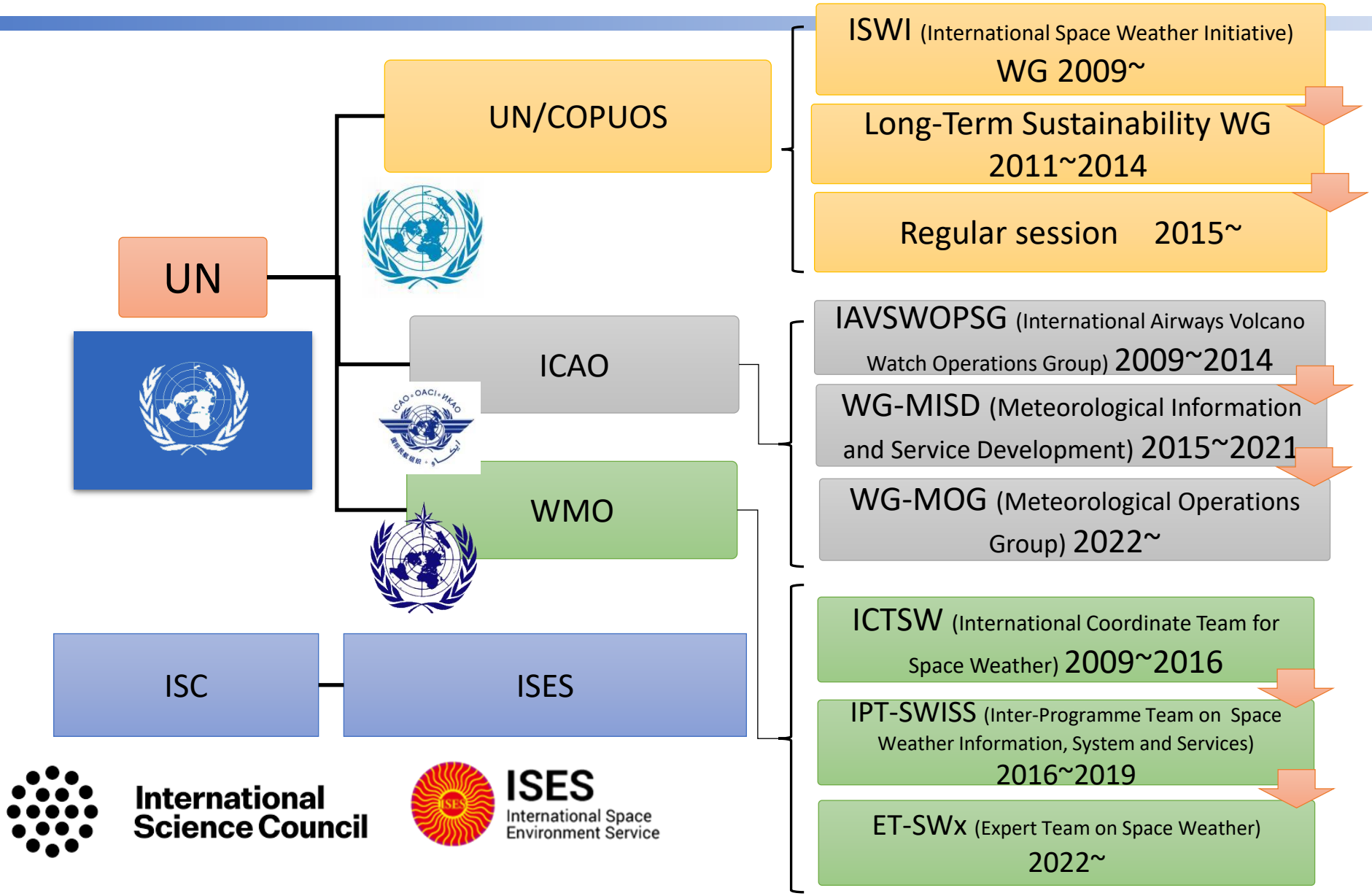
“Global Space Weather Warning System”…

Two Essential engagements

- International cooperation / collaboration / coordination
- User engagements

Drawn by Gemini with the words “International cooperation and user engagements”

International Organizations related to Space Weather Services



ISES Officials

ISES started four-year period in April 2023 with new office members

Mamoru Ishii,
RWC Japan
Director

Sergio Dasso,
RWC Argentine
Deputy Director

Mpho Tshisaphungo,
RWC South Africa
Secretary for Space
Weather

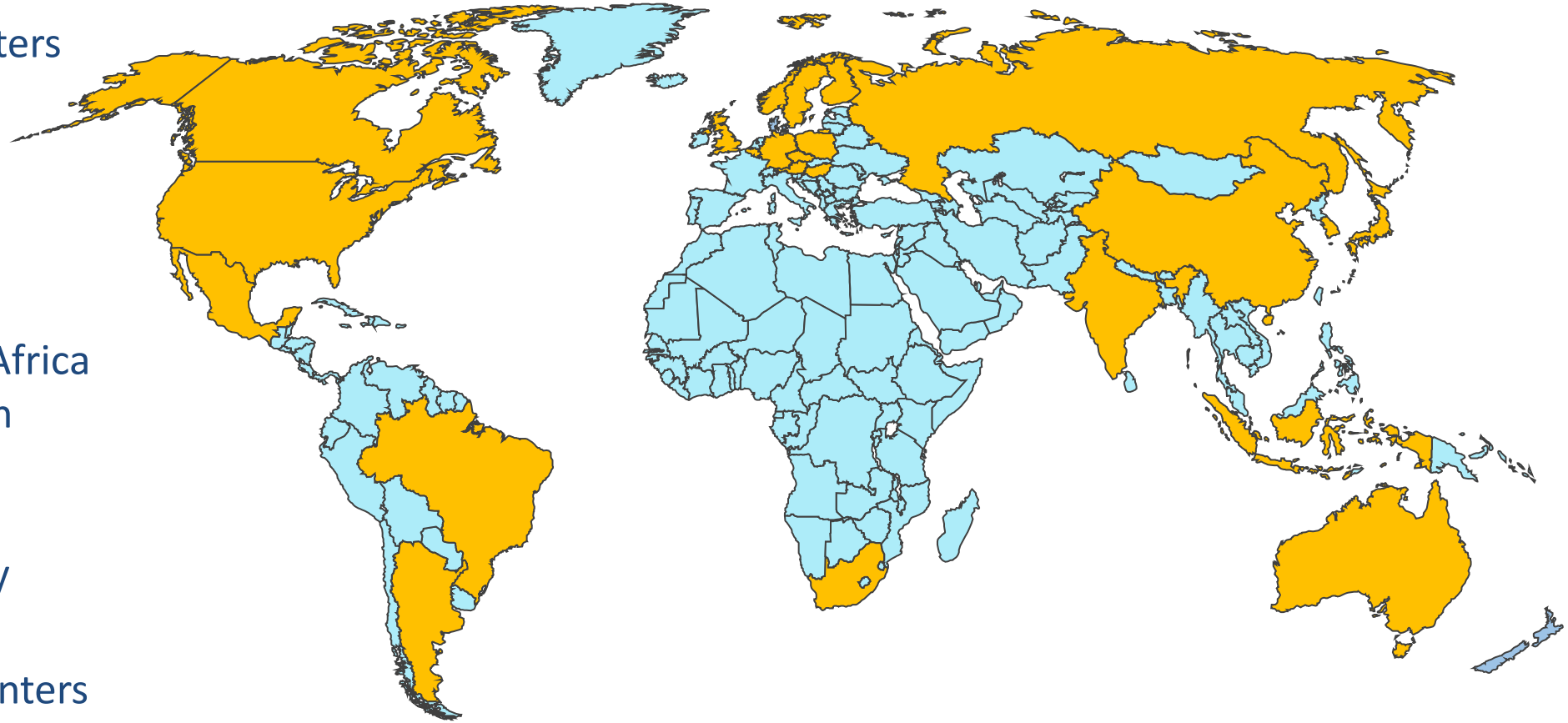
Kichang Yoon,
RWC Korea
Secretary of Web
Presence

Robyn Fiori
RWC Canada
Secretary for world
Days

ISES Member States

21 Regional Warning Centers

- Argentina
- Australia
- Austria
- Belgium
- Brazil
- Canada
- China
- Czech Rep.
- India
- Indonesia
- Japan
- Korea
- Mexico
- Poland
- Russia
- South Africa
- Sweden
- UK
- USA
- Norway
- Finland



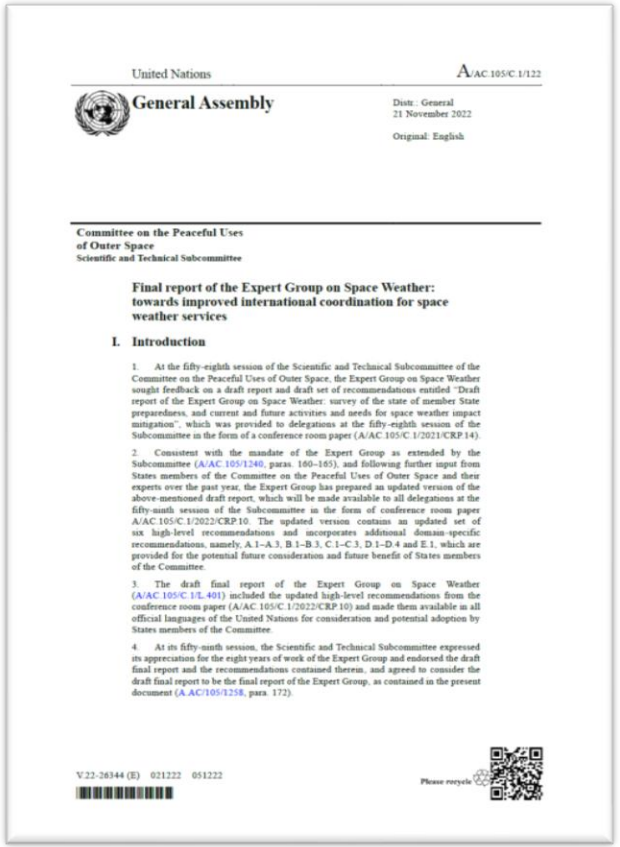
3 Collaborative Expert Centers

- Germany
- Hungary
- ESA

WMO-ISES-COSPAR Coordination

- The Committee on the Peaceful Uses of Outer Space (**UNCOPUOS**) and its Scientific and Technical Subcommittee (STSC) published a document “Final report of the Expert Group on Space Weather: towards improved international coordination for space weather services”(United Nations A/AC.103/C.1/122).

- COSPAR, ISES and WMO are invited to lead efforts to improve the global coordination of space weather activities in consultation and collaboration with other relevant actors and international organizations.



United Nations A/AC.105/C.1/122

General Assembly

Distr.: General
21 November 2022

Original: English

Committee on the Peaceful Uses of Outer Space
Scientific and Technical Subcommittee

Final report of the Expert Group on Space Weather: towards improved international coordination for space weather services

I. Introduction

1. At the fifty-eighth session of the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space, the Expert Group on Space Weather sought feedback on a draft report and draft set of recommendations entitled "Draft report of the Expert Group on Space Weather: survey of the state of member State preparedness, and current and future activities and needs for space weather impact mitigation", which was provided to delegations at the fifty-eighth session of the Subcommittee in the form of a conference room paper (A/AC.105/C.1/2021/CRP.14).

2. Consistent with the mandate of the Expert Group as extended by the Subcommittee (A/AC.105/1240, paras. 160–165), and following further input from States members of the Committee on the Peaceful Uses of Outer Space and their experts over the past year, the Expert Group has prepared an updated version of the above-mentioned draft report, which will be made available to all delegations at the fifty-ninth session of the Subcommittee in the form of conference room paper A/AC.105/C.1/2022/CRP.10. The updated version contains an updated set of six high-level recommendations and incorporates additional domain-specific recommendations, namely, A.1–A.3, B.1–B.3, C.1–C.3, D.1–D.4 and E.1, which are provided for the potential future consideration and future benefit of States members of the Committee.

3. The draft final report of the Expert Group on Space Weather (A/AC.105/C.1/L.401) included the updated high-level recommendations from the conference room paper (A/AC.105/C.1/2022/CRP.10) and made them available in all official languages of the United Nations for consideration and potential adoption by States members of the Committee.

4. At its fifty-ninth session, the Scientific and Technical Subcommittee expressed its appreciation for the eight years of work of the Expert Group and endorsed the draft final report and the recommendations contained therein, and agreed to consider the draft final report to be the final report of the Expert Group, as contained in the present document (A/AC.105/1258, para. 172).

V.22-26344 (E) 021222 051222

Please recycle

United Nations Committee on the Peaceful Uses of Outer Space

WMO

ISES International Space Environment Service

COSPAR COMMITTEE ON SPACE RESEARCH

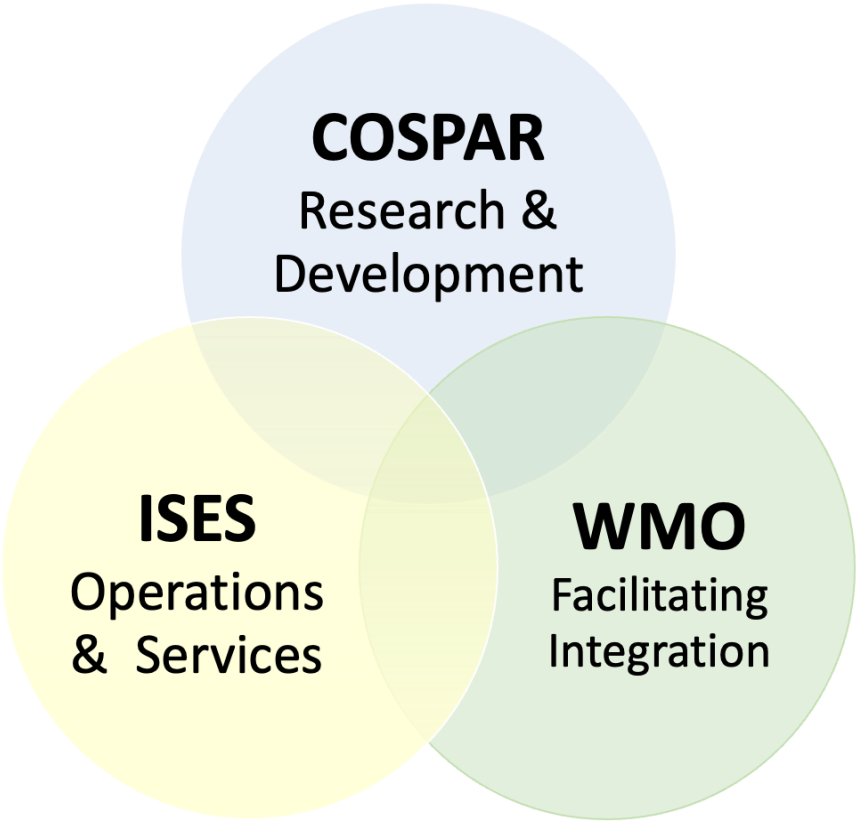
Brainstorming meeting in Coimbra, Sep 30 – Oct 1, 2022 (after ISWAT 2022)

- **Moderator:** Ian Mann on behalf of UNCOPUOS (remote participation)
- **Facilitator:** Suzy Bingham, WMO/UK MetOffice
- **Venue:** Observatório Geofísico e Astronómico da Universidade de Coimbra (OGA)
- **Participants:**
  - COSPAR: Masha Kuznetsova (Chair of PSW) and Hermann Opgenoorth (Vice-Chair of PSW)
  - ISES: Jesse Andries (Director) and Mamoru Ishii (Deputy Director)
  - WMO: Kenneth Holmlund (H/SSU) and Kirsti Kauristie (co-chair of ET-SWX)

Come together with open hearts and open minds

The Coimbra Declaration

- **Agreed on core expertises of the three organizations**
- Agreed to define collaboratively the overarching activities in the overlapping areas
- **Established WMO-ISES-COSPAR Coordination Team (WICCT).** Meet in person (at least every 6 months) + virtually
- Agreed to establish cross-memberships in the organizations' working groups
- Agreed to orgnise a **Space Weather International Coordination Forum** to bring together representatives from major organisations and activities in space weather.



Space Weather International Coordination Forum (Nov 17 2023, Geneva)

Anticipated outcomes include:

- An outline of the international space weather landscape identifying **primary expertise of each organization** represented in the Forum

- Initial Discussion about the coordination in;
  - Space Based Observation
  - Ground Based Observation
  - User Engagements
- Plans for interfacing with organizations representing major user groups
- Approach to alignments with national strategic planning activities and funding programs
- Plans for join projects to demonstrate the value of collaboration and coordination

Now, ISWCF Webpage is on public!
https://www.iswat-cospar.org/iswc-forum

Keywords

International Space Weather Coordination Forum

ISWC Forum Home | Meetings | Statements | Coordination Themes | Projects | FAQs | Participating Organizations | Login

The International Space Weather Coordination Forum (ISWCF) is open to all international organizations that embrace the spirit of working together on space weather, and recognize the benefit of coordinating their efforts. The Forum identifies areas where coordination can be improved and explores pathways for enhancing international collaboration and cooperation. The Forum promotes focused collaborative activities. The aim of the Forum is to optimize efforts amongst international organizations to improve space weather capabilities.

This ISWCF website is a hub facilitating collaboration, coordination, information exchange and resource optimization for organizations within the global space weather landscape. Coordination Themes are areas where coordination can be improved. Projects are activities towards addressing the Themes. Information on Participating Organizations is provided to help identify and establish partnerships between relevant entities to work on projects.

This website's content management system enables representatives from organizations to update this website. Each organization has a dedicated webpage, linked from the Participating Organizations webpage, which can include links to organizational webpages. Each joint project will have a dedicated webpage, anticipated to be regularly updated by project coordinators.

WMO-ISES-COSPAR Coordination Team (WICCT) is coordinating efforts for the Forum. If any organization is interested in joining the Forum or for any other queries, please contact **WICCT members** (wicct@googlegroups.com).

For questions related to accounts on this website, please contact maria.m.kuznetsova AT nasa.gov or annemichelle.m.mendoza AT nasa.gov.

Candidates of Pilot Projects

User Engagements

- Essential Space Environment Quantities (ESEQs)
- Collaborative development of generic displays for major user groups
- International user-group community participation analogous to the ICAO activity.
- Overarching space weather portal for forecast/operational services (for users).e.g. Centralized directory.

Establishment of framework for severe space weather events

- Global Space Weather Warning System
- Extreme space weather event thresholds/categorization
- Simulated exercise for testing/improving response to global super-extreme events
- Collect information on socio-economic benefit studies - such as sharing and comparing processes, best practices, risk assessment protocols, etc - across the space weather community.

Coordination among observations, models and forecasts

- Coordination of similar instruments in ground-based networks (ionosondes, neutron monitors, magnetometers, …)
- Standards - many possible projects, for example (1) identify meta-data for a relevant domain, e.g. ionosondes (2) establish coordinate reference system (CRS) and transformation standards for space weather, equivalent to terrestrial weather's PROJ. Going beyond "see Hapgood [1992]".
- FAIR common information architecture - many possible projects, for example (1) sharing and discoverability of ionosonde data (e.g. through WIS2.0), (2) showcasing interoperability between two platforms (e.g. SPASE, WIS)
- Coordinated validation and inter-comparison of models, forecasts and/or end-user products. This can involve workshops, real-time scoreboards and other community tools,…
- Coordinated efforts to enable access to space weather impact information including anomaly databases, GIC data, etc

Capacity building

- Training for early career researchers. Building on work by COSPAR Panel on Capacity Building and existing agreement between COSPAR-WMO; lecturers have included some ISES representatives.
- Capabilities Building / Training
- Competency based training frameworks for space weather forecasters.

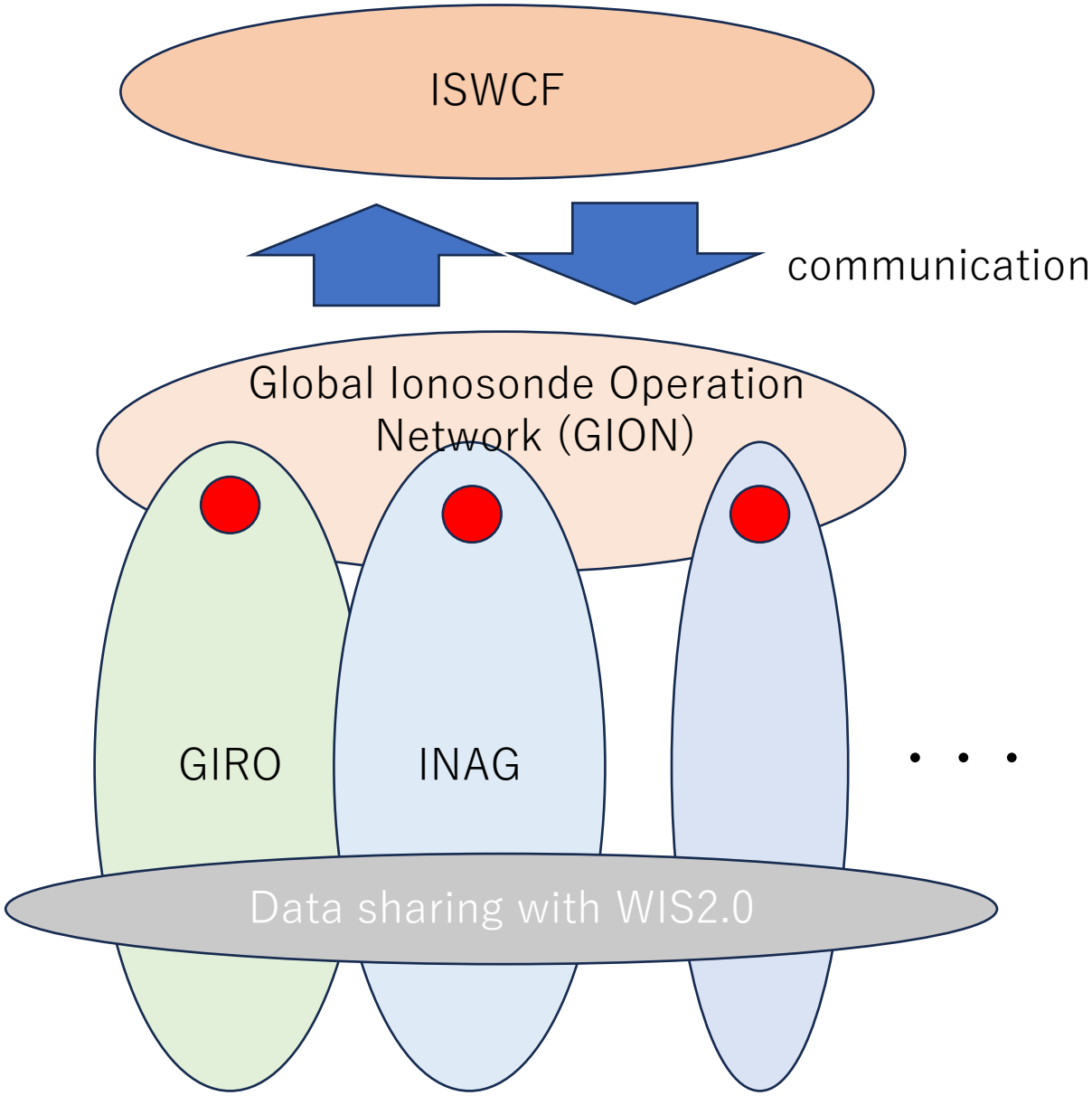
Others

- A Citizen science project
- Standardized naming of large space weather events

Establishment Plan of “Global Ionosonde Operation Network (GION: tentative name)

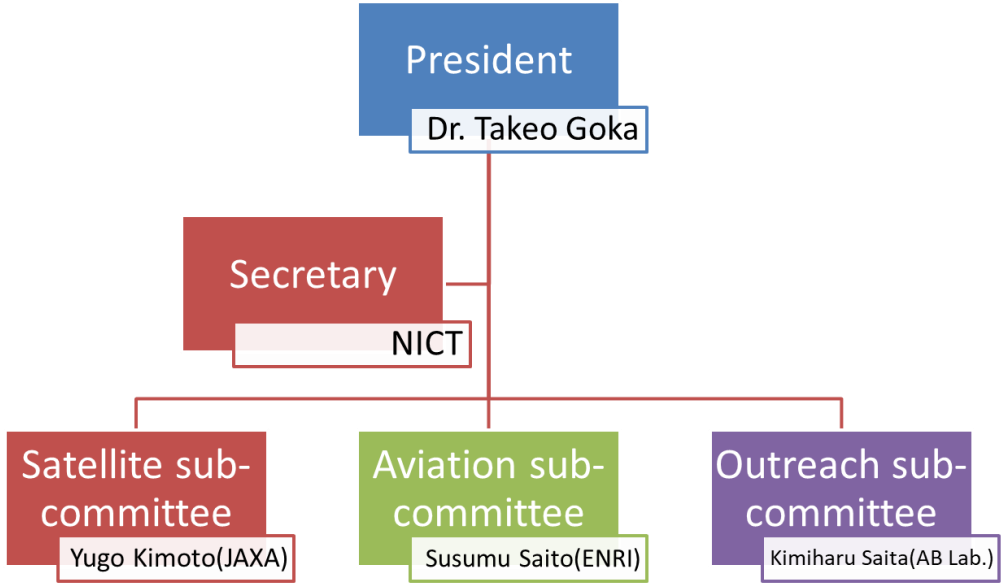
Aim: establish the international comprehensive organization who work for Ionosonde observation/operation as a member of ISWCF.
Structure: group of the representatives and liaisons of existing organizations
Function:

- Work as the representative of Ionosonde observation in ICFWS: input opinions as ionosonde community and spread the information discussed in ISWCF in ionosonde community
- Discuss coordination of ionosonde network
  - Data sharing with WIS2.0
  - Registration of Observation: New digisonde and registration of the URSI station code (from Ivan)



User Engagements –Japanese case—

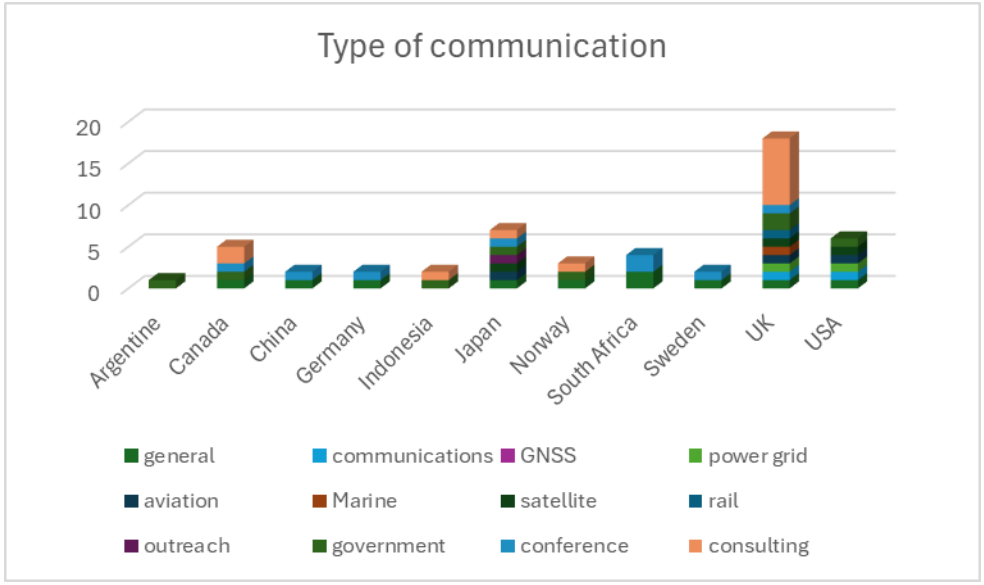
- Constructing framework for user communication
  - “Space Weather User Committee”
  - Japanese Domestic activity established in 2015 for bridging between space weather user requirements and cutting-edge knowledge of space weather in research field.
  - Members: 47 organizations
    - Governmental organizations:5
    - Research organizations:3
    - Non-Governmental Organizations:6
    - Industries:33

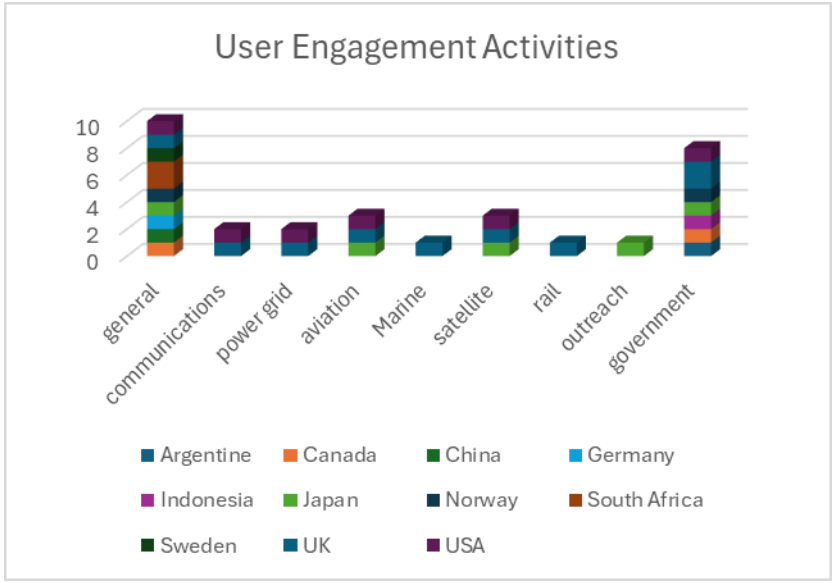


14

Results of user-communication survey in ISES

- As a grass-root action discussed in ISWCF, Nov. 17 2023, in Geneve.
- Survey Period: March 27-April 22
- Status: 10 of 23 members responded; Argentine, Canada, China, Germany, Indonesia, Japan, Norway, South Africa, Sweden, UK and USA
- Results:
  - Many countries have two functions;
    - Public open outreach lectures
    - Closed consulting to specific field, especially government
  - Several countries have channels to specific field
    - Japan: aviation, satellite, outreach, government
  - UK: communication, power grid, aviation, marine, satellite, rail, government
  - USA: communication, power grid, aviation, satellite, government





What are needed for further user engagements?

- Existing Communication method
  - Public open outreach lectures
  - Closed consulting to specific field
  - SNS
- Further approach
  - Show the relation between space weather phenomena and their impact on social infrastructure
    - Quantitative analysis of the relation between the space weather phenomena and response of social infrastructure
      - Experiments
      - Accumulating social impact database
    - Set scales based on the impact on social infrastructure

Summaries

- International framework for Space Weather Research, Development and Operation is now changing significantly.
- The comprehensive ionosonde observation/operation network group in the world will be established soon. Following this action, (probably) similar group for GNSS and ground-based magnetometer is to be discussed.
- Many countries have frameworks for building user engagements. It is essential to hear user needs to be on the right track for improving operational space weather services, but for that we need to build trustiness with users.
- It is important to have cooperative experiment with users for finding the relation between space weather phenomena and its impact on social infrastructure.