WORLD METEOROLOGICAL ORGANIZATION
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COMMISSION FOR BASIC SYSTEMS
COMMISSION FOR AERONAUTICAL METEOROLOGY

INTER-PROGRAMME COORDINATION TEAM ON SPACE WEATHER

FOURTH SESSION

GENEVA, 25-28 NOVEMBER 2013

ICTSW-4/Doc. 7
(22.XI. 2013)
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ITEM: 7

Original: ENGLISH

WARNING FOR EXTREME SPACE WEATHER EVENTS

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Summary and Purpose of Document

Following discussions by ICTSW-3, a Panel session on extreme space weather event warning was held in Boulder in May 2013. The document summarizes major outcomes of this session and suggests actions towards improved coordination and agreed best practices to deal with severe space weather event warnings.

ACTION PROPOSED

The Inter-Programme Coordination Team is invited to consider the requirements and recommendations indicated in the document and take action as appropriate.

DISCUSSION

1. BACKGROUND

1.1 ICTSW-3 discussions on extreme events

The ICTSW-3 meeting (12-14 November, 2012) discussed the preparedness extreme space weather events.. It was agreed that we should aim at well-documented scenarios and procedures for such events and ultimately establish a global coordination to detect, warn, and facilitate response to such events.
A number of issues were identified:

- Agreed definition of extreme events, characterizing their occurrence probability and potential impact;
- Identify the information service requirements, to support decision making, including standardization (e.g. space weather hazard scales);
- Define functional and organizational requirements to provide such a service;
- Develop guidelines for national procedures for preparedness and for response to such events.

It was agreed to draft an overview of the processes involved for further discussion by ICTSW, and to draft a recommended approach to evaluate, improve and expand as necessary the set of global/local space weather scales in order to ensure efficient and standardized information communication to the users (Actions 3.24 and 3.25).

1.2 ISES-ICTSW Panel on extreme space weather events warning (April 2013)

During the NOAA Space Weather Workshop held in May 2013 in Boulder, Colorado, a panel discussion was organized by ISES and the WMO ICTSW on International Communication and Coordination for Extreme Space Weather Events.

The panelists included representatives of space weather warning centres from Australia, Brazil, China, Japan, Poland, South Korea, United States, and United Kingdom, and representatives of the North Atlantic Treaty Organization (NATO) space weather working group, and the WMO Secretariat.

The purpose was to address detection and response to extreme events and to identify capability gaps. There were very informative presentations sharing experience and views on a number of topics including the characterization of events, the alert chain, the forecast models, the available services, and methods of communication to the users.

The findings of this Panel session were also reported in November 2013 at the 10th European Space Weather Week[1].

1.3 International framework for building resilience

During the panel discussion, information was reported on the existing international framework for disaster risk reduction (not specifically related to space weather), and in particular:

The International Conference on Early Warning (2003) which identified 4 components

- Monitoring and warning service
- Risk knowledge (taking into account exposure and vulnerability)

[1] Onsager, T., Lafeuille, J., Sharma, M., International space weather service coordination during extreme events, ESWW10, Antwerp, 18-22 Nov. 2013.

- Communication & dissemination
- Response capacity

The Hyogo Framework for Action (HFA) « Building the Resilience of Nations and Communities to Disasters » (2005) which went further in outlining 5 priority areas:

- Institutional basis
- Risk monitoring and warnings
- Education to safety
- Risk factor reduction
- Preparedness

This highlights the importance of addressing the extreme event warnings in the broader context of a multi-hazard, end-to-end chain.

Figure 1: Schematic diagram of the four components identified by the International Conference on Early Warning (2003).

2. MAIN OUTCOMES OF THE PANEL SESSION

2.1 Increasing recognition of the space weather risk

In a number of countries, space weather risk is now recognized among the risks to be managed by the national civil contingencies agency. Reports were provided in this regard by the United States (the National Science and Technology Council lists space weather among the Grand Challenge for Disaster Risk Reduction), the United Kingdom (the Cabinet Office includes space weather in the National Risk Register of Civil Emergencies), Sweden (Space weather is addressed by the Swedish Contingencies Agency), the Netherlands and Norway.

2.2 Characterization of extreme events

Extreme events are supposed to be infrequent or exceptional (decadal or centennial), involving unusually large energy levels, and having large impact, often with cascading effects. This corresponds typically to what is called “superstorms”. Various indexes have been considered to characterize such events, by various authors. Some consensus index and corresponding threshold should be defined.

2.3 Scope of warning procedures

Such « worst case » events are fully relevant for design purpose and vulnerability assessment. Warning procedures, however, should extend to any « severe » event requiring emergency reaction, potentially hazardous consequences, which are more likely to be experienced in a man’s life.

2.4 Cross-border consistency

Cross-border information consistency is required for large scale events that have an international impact. It is also important for international users to be faced with consistent procedures and terminology in various parts of the world.

Interoperability and exchange of information among regional warning centres is necessary. The centres need to share data and experience, they should be able to seek confirmation from each other and provide mutual back-up.

This does not necessarily imply that all Warning Centres use the same alert thresholds, since some physical thresholds could be adjusted regionally to ensure consistent degree of rarity of « extreme » events, and take into account regional differences in hazard frequency, but also exposure and vulnerability.

2.5 Essential requirements for severe event warnings

The warning information shall be :

- **Efficiently and timely communicated**
  - Using specific, active delivery mechanisms (beyond routine channels)
  - From officially designated authoritative source
  - To well determined recipients: authorities, major operators, public at risk

- **Properly understood**, **minimizing information losses or risk of misinterpretation**:
  - Simplified
  - Focused on decision support, describing the risk resulting from the hazard
  - Standardized (e.g. scale) with pre-defined explanations

- **Trusted, having demonstrated its reliability**
  - Noting that standardized information enables to draw post-event verification statistics.
  - There is no expectation that a warning should be 100% correct, but the frequency of announcing “exceptional” or “severe” situations should at least be consistent with the actual frequency of “exceptional” or “severe” situations.

- **Responded, through an efficient user reaction**
  - This should result of the recognition of space weather severe events in the “risk register” maintained by civil contingency agencies in every country
  - It involves preparedness for mitigation, throughout the alert chain.

3. CONCLUSION

Recommended areas for further action:

- Ensure that space weather risk is included in national multi-hazard warning schemes;
- Identify a proper scale to characterize the severity of the events;
- Define levels above which specific communication procedures should be activated;
- Establish a real-time communication mechanism among warning centres to share urgent technical and informal information, cross-verify forecasts, keep each other informed of the press/media accounts about extreme events ;
- Develop manual of best practices;
- Develop a standard set of products in concise formats (e.g. risk index in a scale);
- Exercise coordination mechanisms under test conditions;
- Conduct post-event analyses to refine the capabilities and document the reliability of the warnings.