

WMO-ITU Seminar

Spectrum use for meteorology: challenges, opportunities and evolving requirements

Presenter: Markus Dreis, Chair ITU-R Study Group 7

Seminar Introduction



Geneva, 28-30 September 2026

Introduction

Meteorology is a crucial part of our everyday life and has many connections with our daily routines and activities such as:

- weather forecasting;
- detection and tracking of many natural hazards (heavy precipitation, floods, storms, hurricanes/ tropical cyclones, heat waves/draughts, earthquakes, tsunamis, forest fires, or other disasters such as oil leaks, atmospheric or marine pollution etc.);
- providing alert & warning information;
- damage assessment and planning relief operations;
- climate change monitoring and prediction;
- global environment monitoring – atmosphere (including greenhouse gases emissions), oceans, land surface, biomass, etc.).

Weather & Climate effects on us

Our economies and many areas of our modern lives are very weather and climate sensitive.

Consequently, the socio-economic benefits of weather forecasts and climate monitoring and their constant improvement are essential and proportional to the Gross Domestic Product (GDP) of any country or region.



Safety of life, property and infrastructure...



Transport ...



....Energy, agriculture, tourism....



...Climate policy and environment protection

Radio technology is key for meteorology (1/3)

- Many meteorological and climate information gathered and distributed is either based on measurements from systems using radio (electromagnetic) waves, or otherwise gathered but provided and distributed by radiocommunication systems.
- These systems, space-based as well as surface-based, employ various types of technologies, including:
 - radiocommunication (e.g. radiosondes, satellites),
 - active remote sensing (e.g. weather radars, wind profilers, precipitation radars, cloud profile radars),
 - and passive remote sensing (e.g. microwave sounders, microwave radiometers, lightning detection).

Radio technology is key for meteorology (2/3)

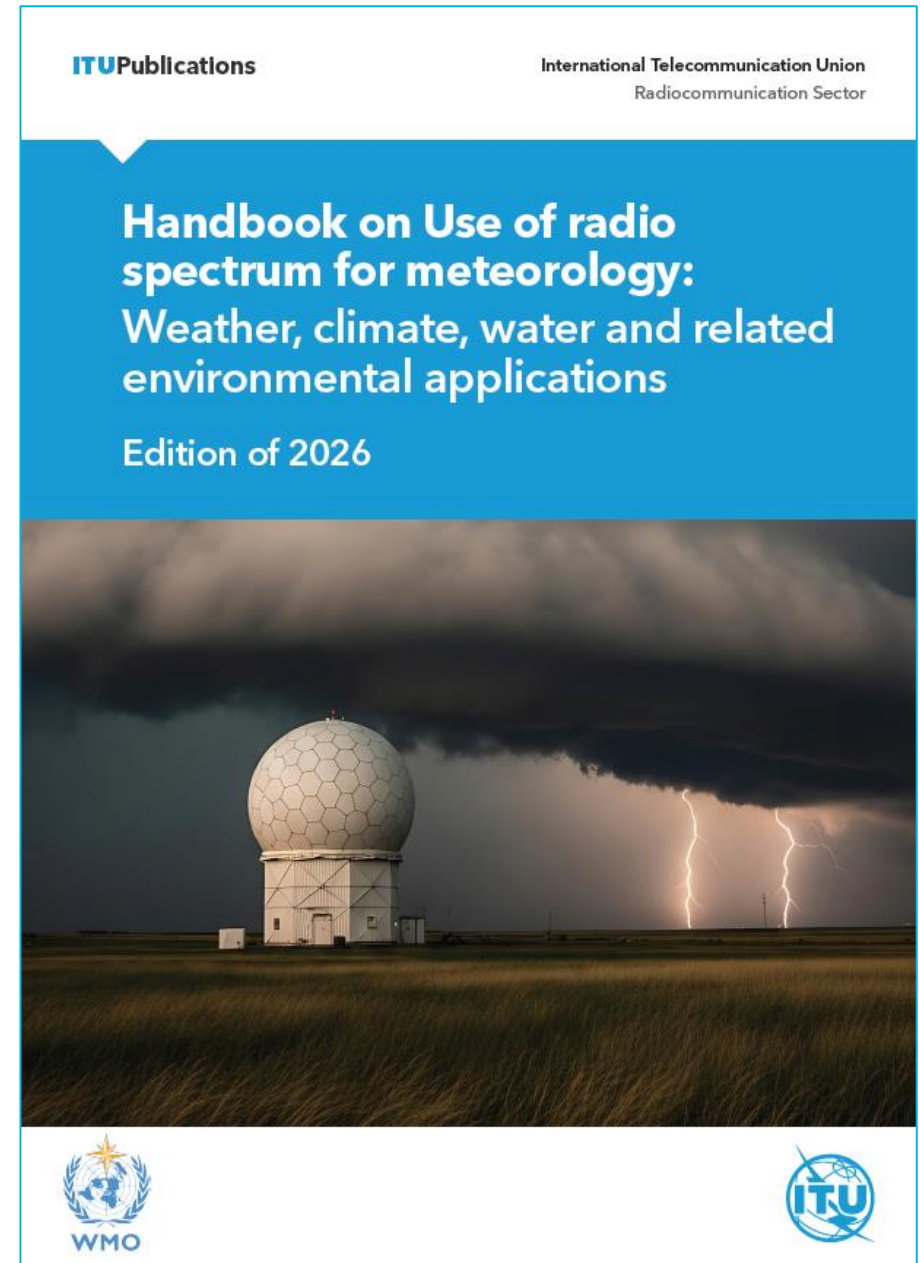
- Thus, radio systems are fundamental for observing weather and monitoring the Earth's climate and supporting countries in mitigating and adapting to the effects of weather and climate change, and in addressing its major challenges.
- The systems used to obtain and disseminate meteorological information make use of a variety of radio technologies and require reliable access to radio frequencies throughout the radio spectrum, operating at frequencies ranging from a few kHz to several hundreds of GHz, noting that those frequencies are a limited, scarce natural resource governed by the Radio Regulations of the ITU.
- Therefore, ensuring the availability of radio frequency bands free from harmful interference is crucial for the operation of all Earth observation systems.

Radio technology is key for meteorology (3/3)

- These systems using radio-frequencies are interconnected and collectively comprise a comprehensive global meteorological and related environmental monitoring system.
- The degradation of any of the radio components within this global system, whether related to observation or data dissemination, can jeopardize the entire Earth system monitoring and prediction process.
- It is also emphasised that systems using these frequencies play a crucial role in the detection, forecasting and warning of extreme weather, climate and water conditions worldwide.
 - Given that these disasters account for more than 50% of all reported disasters, these systems are essential components of multi-hazard early warning systems that are crucial in mitigating disasters and emergencies.

Handbook on meteorology (1/3)

- For providing a comprehensive overview on the radio technology based systems used to obtain and disseminate meteorological information this handbook was developed and updated in 2026.
- One primary purpose of this Handbook is to provide the reader with information about the use of radio systems and radio frequency bands, and the importance of this use to public safety and the world economy.
- It was prepared and published in collaboration between ITU-R Study Group 7 (SG7) Working Parties 7C and 7B (WP7C & 7B) and the Expert Team on Radio Frequency Coordination (ET-RFC) of the WMO.
- The update to this Handbook could not have been completed without the contribution and efforts of numerous experts from around the world.



Handbook on meteorology (2/3)

- The purpose of this handbook is to serve as a guide to
 - professional users of meteorological and related environmental data from radio-based systems,
 - the public and governments relying on these systems, and
 - the radiocommunications community, including regulators and the wireless telecommunications industry.
- This Handbook presents
 - the overall structure of the WMO global infrastructure and its observing components,
 - an overview and discussion of each meteorological and related environmental system's technical and operational characteristics.
- The description of each meteorological system includes:
 - the radio-frequency bands used,
 - the criteria for predicting harmful interference from competing radiocommunication systems;
 - and the potential impact of harmful interference on weather, climate, water, and related environmental data, forecasts and warnings.

Handbook on meteorology (3/3)

- To assist in understanding this complex area, discussions have been divided into the following types of systems as outlined in the following handbook sections:
 - 1 WMO global infrastructure
 - 2 Meteorological satellite service systems
 - 3 Meteorological aids service systems, mainly radiosondes
 - 4 Ground-based meteorological radars, including weather radars and wind-profiler radars
 - 5 Passive and active spaceborne remote sensing for meteorological and related environmental activities
 - 6 Space weather sensor systems
 - 7 Other radiocommunication systems for meteorological and related environmental activities.

Seminar agenda - Day 1: Mapping the content of the handbook

- To assist in understanding this complex area, presentations have been divided into the following types of systems:
 - 1 WMO global infrastructure (next presentation)
 - 2 Meteorological satellite service systems (first session after lunch today)
 - 3 Meteorological aids service systems, mainly radiosondes (last session today)
 - 4 Ground-based meteorological radars, including weather radars and wind-profiler radars (last session today)
 - 5 Passive and active spaceborne remote sensing for meteorological and related environmental activities (first session after lunch today)
 - 6 Space weather sensor systems (last session today)
 - 7 Other radiocommunication systems for meteorological and related environmental activities (last session today)

Seminar agenda - Day 2:

Session 1: Meteorology and spectrum: societal benefits and public value

- 5 presentations to line out the socio-economic aspects/benefits/impacts and the its contribution to UN Sustainable Development Goals

Session 2: World Radiocommunication Conferences 2027 and 2031

- 4 presentations on WRC-27 preparations, agenda items of interest and WRC-31 outlook

Session 3: Meteorology and spectrum: operational needs and protection

- 4 presentations from National Weather Services and forecast centres

Session 4: Impact of RF interference on spectrum use for meteorology

- 3 presentations on “famous” RFI cases and general practices for RFI detection, monitoring and mapping

Seminar agenda - Day 3:

Session 1: Overview of space-based meteorological observation programmes

- 4 presentations from MetSat operators and an insight to CGMS

Session 2: Overview of space-based Earth observation programmes

- 4 presentations from National and regional space agencies deeply involved in Earth observation

Session 3: Industry perspectives on meteorological observation technologies

- 3 presentations from industry on their approach to meteorological/Earth observation

Panel Discussion: Future Priorities for Spectrum Use in Meteorology

Conclusion

- With this seminar, with such a wide variety of topics addressed, we are hoping to provide a valuable insight into meteorological services, systems and applications using radio technology, socio-economic aspects and perspectives from operators, agencies and users.
- ... and with the updated Handbook a good source for information is provided.
- Sincere thanks again to the numerous contributors participating in SG7's WPs 7C and 7B and WMO ET-RFC who made this update of the handbook possible.