World Meteorological Organization

Weather • Climate • Water

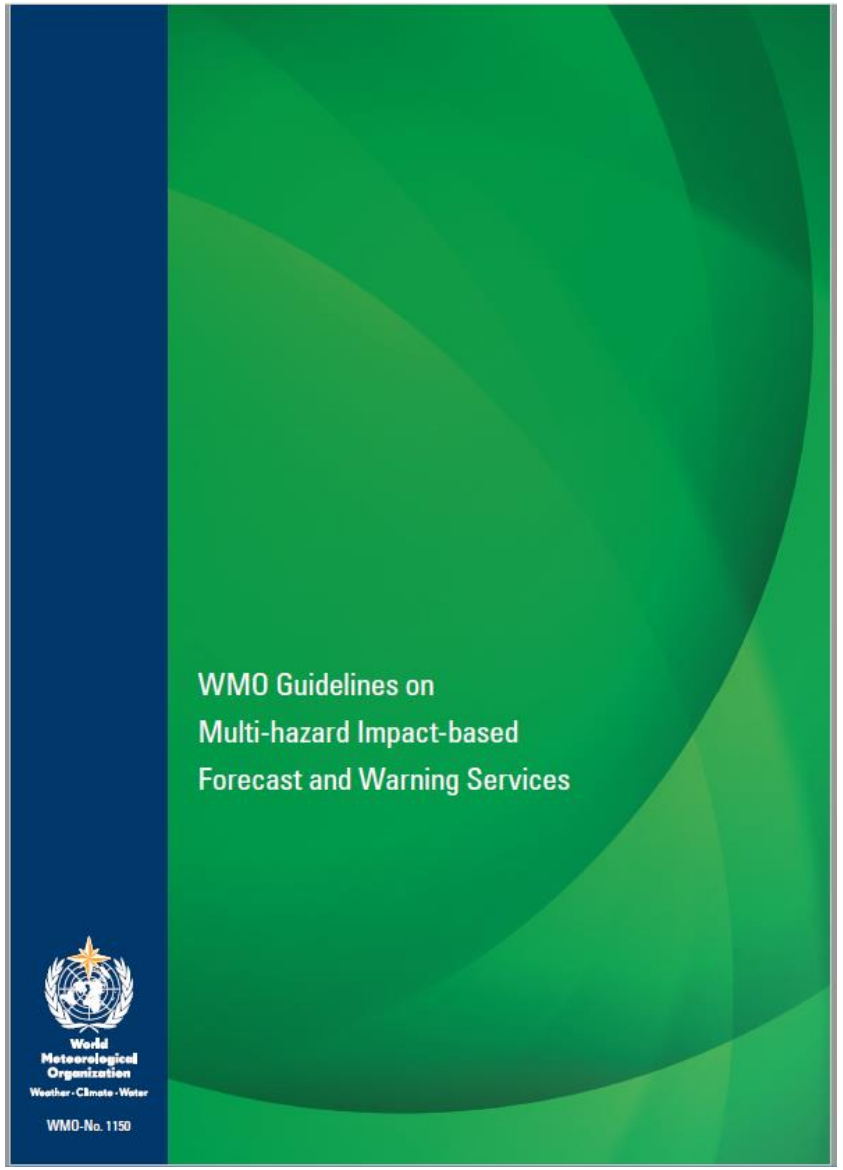
WMO No. 1150

WMO Guidelines on Multi-Hazard Impact-based Forecast and Warning Services

Gerald Fleming

WMO No. 1150

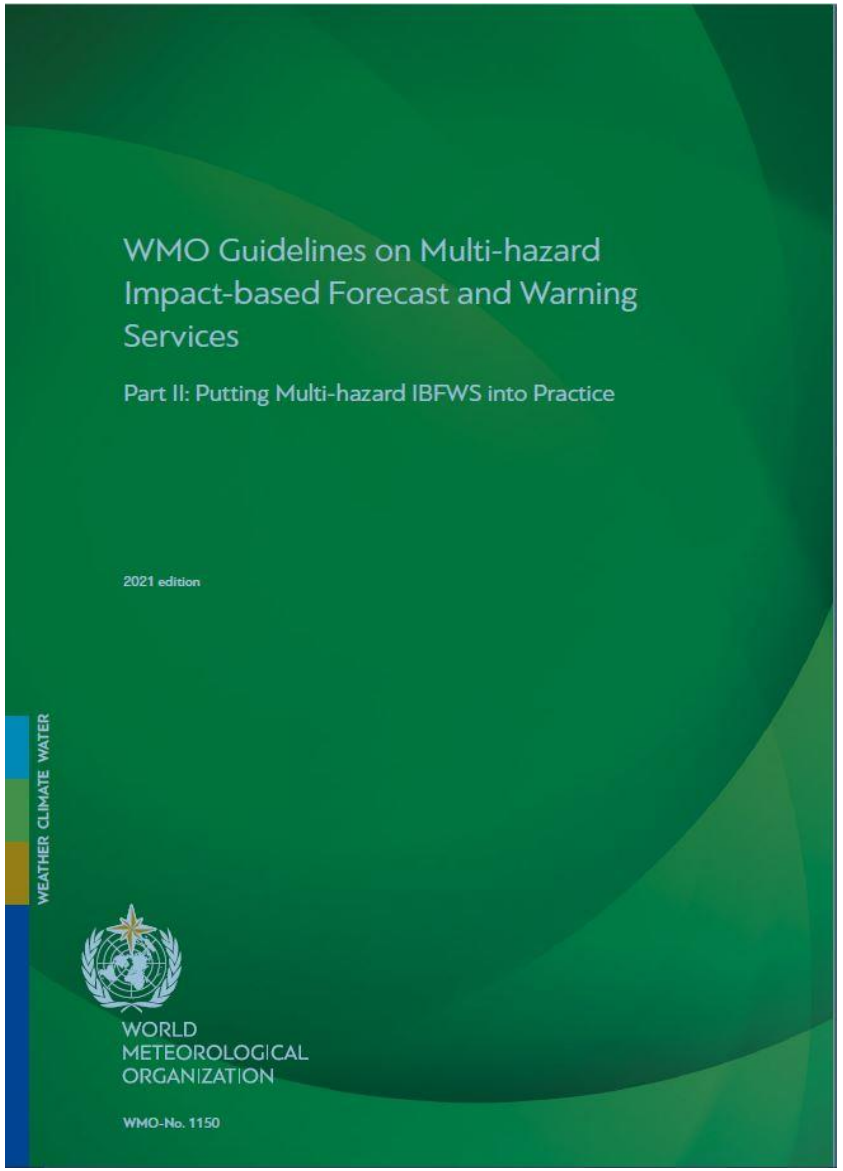
WMO Guidelines on Multi-Hazard Impact-Based Forecast and Warning Services



WMO No. 1150 Part II

WMO Guidelines on Multi-Hazard Impact-Based Forecast and Warning Services

Putting Multi-hazard IBFWS into Practice



wmo 1150

Google Search I'm Feeling Lucky

Google offered in: ລາວ

wmo 1150

All Images Maps Videos News More Settings Tools

About 166,000 results (0.35 seconds)

[PDF]
WMO Guidelines on Multi-Hazard Impact-based forecast and - World ...
https://www.wmo.int/.../WMOGuidelinesonMulti-hazardImpact-basedForecastandWar...

Multi-hazard Impact-based. Forecast and Warning Services. **WMO**-No. **1150** ... The **WMO** Public Weather Services Programme would like to take this opportunity ...

WMO Guidelines on Multi-hazard Impact-based Forecast ... - E-Library
https://library.wmo.int/index.php?lvl=notice_display&id=17257

WMO Guidelines on Multi-hazard Impact-based Forecast and Warning Services ... Available online: http://library.**wmo**.int/pmb_ged/**wmo_1150_en**.pdf.

WMO Guidelines - E-Library
https://library.wmo.int/index.php?lvl=etagere_see&id=153&page=2&nbr...

World Meteorological Organization (WMO) - WMO, 2015 (**WMO**, **1150**). Improving the understanding of the potential impacts of severe hydrometeorological ...

The Case for Impact-Based Forecasting

It is no longer **enough** to provide a good weather forecast or warning – people are now demanding information about **what to do** to ensure their safety and protect their property.

Many people still **lose their lives**, and socio-economic costs associated with hydrometeorological hazards continue to rise…..

….due, in part, to a **lack of appreciation and understanding** of the impacts

How should WMO Members **change what they are doing** to solve this problem?

The Case for Impact-Based Forecasting

An **accurate and timely** hydrometeorological warning **does not guarantee** safety of life or prevent major economic disruption…

National Meteorological and Hydrological Services need to **work more effectively** with Disaster / Emergency Managers, as well as with the public and stakeholders, to **help people understand** how hazards can affect them to ensure appropriate actions.

These can be done in a **subjective** way working alongside users and customers, or in an **objective** way through developing an impact model using ***vulnerability*** and ***exposure*** datasets as well as meteorological information

The Case for Impact-Based Forecasting

Successful impact-based forecasting requires collaboration with others who have the additional necessary expertise, resources and knowledge (such as demographic data, crowd-sourcing techniques, geographical information systems (GISs), interoperability, and third-party data integration and usage) to deliver impact services that NMHSs cannot do on their own

The Case for Impact-Based Forecasting

Successful impact-based forecasting requires **collaboration** with others who have the **additional necessary expertise**, resources and knowledge (such as demographic data, crowd-sourcing techniques, geographical information systems (GISs), interoperability, and third-party data integration and usage) to deliver impact services that NMHSs cannot do on their own

The Case for Impact-Based Forecasting

Successful impact-based forecasting requires collaboration with others who have the additional necessary expertise, resources and knowledge (such as demographic data, crowdsourcing techniques, geographical information systems (GISs), interoperability, and third-party data integration and usage) to deliver impact services that NMHSs cannot do on their own

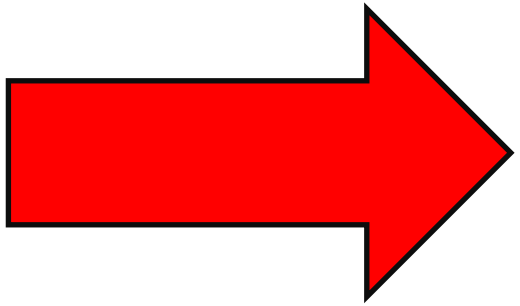
PARTNERSHIPS

The Case for Impact-Based Forecasting

These Guidelines outline a road map to assist WMO Members to progress from weather forecasts and warnings to multi-hazard impact-based forecast and warning services in a manner that is aligned with *The WMO Strategy for Service Delivery and its Implementation Plan* (WMO-No. 1129).

The Case for Impact-Based Forecasting

Weather Forecasts and Warnings



Impact-Based Forecast and Warning Services

Key Ideas in Impact-Based Forecast and Warning Services

Hazard

— Meteorological or hydrological element that poses a threat

Forecast Uncertainty

— The limit of predictability imposed by the nature of the atmosphere

Key Ideas in Impact-Based Forecast and Warning Services

Exposure

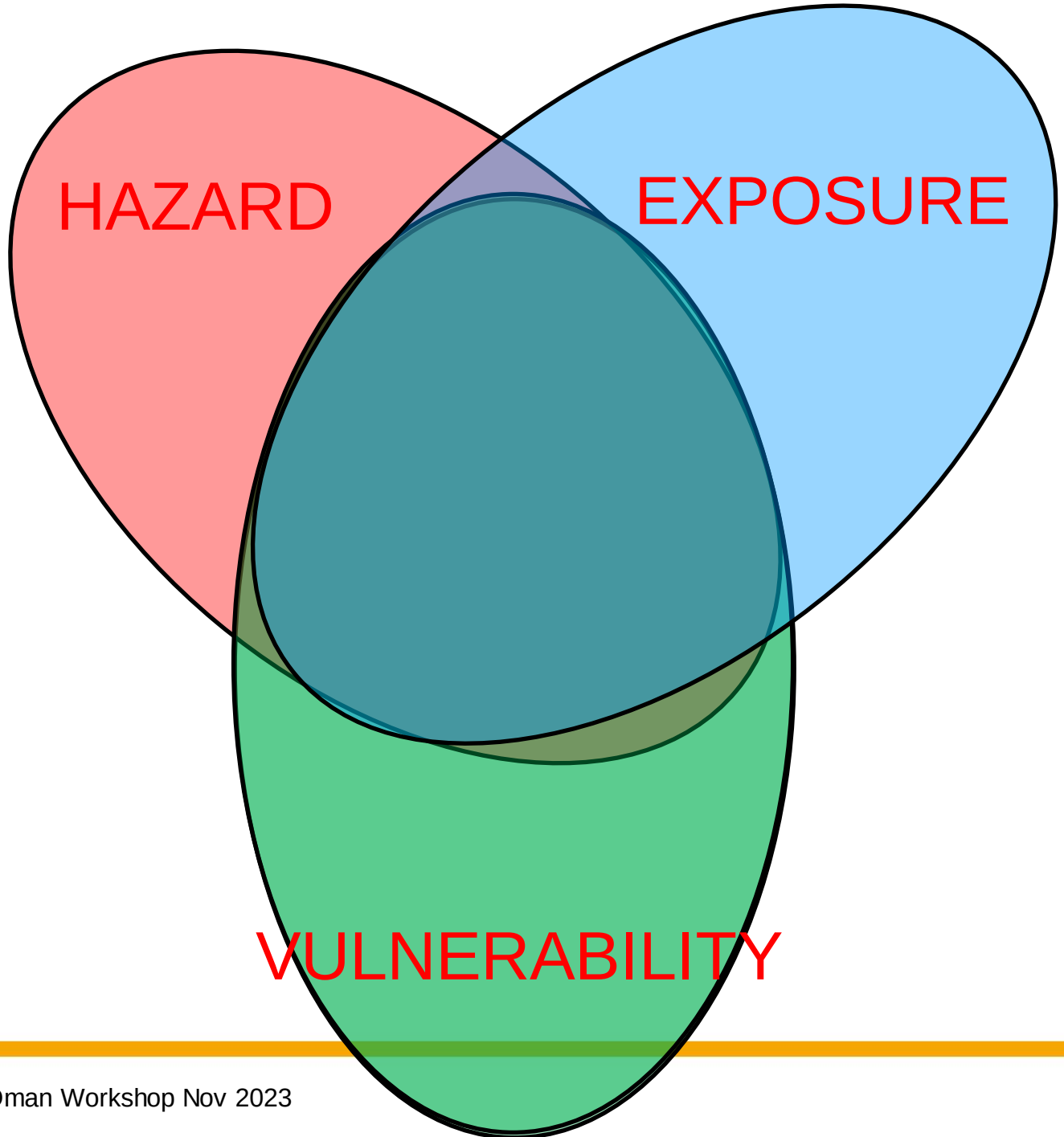
— Who or what may be affected in an area where a hazard may occur

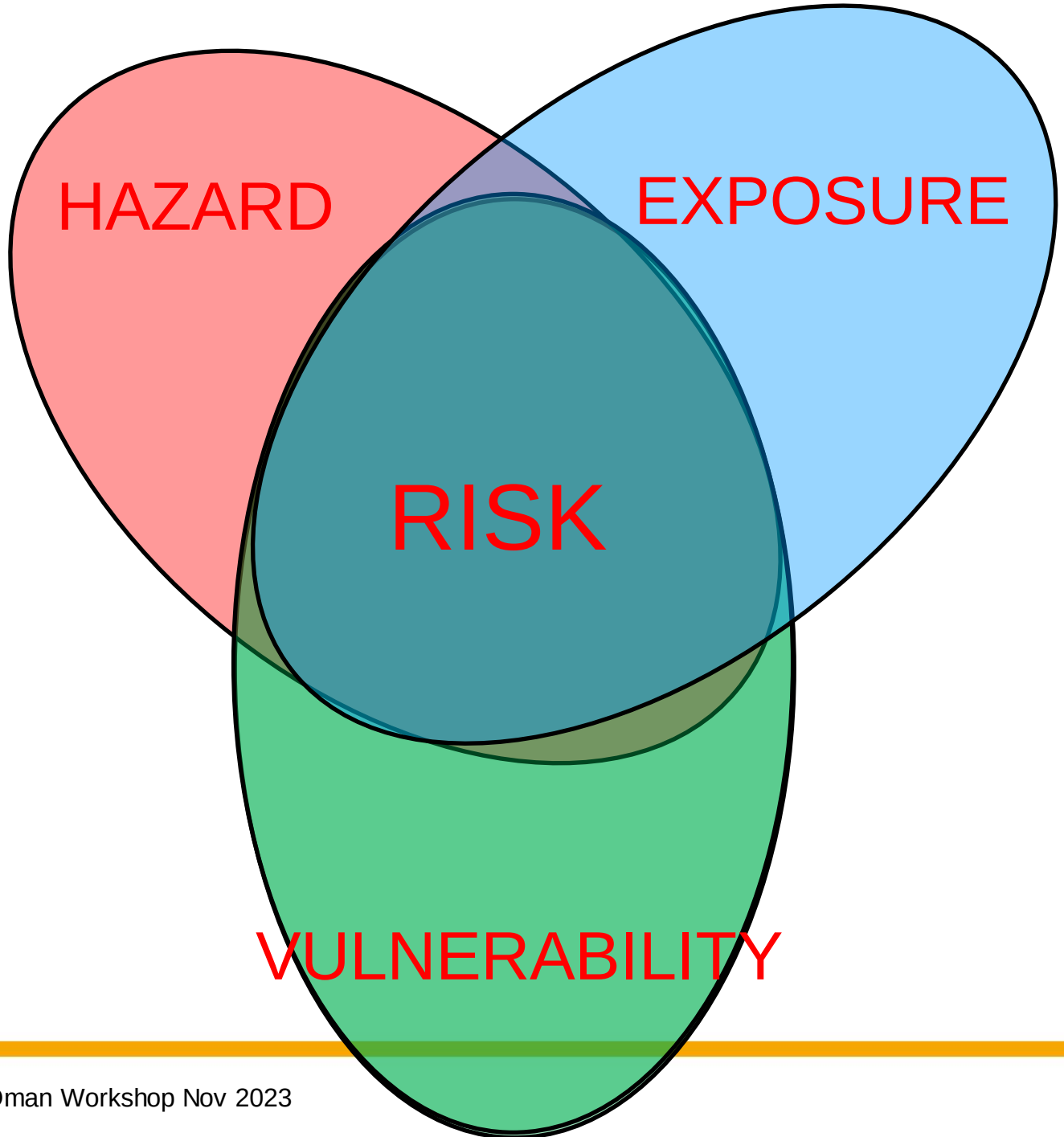
Vulnerability

— The liability of exposed human beings, their livelihoods and property, to suffer bad effects when affected by a hazard

Risk

— The probability and magnitude of harm possible to humans, their livelihoods and assets because of exposure and vulnerability to a hazard


HAZARD
EXPOSURE
VULNERABILITY


HAZARD
EXPOSURE
RISK
VULNERABILITY

Key Ideas in Impact-Based Forecast and Warning Services

Weather Warning:

— "*Strong winds are expected tonight with wind speeds of 20m/s likely*"

Impact-based Warning:

— "*Strong winds are expected tonight which may result in delays or cancellation to ferry services and keep small fishing boats tied up*"

Weather Warning Services

Different types of Weather Warning

1. Warnings with fixed thresholds.
2. Warnings with user-defined thresholds
3. Warnings with variable thresholds

Weather Warning Services

Different types of Weather Warning

1. Warnings with fixed thresholds.

Saffir-Simpson Scale for strength of Tropical Cyclones / Hurricanes

Category	Sustained winds
1	74–95 mph 64–82 kt 119–153 km/h

Weather Warning Services

Different types of Weather Warning

2. Warnings with user-defined thresholds.

Flash Flood Warning for City Authority

"50mm of rain expected during the next two hours which will cause problems with the street drainage system and lead to flooding on the roads"

Weather Warning Services

Different types of Weather Warning

3. Warnings with variable thresholds.

High Temperature Warning

Minimum temperature (°C)			
Osijek	20.1	21.2	22.9
Zagreb	20.2	21.3	22.9
Karlovac	20.0	21.1	22.7
Gospić	17.0	18.0	19.6
Rijeka	22.7	23.7	25.1
Knin	20.5	21.6	23.1
Split	25.8	26.8	28.2
Dubrovnik	25.4	26.3	27.6

Maximum temperature (°C)			
Osijek	35.2	36.7	38.8
Zagreb	33.7	35.1	37.1
Karlovac	34.5	35.9	38.0
Gospić	32.1	33.4	35.4
Rijeka	32.7	33.9	35.5
Knin	35.5	36.9	39.0
Split	33.9	35.1	36.7
Dubrovnik	32.3	33.2	34.7

Weather Warning Services

Different types of Weather Warning

Warnings with fixed thresholds	Rainfall accumulations of 30 mm to 40 mm expected tomorrow between 1400 and 2300.	Hazard

Weather Warning Services

Different types of Weather Warning

Warnings with user-defined thresholds	Heavy rain expected tomorrow afternoon with rainfall intensities of 3 mm/10 mins possible, leading to overflow in the drainage system.	Hazard + Vulnerability

Weather Warning Services

Different types of Weather Warning

Warnings with variable thresholds (time to time)	Weather warning – rainfall accumulations of 15 mm to 20 mm expected tomorrow afternoon during rush hour.	Hazard + Vulnerability

Weather Warning Services

Different types of Weather Warning

Impact Warning	Expect journey times on the A11 Highway to be lengthened by an hour because of significant traffic disruption in the south-east tomorrow afternoon due to localized flooding which is expected to follow a heavy rain event.	Hazard + Vulnerability + Exposure

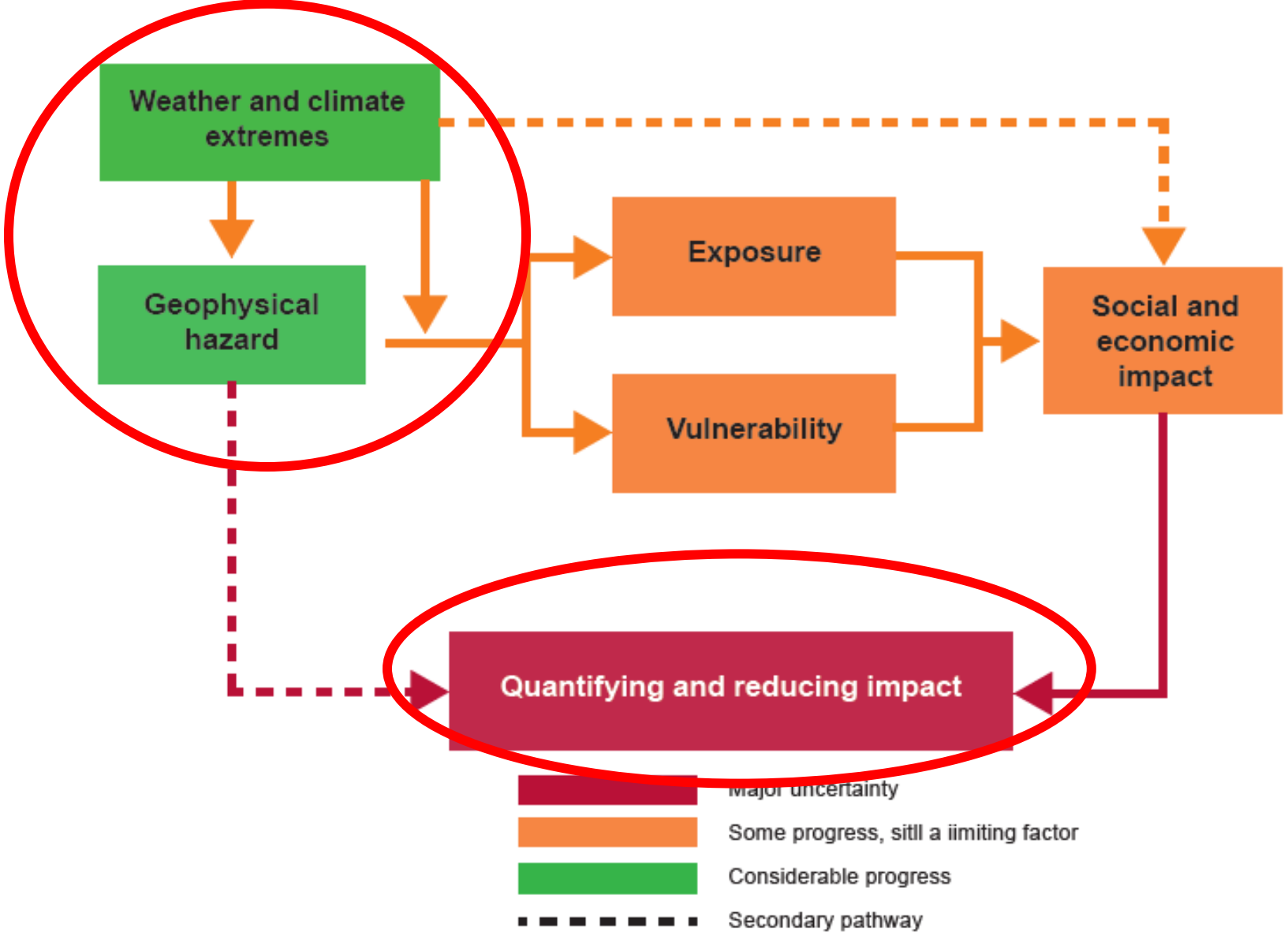


Figure 1. Relationship among the key elements of an impact forecast system

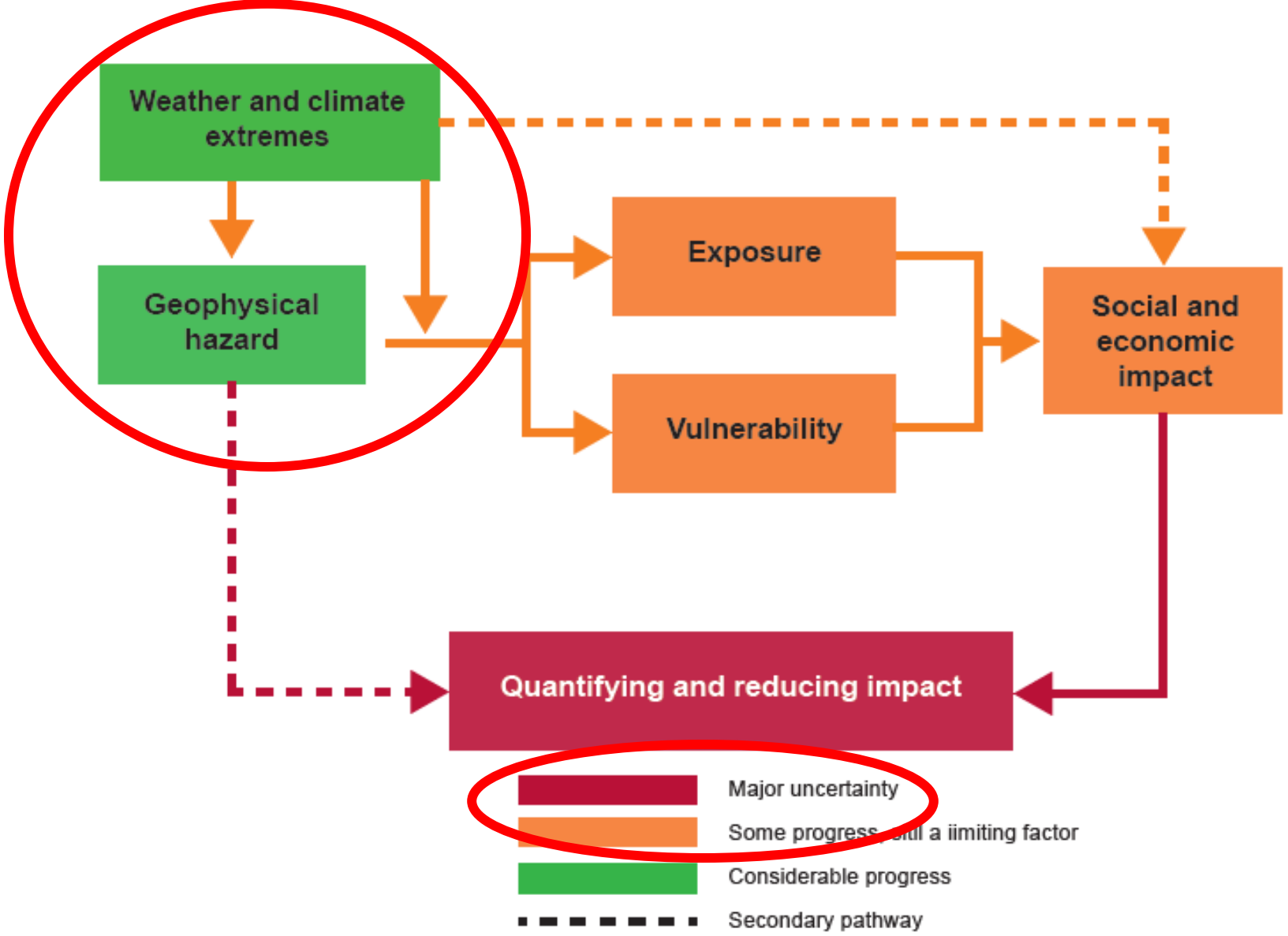
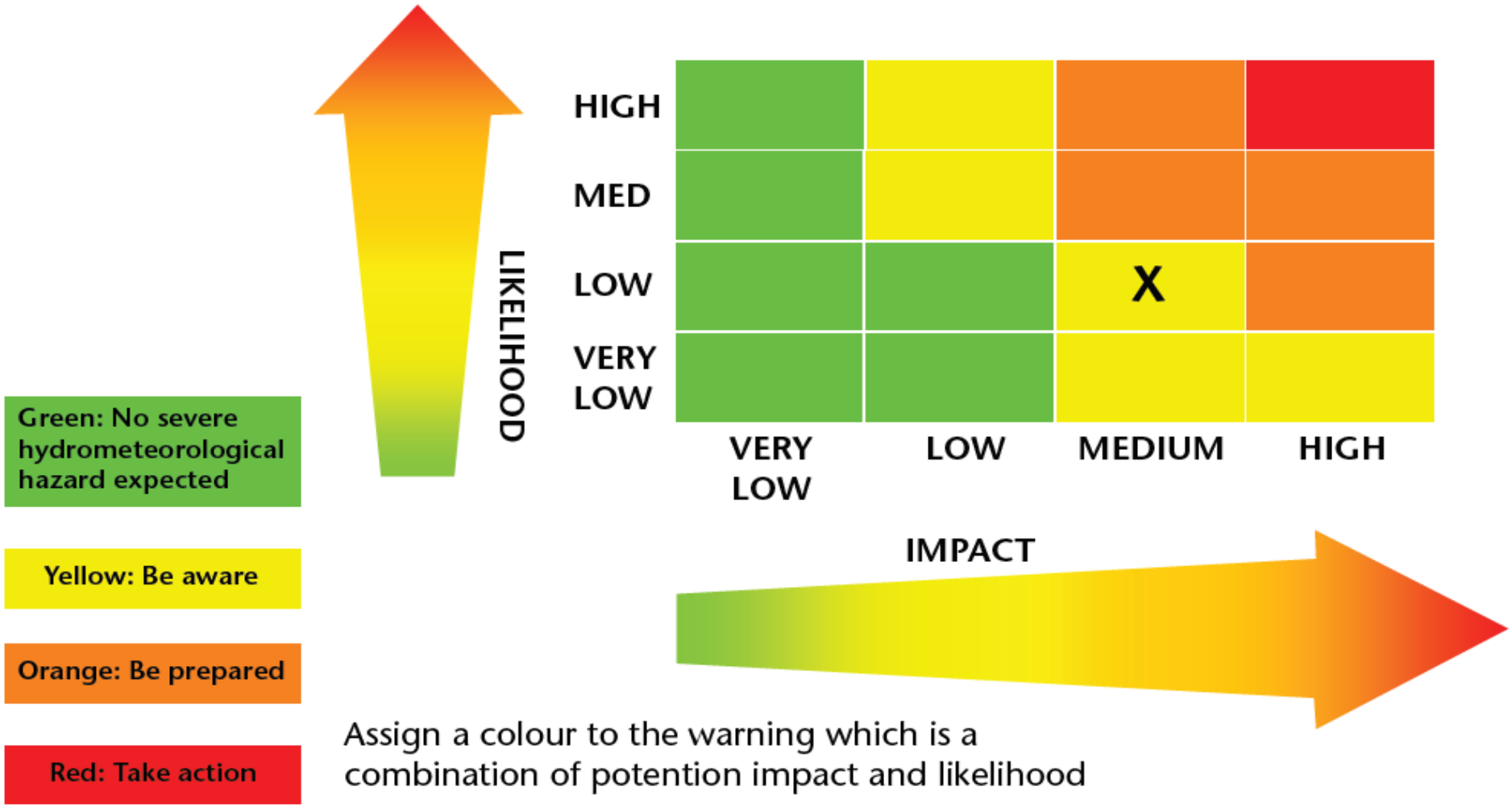


Figure 1. Relationship among the key elements of an impact forecast system

The Weather Warning Risk Matrix

Weather Warnings have always had a focus on **SEVERITY**

Now also need to look at **UNCERTAINTY**



(Source: Met Office, United Kingdom)

Figure 2. Risk matrix

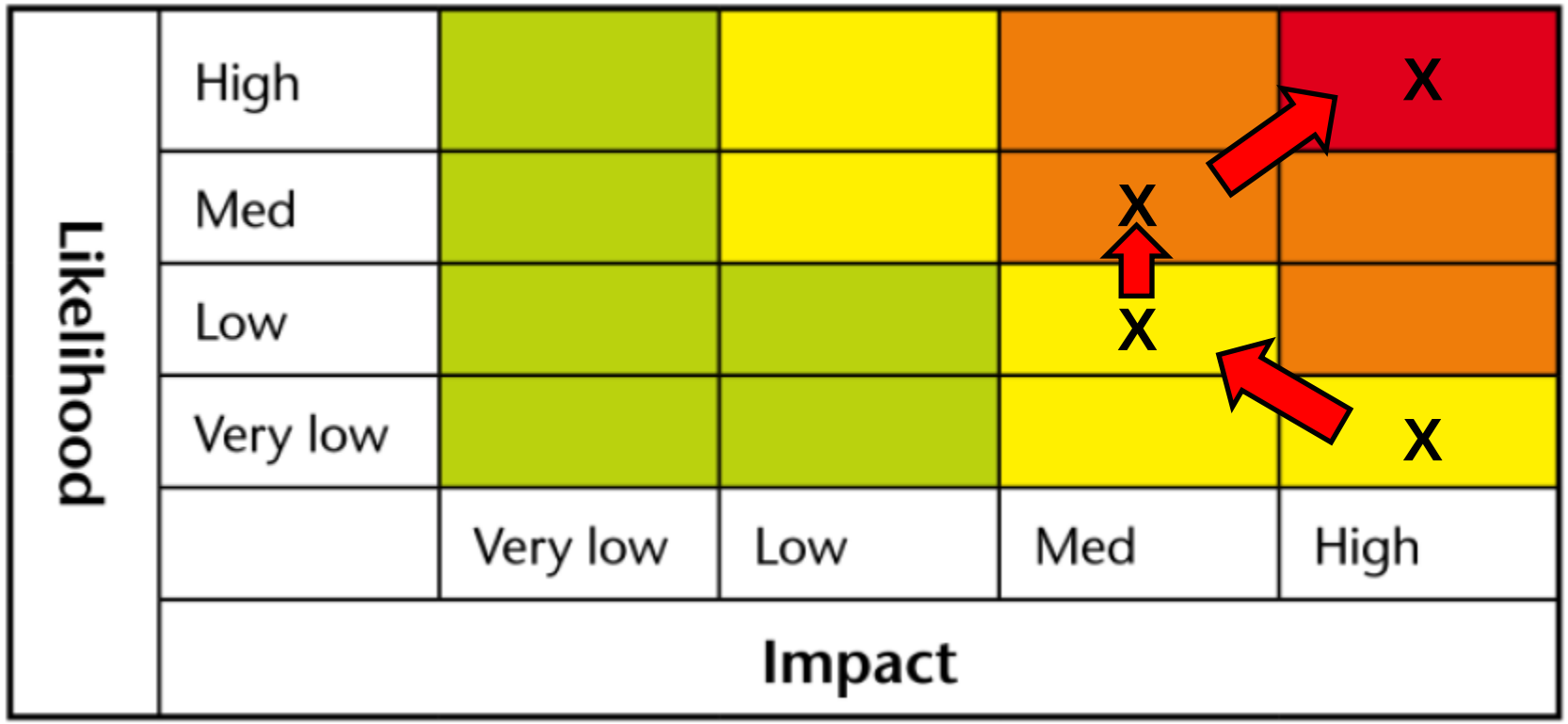
The Weather Warning Risk Matrix

Why should we use the risk matrix??

- We can now have an earlier expression of potential impact, well before a significant hydrometeorological event.
- We can from day to day show the changing expectation of risk, depending on changing exposure, vulnerability and hydrometeorological likelihood.

The Weather Warning Risk Matrix - Example

Path of Risk over many days



The Weather Warning Risk Matrix - Benefits

- Improved planning for different scenarios based on different impacts or combinations of impacts occurring;
- Better contingency planning (best, reasonable worst-case and most likely outcomes);
- Information about level of confidence in the forecast (a more informed risk assessment);
- New information to facilitate wider social benefits;
- A coordinated process to address disaster response and preparedness.

Developing Impact-Based Forecast and Warning Services

- Which government bodies and other stakeholders can support impact-based forecasting?
- Develop governance mechanisms between parties including steering committees and advisory groups;
- Establish programme management - roles and responsibilities for development, implementation, delivery;
- Develop a communications strategy – what are the expected services, the respective roles of parties, and outreach activities;
- Agree how best to provide quality management and assurance of products and services;
- Think about whether international cooperation is required.

Developing Capacity for NMHSs in IBFWS

- What are the required competencies and skills?
- Cross-training with users on requirements and procedures
- Educating users on how to use impact-based forecast and Warning services
  - Special Users (transport, electricity, city authorities…)
  - Media
  - Public

Symposium on Impact-Based Forecast and Warning Services

- This was held in Exeter, UK in **December 2019**
- The Symposium gathered extensive **experience** from countries who have tried out Impact-Based Forecast and Warning Services
- The following page on the WMO website contains links to all of the presentations made, which incorporate rich learnings:

https://public.wmo.int/en/events/meetings/symposium-impact-based-forecast-and-warning-services-ibfws

- Following the Symposium, an updated edition of the “Guide to Multi-Hazard Impact-Based Forecast and Warning Services” (WMO No.1150) has been prepared (currently in production).

“Guide to Multi-Hazard Impact-Based Forecast and Warning Services – 2nd Edition”

Six New Chapters…

5. Partnerships
6. Communications
7. Risk Communication
8. Impacts and Methodologies
9. Value of IBFWS
10. Training

Partnerships

- A coordinated effort between information providers and information customers to ensure effective communication of actionable information;
- For IBFWS to be successful, it must be collaborative, inclusive, supported by senior leadership/strategy and have adequate funding;
- Collaboration; buy-in / support of top management;
- Be prepared to share; give and take information – not hanging on to data and information.

Communications

- To listen to users and engage in an open dialogue with them at all times so as to understand and better meet their needs;
- Very good translators between meteorologists and public;
- Share experience; continuous dialogue;
- Caring and Science.

Risk Communications

- Culture change on “What weather will do” for met community and user community;
- Successful IBF ensures that decision-makers have the information they need to reduce their risk from hydro-meteorological events;
- The so-what of weather! Translation of severe weather forecasts into potential hazards so that good decisions can be made, and wise actions taken, to mitigate the effects;
- Integration, training, communication.

Impacts and Methodologies

- Database with exposure, vulnerability and hazard information on every place for which IBF is needed;
- Impact, vulnerability and exposure data updated;
- Understanding of vulnerabilities and exposure associated with hydro-met hazards;
- Search for innovative solutions.

Value of IBFWS

- Beneficiaries need to believe that the information can save their lives and livelihoods or enable them to make sound decisions to protect others;
- National interest.

Training

- Teach meteorologists how to translate and actual forecast into IBF forecast showing the impact expected from this forecast;
- Successful IBF needs cooperation, training and willing participants;
- Education on IBF to forecasters and users.

Big data enabling impact-based decision-making