World Meteorological Organization

Weather • Climate • Water

Impact-Based Forecast Demonstration Projects

Overview of IBFWS Projects and approaches

Links to the WMO Competency Framework

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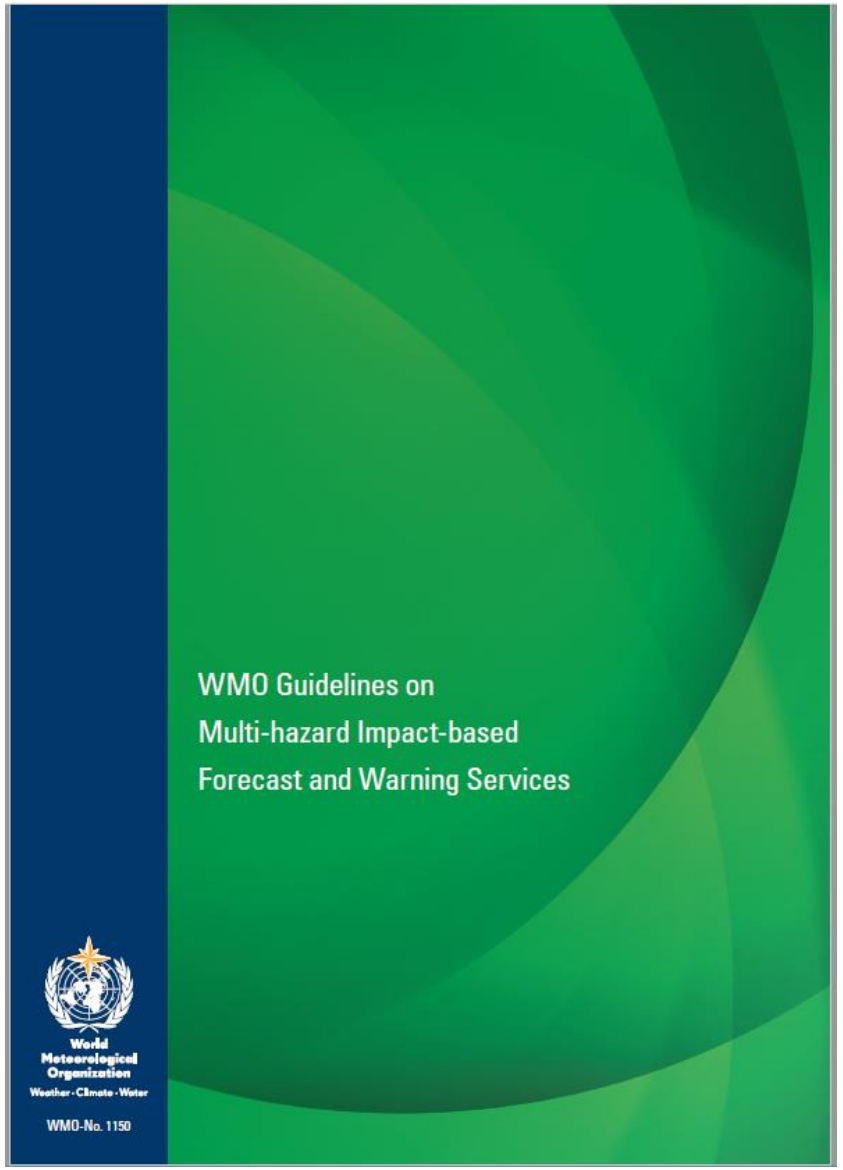
WMO No. 1150

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



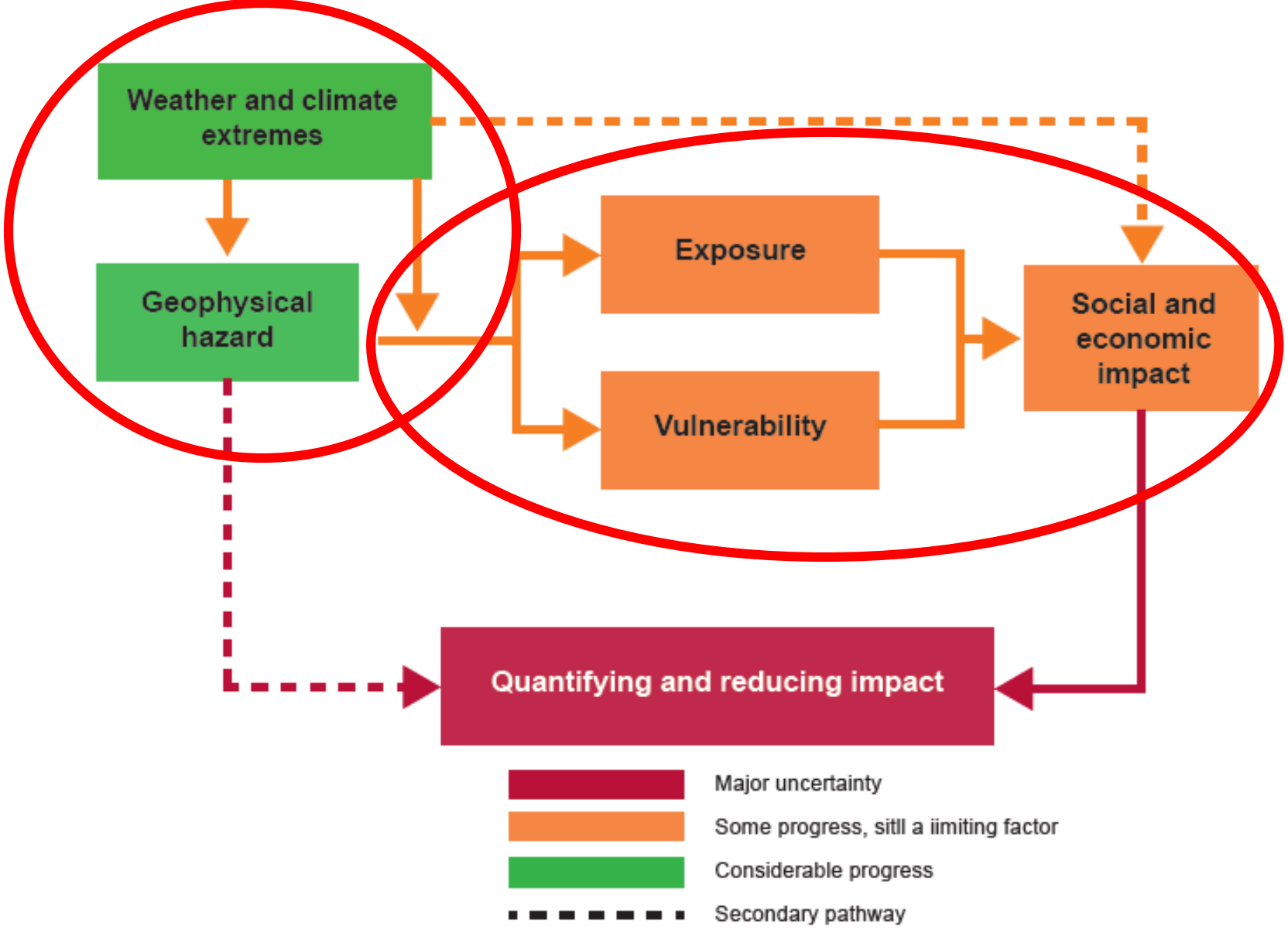


Figure 1. Relationship among the key elements of an impact forecast system

Countries moving towards IBFWS - Europe

- UK has been a leader in developing this approach
  - Vehicle Overturning Index – modelling Exposure and Vulnerability
  - Natural Hazards Partnership – working with other agencies
  - Improved system for preparing and presenting warnings
    - Forecaster has to consider questions such as “What will happen” and “What should I do”?
    - Research into use of warnings by the public, with Leeds Centre for Decision Research (social science)
  - Aiming at reducing the number of “low-level” warnings
  - It’s all about Communication

Countries moving towards IBFWS - Europe

- DWD Germany works within a complex system of regional and local Emergency Management structures
  - Presenting warnings at very high resolution (more than 10k regions defined for warnings)
  - Warning text in both German and English
  - Adding warnings for Flood, Storm Surge and Avalanche
  - Many responders work at different levels (national, sub-national, federal, district, local) which presents challenges in giving appropriate information to each level.

Countries moving towards IBFWS - Europe

- Meteo France
  - Need to develop maps with sensitive sites, such as critical infrastructure, rail/roadway maps, flood-risk areas, campsites etc
  - Need also to show real-time sensitivity (large events, real-time traffic flows, soil moisture, river levels..)
  - Working on developing fast and efficient communications
  - Need to specify
    - Warnings
    - Consequences
    - Recommended Actions

Countries moving towards IBFWS - Europe

- Austria
  - ZAMG have developed a “Trusted Spotter Network” to provide reports of weather events
  - These reports go through a QC procedure and are used by the ZAMG forecasters
  - Provides a network of Met Service “champions” in the local regions who can link the work of the NMHS with communities

Countries moving towards IBFWS - Europe

- Netherlands
  - KNMI are working to develop an “Early Warnings Centre” to serve society better with safety-related information.
    - More personal-level information
    - Improved risk communication
    - Assess composite impact
    - Integrate communication and social media.
  - Already covered – road maintenance, space weather, seismology
  - Planned – Pollen levels, Air Quality, Traffic
  - Aiming at two-tier warning system: Public / Professional Partners

Countries moving towards IBFWS - Europe

- Switzerland
  - Steering Committee on “Intervention in Natural Hazards”
  - Professorship in ETH Zurich on “Weather and Climate Risks”
  - MeteoSwiss can instruct all media to carry warnings proactively – this is not much used and reserved for really severe situations.
  - Need to improve dialogue with major stakeholders
  - Need to improve pubic communications and integrate all relevant warnings

Countries moving towards IBFWS - Europe

- Overall focus of EUMETNET (network of European NMHSs)
  - Align formats for exchange of weather warning information between countries
  - How best to collect Impact Data. Perhaps collaborate with Insurance Companies on this?
  - Agree with Civil Protection the appropriate level of “Take Action” information for the public
  - Possible create a EUMETNET database of Impacts

Countries moving towards IBFWS Weather-Ready Nations

- US-led project to promote projects in IBFWS
  - Building on the experiences of the US National Weather Service
  - Supported by USAID
  - Initial focus on Central America
    - Barbados
    - El Salvador
  - Now active in Indonesia, South Africa and commencing a project in Croatia

Weather Ready Nation is a program addressing impact-based forecast and warning for severe hydrometeorological events and has overarching goals to:

- Team Building between **NMHSs and NDMAs and stakeholders;**
- Leveraging the expertise of all - **NMHSs and NDMAs and stakeholders;**
- **Create an improved set of tools** to link requirements to technical developments that support products and services

Hazards and their Impacts

Source	Primary Hazard	Secondary Hazard	Tertiary Hazard
Westerly frontal systems, Cut-off-lows, Tropical lows	Heavy rain	• Flash floods • Road flooding • Inundation • Sinkholes	• Damaged of infrastructure (roads, bridges) • Informal/formal/flood vulnerable settlements impacts (Deaths, Displacements) • Flooding/inundation of sewage systems (sewage systems not made to handle water/floods) due to paving • Water borne diseases • Environmental degradation
Westerly frontal systems, Ridging high pressure (SE'lies)	Strong wind	• Structural damage • Informal housing damaged • Traffic disruption • Trees blown over • Pylons collapse • Harbor?	• Injury/death/loss of life • Trucks blown over • Air pollution- dust storms • Agriculture damages • Power failures
Westerly frontal systems, Cut-off-lows	Snow	• Roads/passes closed • Structural damage	• Loss of life (human or stock) • Financial loss (Insurance claims)

Countries moving towards IBFWS
South America

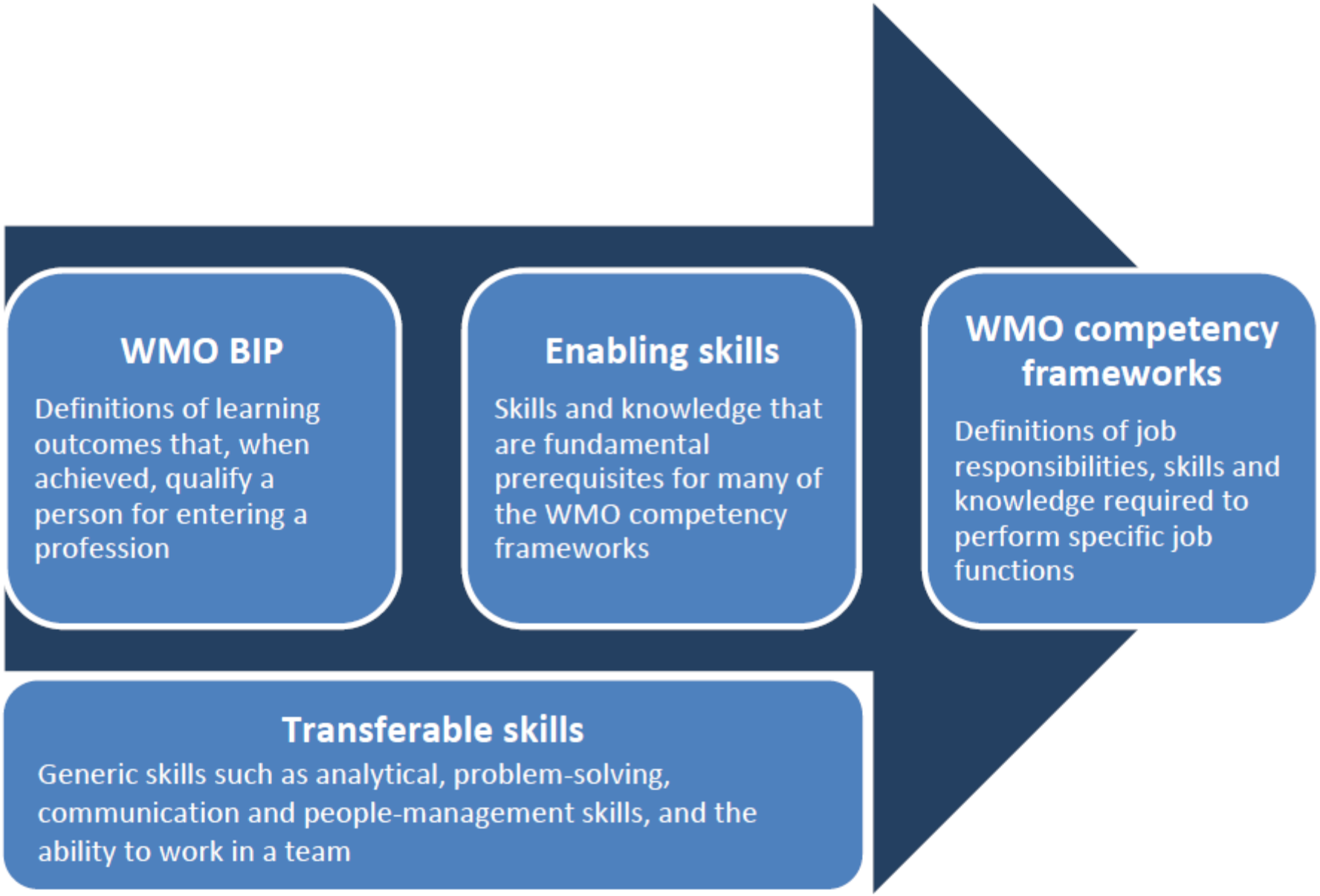
- Workshop in Buenos Aires in September to collect experiences
  - Many countries in this region work under specific national legislation relating to public safety
  - Typically the NMHS works with two or three other organisations in the fields of Hydrology, Emergency Management and Civil Security
  - Identified weaknesses in the Region include
    - Better nowcasting systems
    - Integration of vulnerability and exposure information
    - Better credibility with the media and the public
    - Better trans-national cooperation

Countries moving towards IBFWS- World Bank

- World Bank is supporting modernisation projects in a range of countries in central and south-east Asia
  - Significant sums of money leveraged for infrastructure
  - WB wish to improve forecast systems and communication also
  - Value of investment will be lost if it is not joined with better forecast and warning procedures and improved links to Emergency Management
  - Overall aim is to reduce the risk to the public of the countries involved.

WMO Competency Framework and IBFWS

- Translating scientific knowledge into products and services
  - Communication is all-important
  - Products and services that users want
  - Responsible for “Service Delivery Implementation Plan”
- Simply – “know your user, and their needs, and give them what they want”


WMO BIP
Definitions of learning outcomes that, when achieved, qualify a person for entering a profession
Enabling skills
Skills and knowledge that are fundamental prerequisites for many of the WMO competency frameworks
WMO competency frameworks
Definitions of job responsibilities, skills and knowledge required to perform specific job functions
Transferable skills
Generic skills such as analytical, problem-solving, communication and people-management skills, and the ability to work in a team

Competency Frameworks

- Followed the scheme developed for Aviation Meteorology
- Same structure – generally stated top-level competencies followed by more detailed second-level competencies, which should be testable through assessment
- Not all competencies stated will be relevant to every position – choices to be made at national level
- Mix of technical competencies and more general team-working behaviours

Competency Framework

- Top level Competency
  - Performance Criteria
    - These need to be testable
  - Background Skills and Knowledge

  - Enabling Skills (Radar, Satellite, NWP)
  - Transferable Skills (Leadership, Team Working…)

Competency Frameworks

- Unlike competency frameworks for Aviation Meteorology, these will not be mandatory, but will be “Recommended Practices”
- Helping NMHSs and other service providers to set, and maintain, appropriate standards
- Help to inform training requirements
- Hope to finalise the Frameworks at the forthcoming WMO Congress

Competency Frameworks

- Four areas identified:
  - PWS (bench) Forecaster → fundamental forecasting skills
  - Weather Broadcaster → focus on communication, media liaison and outreach
  - Weather Advisor for Disaster Prevention and Mitigation (DPM) → new and growing area
  - Services and Products Development → mix of IT, science and practical meteorology

Competency Frameworks

- What is a Competency?
  - “The ability of an individual to do their job properly”
  - “The ability to do something successfully and efficiently”
  - “All the related knowledge, skills, behaviours and attributes that form a person’s job”

Competency Frameworks

- A Competency is about more than just knowledge!
  - It is about the application of knowledge to the tasks required in carrying out one's job.
  - Related to behaviour – personality – people skills – ability – context.

A good competency …

- Describes something a person needs to do on the job
- Is action orientated
- Relates to what the employer delivers
- Uses active verbs
- Can be observed, measured and assessed
- May include a level and criteria for observing and assessing
- Is unambiguous
- Is concise
- Is AUTHENTIC!

Table of Top Level PWSD Forecaster Competencies

Personnel engaged in operational forecasting	Weather broadcasters and communicators	PWS Advisers supporting disaster prevention and mitigation and other user activities.	Persons engaged in the development and delivery of meteorological and hydrological products and services
Analyse and monitor continually the evolving meteorological and/or hydrological situation.	Maintain awareness of the evolving meteorological and/or hydrological situation, updated forecasts and warnings, and impacts of anticipated conditions.	Monitor continually the evolving meteorological and/or hydrological situation, updated forecasts and warnings, and impacts of anticipated conditions.	Maintain awareness of developments in technology, and science which facilitate the development and improvement of products and services to meet user requirements.
Forecast meteorological and hydrological phenomena and parameters.	Assemble meteorological and hydrological information that meet user needs for communication and delivery.	Develop and adopt procedures and services to meet user needs and facilitate impact assessments.	Develop applications, products and services that meet user requirements.
Warn of hazardous meteorological and hydrological phenomena.		Develop and manage relationships with Disaster Prevention Mitigation users and other stakeholders.	Develop and manage relationships with users and other stakeholders.
Communicate meteorological and hydrological information and potential impacts to internal and external users.	Communicate meteorological and hydrological information and potential impacts via broadcast and other media.	Communicate meteorological and hydrological information and potential impacts to internal and external users and engage in outreach activities.	
Ensure the quality of meteorological and hydrological information and services.	Ensure the quality of meteorological and hydrological information and services.	Ensure the quality of meteorological and hydrological information and services.	Ensure the quality of meteorological and hydrological information and services.

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Competency Framework supporting DPM and other User Activities

- Can tailor weather warning products for communication to disaster management decision-makers;
- Can communicate information to users, ... on the expected impacts of severe weather;
- Has a knowledge of meteorological and hydrological information requirements of the disaster management and civil protection community;
- Helps develop Impact-based forecast products designed to assist emergency management agencies.

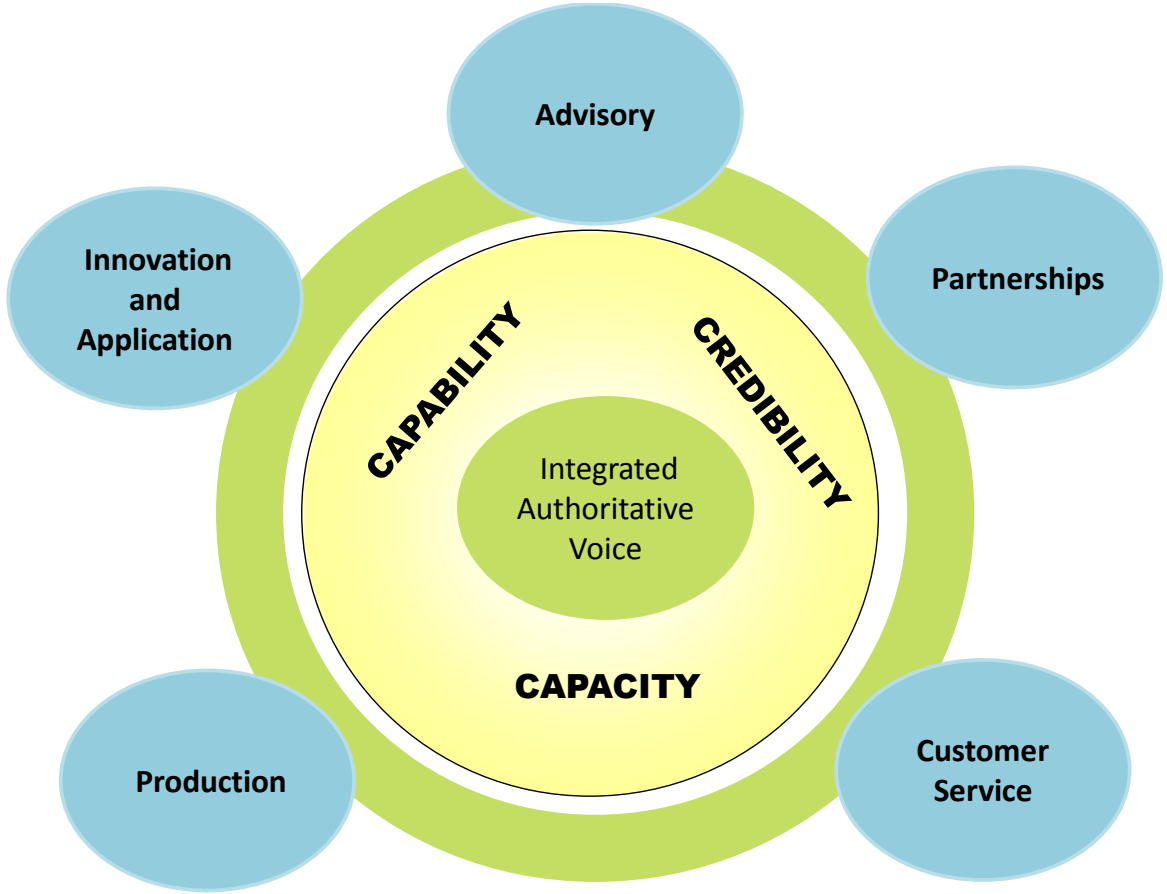
Competency Framework supporting DPM and other User Activities

- Can establish and maintain working relationships at operational and technical levels with the emergency management community;
- Can build and maintain relationships with the media;
- Can assist in the design of effective warning signal systems;
- Can manage an appropriate level of expectation in NMHS capacity among DPM stakeholders;
- Fosters the “Single Official Voice” principle.

Forecasters Training

- Additional Skills now needed:
  - Understanding of Probability, to better exploit EPS products
  - “Soft” Skills, e.g.
    - Communication
    - Listening
    - Presentation
  - “Situational Awareness”

Meteorologists for the Future



Forecaster and User Training

- Issues for providing information on the impacts of forecasts and warning are varied and complex, and require planning and training on many levels
- The role of the Forecaster will develop more towards interpretation and contextualisation
- Forecasters will become more like consultants
- Training of NMHS Forecasters and Partners (especially emergency response staff) will be essential
- This training is more likely to be in the form of Workshops and joint events with users than traditional “academic-type” training

Big data enabling impact-based decision-making