

Motivation

Research Problem: Capacities to receive and to transfer weather warning information into protective action as well as vulnerabilities and coping capacities are unequally distributed within different user groups. Users interpret information based on their experience, cognitive judgments and with regard to their specific needs, values and capacities. These socio-cultural preconditions determine, the impact of risk-based weather warnings on protection measures.

Since the current structure of weather warnings does not explicitly involve risk information, assessment indicators must first be identified and developed.

Results Emergency Services and Transport Sector

- Investigate and develop general assessment criteria for effective and efficient weather warnings. What are users' requirements towards weather warnings? How can weather warnings cover various user needs?
- Describing the use of weather information processing and the present practice of anticipation in EM and discussing the findings in relation to uncertainty, risks and anticipation of future developments.
- Investigate the influence of weather information on economic decisions in the transport sector.

Tab. 2: Workshop participants

Place	Date	Participants	Participants' professional backgrounds
Bonn	07./08. Dec 2015	21	Commanding Fire Fighters, Fire Fighter Associations, DWD, Researchers (Science, Social Science)
Essen	07. Sep 2016	22	Commanding Fire Fighters, Road Maintenance Services, Radio Telescope Operator, Solar Park Operator (Research), Water Resource Management, DWD, Researchers (Social Science)
Offenbach	28. Sep 2016	30	Commanding Fire Fighters, Road Maintenance Services, Chemical Plant Operator, Media, State Government Agencies (Internal Affairs, Environment), Finance, Event Organizers
Berlin	03. Nov 2016	22	Commanding Firefighters, Road Maintenance Services, Security Company, Researchers (Science, Social Science, IT)
Hamburg	24. Nov 2016	16	Federal and State Agencies (BSH, Port Authorities, Waterways and Shipping Administration), Maritime S+R, Construction Companies

Results Work Task "Structural Needs and Principles of Action"

- Developments in science do not necessarily fit the current practices of German emergency services.
- These practices are mostly carried out based on alarms and ground truth in a reactive manner, rather than on anticipation based on prognoses or forecasts.
- Emergency managers cope with uncertainty by collecting, comparing, and blending different information about an uncertain event and its uncertain outcomes within the situation assessment to validate the information (Fig. 1).
- Emergency managers struggle most with an increase in emergency calls and missions due to impacts of severe weather. Because of additional expenditures, the weather event makes it even harder for them to fulfill their core duties.

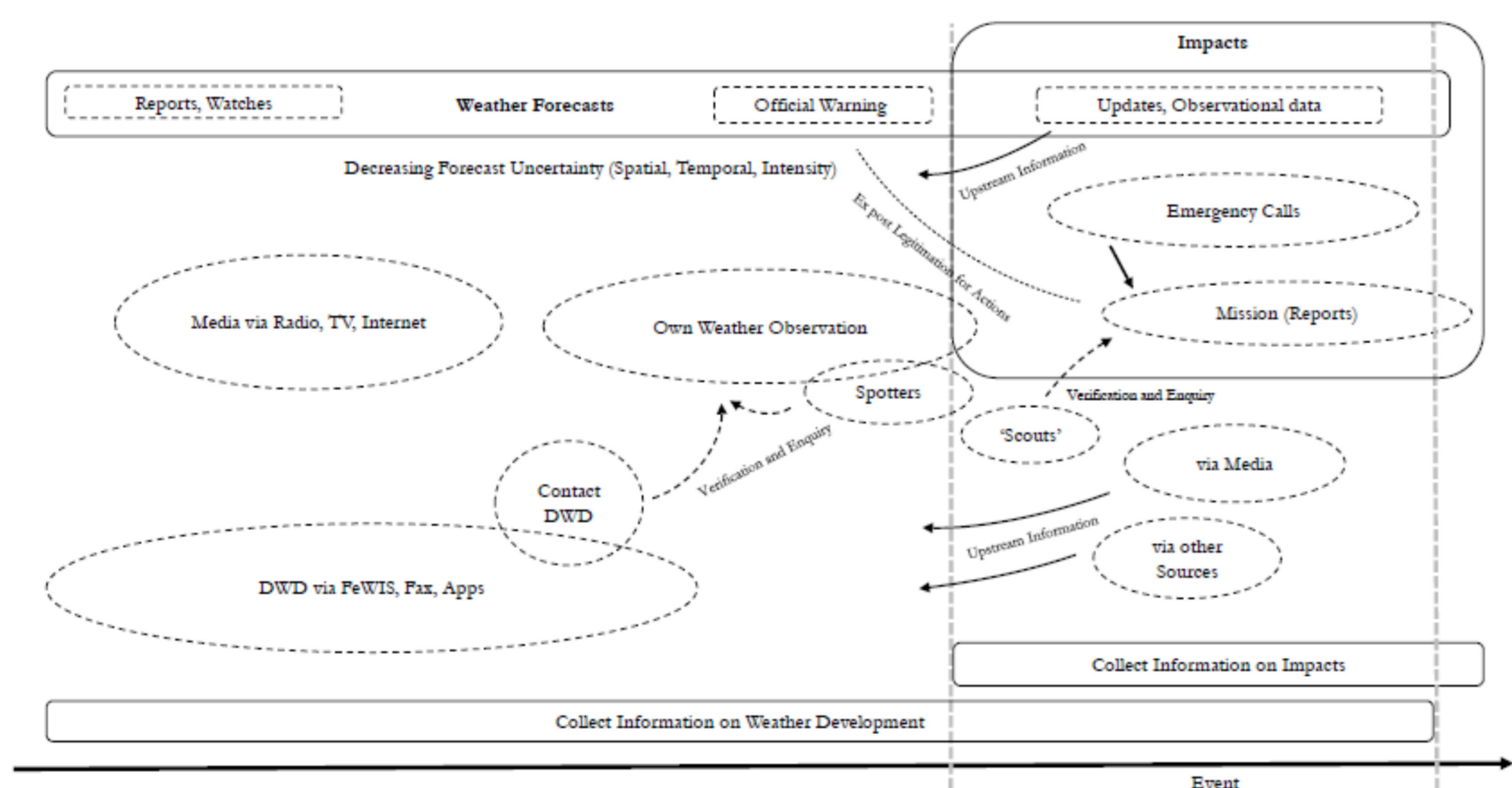


Fig. 1: Application of weather forecasts by emergency services (Kox, 2018)

Next Steps

- Identify and analyse the explicit and implicit practices of preparedness and how forecast uncertainty is incorporated in organizational practices in traffic management
 - Literature review of organizational practices and weather warning assessments
 - Focus group discussion with participants from the organizations
 - Interviews with representatives of police and traffic management agencies

Objective and Approach

Despite the knowledge that the uncertainty of forecasts will help to improve decision making (Hirschberg et al. 2011), weather warnings are still predominately issued as deterministic ("full certainty") forecasts.

General Objective: Support the transition from "warn on observation" towards "warn on forecast" by determining criteria that allow the employability and acceptance of new risk-based warning tools by emergency services (sophisticated users) and everyday people.

General Approach: Mix-method design with different user groups (Tab. 1).

Tab. 1: Studies completed in phase one and two

Date	Emergency Services				Public	Transport
	Sep - Oct 2012	2012 - 2016	2015 - 2016	2017	Mar - Apr 2014	Dec 2015 - Jul 2016
Target Group	Emergency Services	Emergency Services & DWD	Emergency Services & Specific User Groups	Emergency Services	Berlin Public	Supply Chain Managers
Method	Questionnaire	Semi-structured interviews	5 Workshops	Observation	Questionnaire	Semi-structured interviews
Sample Size	161	27	73	-	1342	13
Objective	Perception and use of uncertainty	Anticipation and preparedness measures	User requirements	Use of weather information in everyday working life	Decision thresholds	Economic decision making
Publication	Kox, Gerhold, Ulbrich 2015	Kox, Lüder, Gerhold 2018a	Kox, Kempf, Lüder, Hagedorn, Gerhold 2018b	Kox, Lüder, Brune 2019	Kox 2015; Kox, Thieken 2017	Ulbrich, Lüder, Kox, Gerhold 2016

Results Work Task "Assessment of Weather Warnings"

- Users' requirements towards weather warnings:
 - Recognition of spatial and temporal requests,
 - acceptability,
 - relevance of information,
 - comprehensibility,
 - technical requirements.
- Recommendation to cover various user needs:
 - Inclusion and comparison of real time impact information from third parties and users' own impact observations,
 - strong cooperation between users and meteorologists.

Results Work Task "Case Study Transport Sector"

- Weather is only one among many influencing factors.
- Current weather is more influential than weather forecasts.
- Subjective constructions of weather conditions influence decision-making on an operative level.
- The ability to act on forecasts or warnings is constrained by i.e. managerial decisions, legal requirements, the size of the enterprise and the scale of operations (regional vs. global).
- Decisions taking weather forecasts into account are often taken by supply chain managers of large enterprises managing international supply chains and forwarding agents tend to be ignorant of such decisions.

Conclusions

The findings support the need for impact-based warnings.

The case study findings suggest to investigate further into how weather conditions play a part in decision-making by international supply chain managers compared to socio-cultural, economic and legal conditions.

The results were published in Schriftenreihe Sicherheit: Wetterwarnungen: Von der Extremereignisinformation zu Kommunikation und Handlung. Beiträge aus dem Forschungsprojekt WEXICOM.

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