PROCEEDINGS OF SCIENCE

The Significance of Human Weather- and Impact-Reports from a National and International Perspective

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Since 2019 human weather- and impact observations are available to the Austrian national weather service Zentralanstalt für Meteorologie und Geodynamik ZAMG, generated with the help from the web-app wettermelden.at. These observations provide additional sources of information about the impacts of weather on the ground, the „ground truth “. Thus, an instantaneous feedback loop between disseminated weather warnings and impact reports can be established in real time, which is crucial to ZAMG as a consultative part of the Austrian National Crisis and Disaster Management SKKM. Further, these reports are utilized for forensic damage assessment after extreme weather events and for climate impact research. ZAMG offers a standardized training concept for weather enthusiasts and lay persons, improving the reliability of their reports. Fully trained observers are members of the Trusted Spotter Network Austria. Together with other European National Weather Services (NMHSs), ZAMG is committed to swap and standardize impact reports for cross border extreme weather events. Also, the observer training and exchange protocols will be standardized for warning purposes and scientific research, respectively. This article extends our poster presentation at the Austrian Citizen Science Conference in June 2022.

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1. Introduction

The Trusted Spotter Network Austria TSN was founded 2009 by ZAMG, the association SKYWARN Austria (https://www.skywarn.at/) and the European Severer Storms Laboratory ESSL (https://www.essl.org) to standardize severe weather reports on the national level from voluntary observers and spotter organizations alike. The reporting criteria of the European Severe Weather Database ESWD (https://www.eswd.eu/), (https://www.essl.org/cms/wp-content/uploads/ESSL-rep-2020-11.pdf) was then recognized as an European standard by all collaboration members, as was the quality control scheme, applied to observations of a certain reliability, plausibility and confirmation through scientific analysis [1], [2]. Given the complexity of the applied criteria of the ESWD, the ESSL developed a more generalized version for weather and impact report scheme for laypersons, the European Weather Observer EWOB (https://www.eswd.eu/ewob/), (https://www.essl.org/cms/european-severeweather-database/ewob/). Here, weather and impact reports are submitted via a native App. This generalized and simplified EWOB-approach has been adopted immediately to the Austrian Trusted Spotter Network, yielding huge advantages for voluntary observers to understand and apply reporting criteria more easily than before. Since 2019 ZAMG provides a Web-App wettermelden.at as a tool for 195 reporting types, sub types and intensities of the weather and impact parameters, identical to the European EWOB from ESSL. In this regard, also the training efforts provided by ZAMG for all members of the TSN became simpler and more comprehensible. Also here, the ESSL scheme of competence levels for the EWOB was applied to the TSN: the first level of reliability RL0 is given to all reports from observers without any training; the second RL1 represents observers with basic training and the third RL2 is given to fully trained Trusted Spotters. These standardized reliability levels serve as a first layer of the quality management. In this context, the TSN became the training framework within the voluntary weather observer community. Despite the large number of reporting parameters, even untrained observers are able to use the wettermelden.at app as well intuitively. Subtitles (keyword cues) describe each parameter by its impacts; hence, laypersons are able to select reporting parameters accordingly and predominantly in the correct way (https://trustedspotter.eu/en/reporting-parameters).

2. Instantaneous Feedback Loop

For ZAMG as the Austrian National Weather Service it is the legal obligation to disseminate impact-based weather- forecasts and -warnings for the general public and other stakeholders like civil protection agencies, federal alarm- and emergency response centres as well as rescue organizations. In this regard, the advisory capacity of ZAMG relies on the expertise of the duty meteorologist, the quality of used data and the reliability of measurements and specific ground truth observations of extreme weather events. The latter clearly shows its importance because hail stone sizes, wind damage, flooding and gravitational mass movements like avalanches or landslides can not be measured or detected by the network of automated weather stations, see also Figure 1 below, [3], [4].

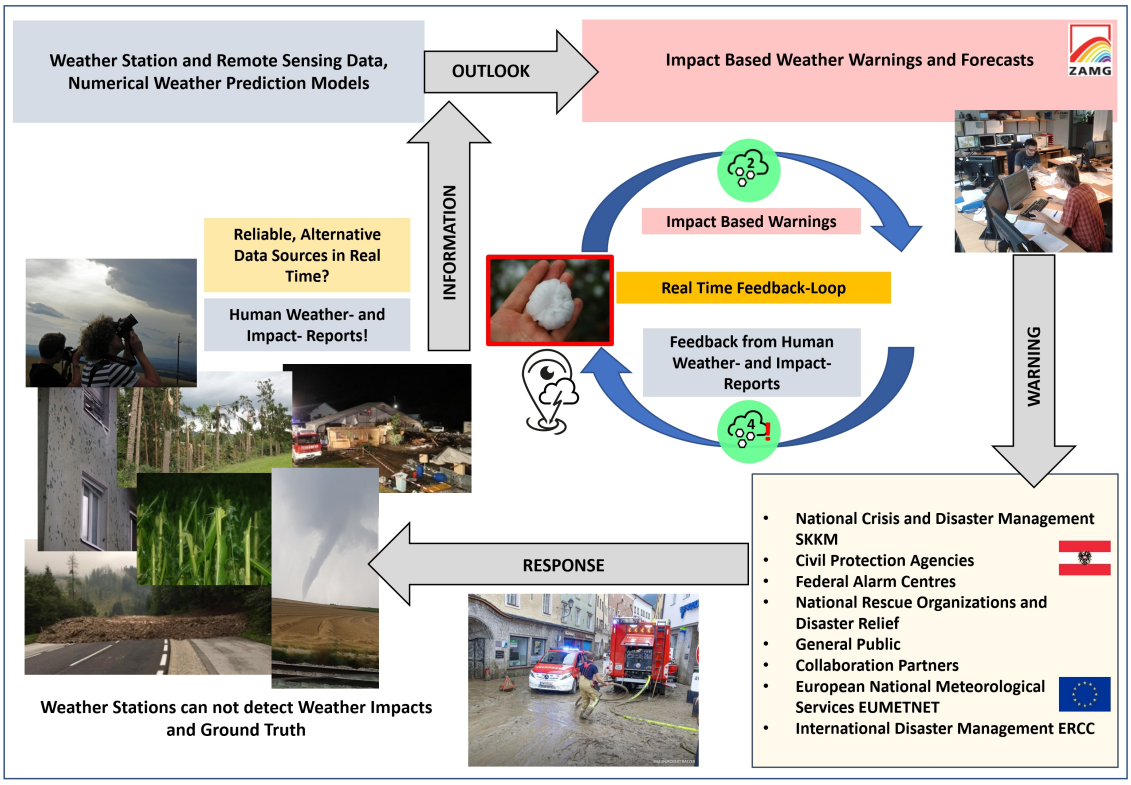

Figure 1: Real time feedback loop between disseminated impact-based weather warnings and human real time weather and impact observations, as a reliable, alternative data and information source about the ground truth of extreme weather events and respective damages.

The life span of a single cell thunderstorm extends from 15 to 30 minutes. Commonly, weather satellite sensors, stations and weather RADAR operate on a measurement frequency of 5 to 10 minutes, their data reaches the forecast offices with a delay of several minutes due to processing and visualization. Even lightning detection systems produce information about time and position of thunderstorms with a delay of about 10 to 20 seconds between visualization and the preceding real event.

In the case of the wettermelden.at web-app, the used technology of message queueing MQTT enables a visualization of the transmitted report within seconds. During a severe thunderstorm, in case e.g., of rapid downburst outbreak, such low temporal latency of the wettermelden.at reports offers a crucial advantage compared to other data sources. With this benefit, weather warnings can be modified immediately and accordingly to mitigate significant damages or injuries. Potentially this improves and supports emergency response teams and disaster relief activities in the continuing path of severe and dangerous weather, see also Figure 1.

Usually, groups or associations of weather enthusiasts or storm spotters/chasers are grown homogeneous communities. Promoting the usage of external apps and tools could be disruptive to their activities and practices. As a solution to this caveat, the scalable architecture of the national wettermelden.at database at ZAMG additionally receives standardized reports from other community-platforms like homepages or apps. These datasets are exchanged in push and pull mode via standardized Application Programming Interfaces API between potential collaboration partners or stakeholders of wettermelden.at, e.g. currently realized with our collaboration partner SKYWARN Austria.

3. International standardization and collaboration

Most of all European NMHSs maintain crowdsourcing activities of different types to gain alternative data sources in addition to conventional weather stations and sensors [5]. Within the framework of European NMHSs EUMETNET, ZAMG works closely to realize a standardized exchange of human weather- and impact reports. A thorough mapping process recently selected a subset of essential reporting parameters focusing on weather phenomena which produce non local, large-scale impacts with high potential for cross border extreme events like precipitation, flooding, hail, icing, and strong winds.

Furthermore, the standardization of the technical exchange method, data protocols and data policies have to be taken into account for future work within this EUMETNET working group, in order to realize such exchange operationally.

4. Outreach and educational value

On the national level, ZAMG provides an outreach platform for more detailed background information about the wettermelden.at project (https://trustedspotter.eu). Further, user management, workshop organization and registry, training activities are facilitated through this additional hub for all collaborators of the project. In this way, universities and other research institutes access the national wettermelden.at database for multiple research purposes, e.g., climate impact studies or automated cloud recognition algorithms for neuronal networks.

A major focus point of this outreach and training activity promotes the improvement of weather awareness among pupils and young persons. Based on scientific expertise, the comprehension of weather physics and morphology, especially the early recognition of dangerous weather risks can be stimulated by awards and gamification of the wettermelden.at web app as an educational tool (https://youngscience.at/de/awards-und-guetesiegel/citizen-scienceaward/gewinnerinnen-und-gewinner-der-citizen-science-awards-2021).

References

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All web links have been successfully accessed on 11 November 2022.