The warning service at MET Norway

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The warning service at MET Norway is currently organized as follows. MET Norway is tasked with the main purpose of preventing damage to life and society, and it is responsible for providing a weather warning service for Norway. This responsibility, described in the guidelines, is to notify and report to the coordination channel managed by the Norwegian Directorate for Civil Protection (DSB). All types of crises are handled by the principles of responsibility, equality, closeness, and cooperation. The municipalities, county commissioner offices, the Norwegian Directorate for Civil Protection and the Ministry of Justice and Emergency Preparedness (JD) are especially responsible for the preparedness and response in Norwegian society when a crisis, such as a weather event, occurs.

Operational forecasters at three regional offices in Tromsø, Bergen and Oslo have a 24/7 responsibility to monitor, analyze and issue weather warnings for a range of phenomena (in Norwegian: https://www.met.no/vaer-og-klima/ekstremvaervarsler-og-andre-farevarsler/vaerfenomener-som-kan-gi-farevarsel-fra-met). On a daily basis, there is a video meeting with NVE (the Norwegian Flood and Energy directorate) to discuss precipitation and the possibility of flash floods, flooding and landslides etc. In a situation with a (possible) orange or red event, an additional forecaster is added to the team and contact with local authorities are established. The role of this senior forecaster is to coordinate the tasks and stakeholders involved, to ensure that the situation is well handled. The warnings and the warning system are, with a varying degree of systematization, evaluated, surveyed, and reported post-event. Based on these insights, several groups have the responsibility to follow-up suggestions and recommendations. One group has the superior responsibility for following-up the reports mentioned above (*Farevarseloppfølgningsgruppen*), and to follow-up and coordinate the expert teams that are responsible for specific phenomena (*Fenomengruppene*). In addition, there is a group with members from MET Norway, NVE, and the public broadcaster (NRK), which focuses on how the warnings are communicated and presented from the weather service to the public (Yr.no).

All orange and red incidents are evaluated, with written reports for both internal and public use. At the yellow warning level, evaluation is performed on a weekly basis but only for selected cases for some phenomena. However, wind, rain, icing, polar low, storm surge and forest fire warnings are evaluated based on easily available data.

▲ *Rockslide in W-Norway in November 2022.*

Several changes have also been made in Norway over the last five years. The warnings are now issued in both Norwegian and English, and include a color/warning level, advice, expected impacts, illustrations and probability information. The warning dissemination is also made available through a broader range of media and specifically in social media channels. MET Norway also disseminates warnings in the CAP protocol, ensuring that all warnings can be made available for all users regardless of the platform. MET Norway is heavily involved in risk assessments regarding probabilities of weather exceeding given thresholds (i.e. traditional forecasting) and now also routinely participates in video conferences on incident handling. Gradually more phenomena have been included in the warning service.

Despite ongoing improvements, there are still some known potential shortcomings. Advice is, in general, not coordinated with authorities and civil protection, but more empirically based. Criteria

is mainly meteorologically based, varying in time and place. Exposure and vulnerability are considered in some degree but MET Norway doesn't necessarily have insight into relevant information owned by contingency actors. Several projects have seen the light to address these issues:

• The K2S project at MET Norway will contribute to advancing socio-economic gains of society through improved preparedness, as well as increasing its resilience across various societal levels against shocks and impacts from an increasingly variable and extreme climate. In a situation with severe weather conditions, *everyone* should know and understand their responsibilities and what to do. Thus, the overall outcome that this project aims for the Norwegian society to get (improved) access to and (better) understand impact-based weather warnings so that protective measures, such as safeguarding life and property, can and will be made. The main impact of the project will be to better support both the public and societal actors in their preparedness and response when facing hazardous weather conditions based on the premise that impact-based warning information is tailored to a local context and therefore feels more relevant and is more understandable.

• The Norwegian Flood and energy directorate (NVE) has recently started a project named FlomRisk (eng: FloodRisk) where the main aim is to focus on the risk and impacts at a local municipality level for floods. MET Norway will cooperate with NVE on this project where five municipalities are chosen to set up a system for warnings based on the local risk potential. When using the risk of impact in the warning level, it will be easier to allocate resources and take measures to protect the most vulnerable areas. The purpose of these types of warnings is to make people understand the severity and impacts better, they therefore will be more prepared and take proper actions to save lives and secure properties. The project will make available a decision-making tool for the municipalities in case of warnings (rain and flood).

• In the Stimulab project - *En Fare - Lokal innsats* - the focus is on the interplay between various actors in a community and to evaluate which services the different actors need to secure life and property when severe weather is expected. Here, the user journey after a warning is received and until a protective action (decision or measure) is taken will be explored and mapped. The project aims to uncover and map different user journeys within the context of selected local communities by getting to know key public and private actors, as well as their habits and needs better. An ongoing project at MET Norway – Varseltavle or Warning Tables – is an internal pre-warning alert system. The system is regionally based and has a wide range of meteorological parameters. The forecaster/user is alarmed by a color when specific thresholds are exceeded. This is a system specifically aimed to monitor a weather situation before an official warning is sent. Although the system originally was intended for internal use, it will be tested externally to evaluate whether it can be a useful tool for preparedness purposes in the municipalities.

▲ *A polar low pressure affected Trondheim in March 2023, Norway's fourth largest city.*