

Enhanced Accuracy and Precision in Meteorological Hazard Warnings Using the EURO1k Weather Model

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Abstract:

Accurate and precise weather forecasting is crucial for issuing timely weather hazard warnings. However, current numerical weather prediction (NWP) models often struggle to accurately represent extreme weather events due to limitations in spatial and temporal resolutions. Additionally, with only a few model runs typically initialized per day, the effectiveness of the data assimilation process in capturing rapidly changing environments and improving initial conditions is limited. These constraints prevent NWP models from capturing small-scale weather features, such as severe convective thunderstorms. Furthermore, standard fixed thresholds used in issuing weather warnings may not adequately account for the varying levels of risk associated with different locations and use cases. This uniform approach can lead to either underestimation or overestimation of the actual risk.

To address these challenges, Meteomatics has developed the operational high-resolution NWP model EURO1k. Characterized by a 1 km horizontal grid spacing, a 72-hour forecast horizon, and an hourly refresh rate across the pan-European domain, the EURO1k model strongly enhances forecast accuracy. This high resolution allows EURO1k to accurately represent small-scale weather patterns, resulting in precise forecasts of extreme weather events. Additionally, thanks to its hourly refresh rate and data assimilation capabilities, the EURO1k model can be utilized for nowcasting. In addition to assimilating standard data sources like radar, satellite data, weather stations, and radiosondes, the EURO1k model also integrates data from a network of Meteodrones — small unmanned aircraft systems (UAS) developed by Meteomatics that collect vertical atmospheric profiles up to 6000m in altitude.

Moreover, Meteomatics has developed a highly customizable weather warning system, where multiple weather variables can be combined, and specific thresholds selected to enable targeted warnings for specific locations. The integration of the high-resolution EURO1k model with this customizable alert system allows for more accurate and use-case-specific warnings, optimally addressing relevant local risks. By employing this advanced approach, Meteomatics substantially enhances the reliability and precision of weather hazard warnings, ultimately improving preparedness and response measures.