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# Warnings based on risk matrices: a coherent framework with consistent evaluation

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**Abstract:** Risk matrices are widely used across a range of fields and have found increasing utility in warning decision practices globally. However, their application in this context presents challenges, which range from potentially perverse warning outcomes to a lack of objective verification (i.e., evaluation) methods.

In this talk a coherent framework for generating multi-level warnings from risk matrices that address these challenges will be presented. The proposed framework is general, is based on probabilistic forecasts of hazard severity or impact and is compatible with the Common Alerting Protocol (CAP).

Moreover, this work includes a family of consistent scoring functions for objectively evaluating the predictive performance of risk matrix assessments and the warnings they produce. These scoring functions enable the ranking of forecast and warning systems, and the tracking of system improvements, by rewarding accurate probabilistic forecasts and compliance with warning service directives.

This framework and its evaluation method will be illustrated using a flood warning service, and warnings for heavy rainfall based on numerical weather prediction ensemble guidance for Tropical Cyclone Alfred (Brisbane, March 2025).

## REFERENCES

Taggart RJ and Wilke DJ (2025). Warnings based on risk matrices: a coherent framework with consistent evaluation. Natural Hazards and Earth System Sciences, 25, 2657–2677.

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