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New Aspects of Probabilistic Forecast Verification Using Information Theory

Julian Tödter and Bodo Ahrens

Goethe-University, Frankfurt/Main, Institute for Atmospheric and Environmental Sciences, Frankfurt, Germany (toedter@iau.uni-frankfurt.de)

This work deals with information-theoretical methods in probabilistic forecast verification, particularly concerning ensemble forecasts. Recent findings concerning the "Ignorance Score" are shortly reviewed, then a consistent generalization to continuous forecasts is motivated. For ensemble-generated forecasts, the presented measures can be calculated exactly.

The Brier Score (BS) and its generalizations to the multi-categorical Ranked Probability Score (RPS) and to the Continuous Ranked Probability Score (CRPS) are prominent verification measures for probabilistic forecasts. Particularly, their decompositions into measures quantifying the reliability, resolution and uncertainty of the forecasts are attractive.
Information theory sets up a natural framework for forecast verification. Recently, it has been shown that the BS is a second-order approximation of the information-based Ignorance Score (IGN), which also contains easily interpretable components and can also be generalized to a ranked version (RIGN).
Here, the IGN, its generalizations and decompositions are systematically discussed in analogy to the variants of the BS. Additionally, a Continuous Ranked IGN (CRIGN) is introduced in analogy to the CRPS. The useful properties of the conceptually appealing CRIGN are illustrated, together with an algorithm to evaluate its components reliability, resolution, and uncertainty for ensemble-generated forecasts. This algorithm can also be used to calculate the decomposition of the more traditional CRPS exactly.
The applicability of the "new" measures is demonstrated in a small evaluation study of ensemble-based precipitation forecasts.