EMS7/ECAM8 Abstracts,
Vol. 4, EMS2007-A-00264, 2007
7th EMS Annual Meeting / 8th ECAM

Could a perfect model ever satisfy the forecaster? On areal versus point forecasts.

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Although physical models have to forecast areal mean precipitation because of conservation laws, in the operational practise they are mostly interpreted as deterministic predictions of local precipitation and verified against rain gauges, i.e. “point” measurements. This deficient interpretation of numerical model output has traditionally led to a poor appreciation of the skill of numerical rainfall forecasts.

In order to show how a „perfect numerical forecast“ could maximally score given its interpretation as a point forecast, we use the daily „grid box“ mean precipitation computed from observations of a high density network of daily rainfall accumulations over Europa as a predictor of the subgrid-measurements. If we define a particular weather event, e.g. daily rainfall exceeding 50mm at at least one “point“ within the grid box, we can then verify the forecasts as a function of the threshold of the grid box mean from which on we issue a forecast of the event.

The results indicate that even this „perfect model” is far from maximal scores. For instance: the maximal ETS hardly reaches 50%; an unbiased forecast has a hit rate below 50%; a typical requirement for warnings of having a hit rate of 90% has a bias of 400% and is accompanied by a false alarm ratio of 70%; a user with a cost/loss ratio of 0.1 could maximally have 50% more value from the “perfect” forecast than from a climatological forecast etc.. The quantative details of the results are shown to vary, for instance, with “model” resolution or the character of the event, i.e. convectively or large scale driven.

This thought experiment allows a clear demonstration of the two completely independent, but in practise often muddled, tasks in making an event decision: on the one hand to determine a predictor which for all values maximises the probability of either

observing the event or not observing the event and, on the other hand, to set a threshold for the decision to issue an event forecast dependent on the metric to judge the forecast.