Reply

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The results presented by Smith (1979) are certainly a welcome addition to the information currently available concerning the contributions of the average squared error and average variance terms to the average probability or Brier score for precipitation probability forecasts in the summer. As Smith indicates, his analyses of radar data

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reveal that the contribution of the variance term to the overall score for forecast zones in southern Alabama and northwestern Florida is somewhat less than that reported by Murphy (1978) for local raingage networks in the vicinity of Rapid City, South Dakota, and Tucson, Arizona. The difference between these results is relatively small and could be due to a number of factors, including different climatological and/or meteorological regimes (e.g., the relatively moist southeastern United States vis-a-vis the relatively dry northcentral and southwestern United States) and different types of observing systems (i.e., radar vis-a-vis raingages). In any case, Smith's results provide additional evidence that the variance term—a term that does not depend on the forecasts—makes a substantial contribution to the overall probability score.

It may be useful at this time to clarify some aspects of the new partition described by the author (Murphy, 1978) and to briefly compare this partition with the "standard" partition originally formulated by Sanders (1958, 1963). The reliability term in the standard partition measures the correspondence between the forecast probability and the observed relative frequency on a set of forecasting occasions for which the probability value is constant (then a weighted average is taken over all permissible probability values actually used). With regard to the new partition, it must be remembered that this partition is based on the equivalence of an (average) point probability forecast and an expected areal coverage forecast and that the latter is a *categorical* forecast. Thus, the squared error term in the new partition, which appears to be similar to the reliability term in the standard partition, actually measures the *accuracy* of individual categorical forecasts of areal coverage (or the average accuracy of a set of areal coverage forecasts) in terms of the (average) squared error of the forecast(s).

The resolution term in the standard partition simply represents the variance of the observations of precipitation occurrence on the set of occasions for which the probability value is constant (then a weighted average is taken over all relevant probability values). In the standard partition, this variance generally relates to observations associated with forecasts formulated for specific time periods at a particular location, although it could also involve forecasts made at different locations. In any case, the variance term in the new partition is concerned initially with the spatial variability of precipitation occurrence over the forecast area. Of course, for a *set* of expected areal coverage forecasts made on different forecasting occasions, this variance term becomes both a spatial and temporal average. It should be noted that this term does *not* depend on the set of permissible probability values (in contrast to the resolution term in the standard partition). Moreover, the variance term in the new partition need not vary from occasion to occasion to establish a nonzero lower limit on the overall probability score, it is sufficient simply for the observed areal coverage *not* to be equal to one or zero (i.e., precipitation somewhere but not everywhere or nowhere).

In conclusion, as Smith indicates, it indeed would be desirable to evaluate precipitation probability forecasts in terms of areal coverage whenever such an evaluation is feasible. Certainly, this approach can provide additional, potentially useful information concerning the performance of forecasters and the spatial variability of precipitation. Hopefully, Smith's pioneering efforts to use radar data to evaluate precipitation probability forecasts in terms of areal coverage will encourage other meteorologists to undertake similar studies on an operational basis in other locations and for other time periods.

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