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Plain Language Summary: This paper proposes a new verification metric, the Pattern Similarity Index (PSI), which evaluates location errors and shapes of rainfall areas simultaneously. Pixel-by-pixel verification methods are widely used, such as the threat score and root mean squared error, but they have difficulties in evaluating location errors and shapes of rainfall areas. PSI adopts a simpler, computationally more efficient algorithm than the previous studies.

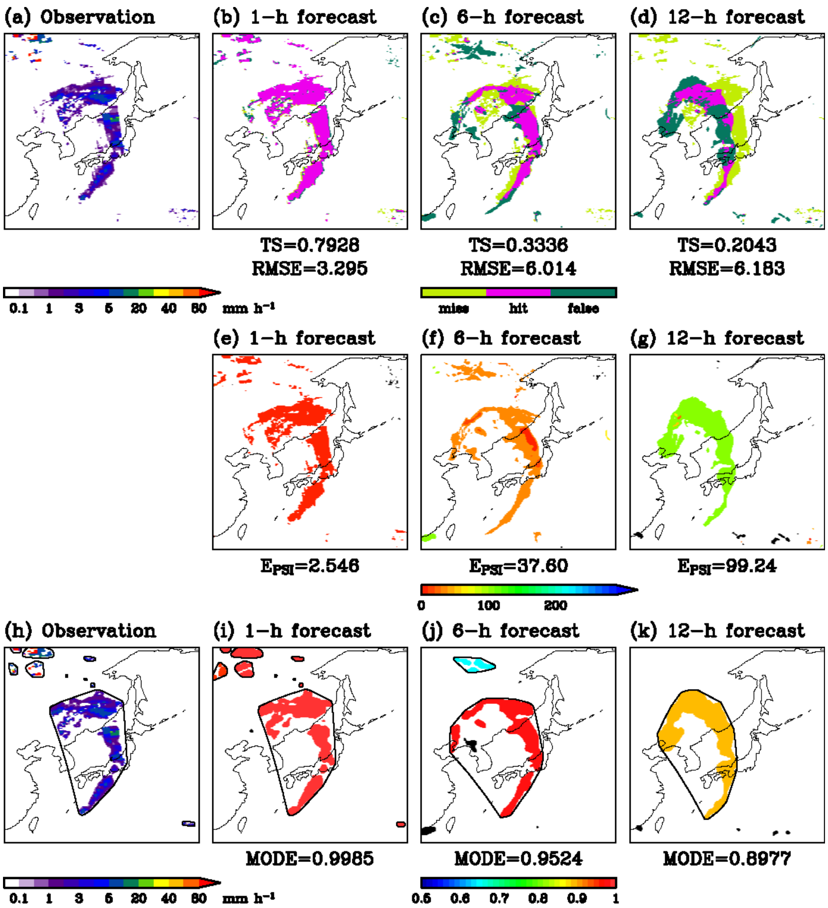

Figure 1. Verification scores in a real-case precipitation over 20°–60°N, 115°–155°E for 1, 6, and 12-h-lead forecasts valid at 1500 UTC 3 May 2016. (a) Observed precipitation rate. (b–d) TS for 0.5 mm h^{-1} and RMSE. Magenta: correct forecasts of rain rate greater than 0.5 mm h^{-1}, light green: misses, dark green: false alarms. (e–g) The proposed method. (h) Precipitation rate after the convolution procedure in MODE. Black lines represent clusters. (i–k) The MODE "total interest." The values are the area-weighted averages for the matched clusters, and the black fill represents unmatched clusters.

- Idealized cases showed the ability of PSI to evaluate location errors and differences in the shape parameters.
- A real case with global precipitation nowcasting showed that the proposed evaluation value increased almost linearly with the forecast time, whereas the threat score (TS) and root mean squared error (RMSE) tended to saturate as the forecast time increased, showing a potential advantage of PSI (Fig. 1).
- Comparison of PSI with another object-based method known as MODE revealed the advantage of PSI in its computational efficiency while providing similar verification scores (Fig. 1).