

Enhancing NWP post-processing with IMPROVER

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Abstract: Statistical post-processing of numerical weather prediction (NWP) guidance is a crucial element of the forecast value chain, enabling the provision of reliable forecast-ready guidance tailored to the needs of users.

For almost a decade, the Bureau of Meteorology has relied upon calibrated, consensus-based guidance as the basis for its official forecast. Use of such post-processed guidance has been instrumental in enhancing the skill of the Bureau's forecasts and supporting increased automation of routine forecast production. However, the Bureau's legacy post-processing platform is inherently deterministic, both in the set of inputs it uses and in the output it produces. With the steady trend towards ensemble models and probability-based forecasts, the Bureau has adopted IMPROVER (Integrated Model post-PROCESSing and VERification) as the replacement post-processing platform.

Begun at the Met Office (Roberts et al., 2019) and since developed in partnership with the Bureau and other meteorological agencies through the Momentum Partnership (*Momentum Partnership*, 2025), IMPROVER (IMPROVER Collaborators, 2024; Roberts et al., 2023) is an open-source library of sophisticated ensemble based post-processing tools, suitable for use in automated forecast of routine weather through to specialised diagnostics focused on high-impact weather. Grounded in ensembles, this library provides a comprehensive modular framework to calibrate, blend and transform forecasts in a fully probabilistic setting. This modularity enables the flexibility to curate separate, differentiated processing chains for each variable, while utilising common functionality; with each step able to be interrogated to verify its added value.

Here we demonstrate our approach to utilising IMPROVER to enable effective post-processing over the vast Australian continent where a greater reliance on global scale NWP is required. Through consideration of some representative examples, namely 2m screen temperature and 24-hour rainfall accumulation, we showcase the value-add afforded by the different steps in the IMPROVER processing chain, including the importance of statistical downscaling, and multi-model blending to produce accurate forecasts for Australia. We shall also provide insights into how probabilistic guidance from IMPROVER is being used within the forecast value chain.

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Keywords: Ensemble post-processing, probabilistic forecasting