Bayesian Processor for Binary-Continuous Events and its Applications on Extended-Range Mei-yu Probabilistic Forecasts

Hsin-Yu Chu[1,2], Hui-Ling Chang[1], Chih-Yung Feng[3], Kuan-Lun Liu[3], Yun-Jing Chen[1], Tsun-Wen Lo[1]
Mei-Yi Juang[1], Chung-Heh Hong[1]

[1]Meteorological Research and Development Center, Central Weather Bureau, Taipei, Taiwan
[2]Geophysical Institute, University of Bergen, Bergen, Norway
[3]Meteorological Subdivision, Many Splendid Infotech, Ltd.

Abstract

In previous studies, Bayesian Processor of Ensemble (BPE) is demonstrated to improve sub-seasonal probabilistic temperature forecasts significantly, even under hindcast-limited scenarios. In this study, we extend the framework BPE with binary-continuous predictand compatibility, allowing the generation of calibrated probabilistic forecasts for variables such as wind and precipitation. This necessitates a coherent method to generate probability of precipitation (PoP) and value estimation, in a fully Bayesian framework. In previous studies, skilled probabilistic forecasts of rainfall in Mei-yu season are known to be very challenging to generate. Hence, we use the probabilistic forecast of weekly precipitation during the Mei-yu season on 318 precipitation stations over Taiwan land area to demonstrate the skill of Binary-Continuous Bayesian Processor of Ensemble (hereafter B-C BPE). The median CRPSS shows that there is about 60% overall improvement of the overall CDF over all stations compared to the raw model. Individual station analysis shows that most improvements are along the south-western part of Taiwan and eastern mountainous regions. The increasing capability of generating downscaled forecasts with improved skills in extended timescale, using robust statistical methods, have profound implications not only for disaster-related risk management, but also for value-adding climate services in agriculture and water-resource management.

Keywords: Bayesian Processor of Ensemble, Extended-Range Mei-yu Probabilistic Forecasts, Statistical Post-Processing