A comparison of ensemble post-processing methods for extreme events

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Ensemble post-processing methods are used in operational weather forecasting to form probability distributions that represent forecast uncertainty. Several such methods have been proposed in the literature, including logistic regression, ensemble dressing, Bayesian model averaging and non-homogeneous Gaussian regression. We conduct an imperfect model experiment with the Lorenz 1996 model to investigate the performance of these methods, especially when forecasting the occurrence of rare extreme events. We show how flexible bias-correction schemes can be incorporated into these post-processing methods, and that allowing the bias correction to depend on the ensemble mean can yield considerable improvements in skill when forecasting extreme events. In the Lorenz 1996 setting, we find that ensemble dressing, Bayesian model averaging and non-homogeneous Gaussian regression perform similarly, while logistic regression performs less well.