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Reliable probabilities through statistical post-processing of ensemble predictions

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We develop post-processing or calibration approaches based on linear regression that make ensemble forecasts more reliable. We enforce climatological reliability in the sense that the total variability of the prediction is equal to the variability of the observations. Second, we impose ensemble reliability such that the spread around the ensemble mean of the observation coincides with the one of the ensemble members. In general the attractors of the model and reality are inhomogeneous. Therefore ensemble spread displays a variability not taken into account in standard post-processing methods. We overcome this by weighting the ensemble by a variable error. The approaches are tested in the context of the Lorenz 96 model (Lorenz 1996). The forecasts become more reliable at short lead times as reflected by a flatter rank histogram. Our best method turns out to be superior to well-established methods like EVMOS (Van Schaeybroeck and Vannitsem, 2011) and Nonhomogeneous Gaussian Regression (Gneiting et al., 2005). A changing climate is taken into account by time-dependent regression coefficients (Kharin et al., 2012).

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