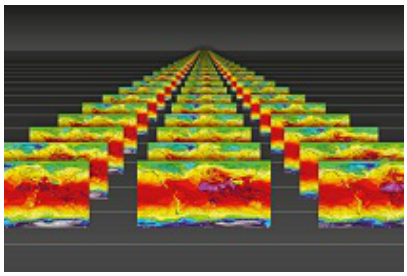

Contribution ID: **16** Type: **Oral presentation**

Isotonic Distributional Regression (IDR): A powerful nonparametric calibration technique

Thursday, 4 April 2019 10:00 (15 minutes)

We introduce isotonic distributional regression (IDR), a nonparametric technique for the generation of calibrated probabilistic forecasts from numerical weather prediction (NWP) model output. IDR learns calibrated predictive distributions directly from training data, subject to natural monotonicity constraints, without invoking any parametric distributional assumptions.

In a nutshell, IDR solves a quadratic programming problem to find distributional forecasts that are simultaneously optimal in terms of a wide class of scoring rules, including but not limited to the continuous ranked probability score (CRPS). For output from a single NWP model, IDR honors the compelling constraint that the probabilistic forecasts ought to be ordered in the same way as the model output. When using output from a single- or multi-model ensemble, IDR honors a suitable partial order. For example, we reduce the ECMWF ensemble output to the triple (HRES, CNT, MPM) consisting of the high-resolution member (HRES), the control member (CNT), and the mean of the 50 perturbed members (MPM), and we define a forecast to be larger than another if it is larger in all three components. The method applies to all types of univariate variables, including binary, discrete, continuous and mixed discrete-continuous weather quantities.

We apply IDR to obtain probabilistic quantitative precipitation forecasts based on the ECMWF ensemble at the airports in Brussels, Frankfurt, London (Heathrow), and Zurich in 2007 to 2017, using rolling training periods. The IDR forecasts outperform the raw ensemble as well as Bayesian model averaging (BMA) and ensemble model output statistics (EMOS) calibrated forecasts. We sketch adaptations to the TIGGE and S2S multi-model ensembles, for which we anticipate
major gain in predictive performance.

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Session Classification: Prediction and Verification Multi-model approaches to prediction

Track Classification: Workshop on Predictability, dynamics and applications research using the TIGGE and S2S ensembles