

EGU2020-5532

<https://doi.org/10.5194/egusphere-egu2020-5532>

EGU General Assembly 2020

© Author(s) 2021. This work is distributed under the Creative Commons Attribution 4.0 License.



A Vision for providing Global Weather Forecasts at Point-scale

Timothy Hewson

ECMWF, Forecast department, Reading, United Kingdom of Great Britain and Northern Ireland (tim.hewson@ecmwf.int)

This presentation will provide a vision, based around current initiatives, of how post-processing and machine learning could work in tandem to downscale the ensemble output of current-generation global models, to deliver probabilistic analyses and forecasts, of multiple surface weather parameters, at point-scale, worldwide. Skill gains would be achieved by adjusting for gridscale and sub-grid biases. One particularly attractive feature of the vision is that observational data is not required for a site that we forecast for, although the more 'big data' that we use, worldwide, the better the forecasts will be overall.

The vision is based on four building blocks - or steps - for each parameter. The first step is a simple proof-of-concept, the second is supervised training, the third is hindcast activation and verification, and the fourth is real-time operational implementation. Here we will provide 3 examples, for 3 fundamental surface weather parameters - rainfall, 2m temperature and 100m wind - although the concepts apply also to other parameters too. We stress that different approaches are needed for different parameters, primarily because what determines model bias depends on the parameter. For some, biases depend primarily on local weather type, for others they depend mainly on local topography.

For rainfall downscaling, work at ECMWF has already passed stage 4, with real-time worldwide probabilistic point rainfall forecasts up to day 10 introduced operationally in April 2019, using a decision-tree-based software suite called "ecPoint", that uses non-local gridbox weather-type analogues. Further work to improve algorithms is underway within the EU-funded MISTRAL project. For 2m temperature we have reached stage 2, and ecPoint-based downscaling will be used to progress this within the EU-funded HIGHLANDER project. The task of 100m wind downscaling requires a different approach, because local topographic forcing is very strong, and this is being addressed under the umbrella of the German Waves-to-Weather programme, using U-net-type convolutional neural networks for which short-period high-resolution simulations provide the training data. This work has also reached stage 2.

For each parameter discussed we see the potential for substantial gains, for point locations, in forecast accuracy and reliability, relative to the raw output of an operational global model. As such we envisage a bright future where probabilistic forecasts for individual sites (and re-analyses) are much better than hitherto, and where the degree of improvement also greatly exceeds what we can reasonably expect in the next two decades or so from advances in global NWP.

This presentation will give a brief overview of downscaling for the 3 parameters, highlight why we believe heavily supervised approaches offer the greatest potential, illustrate also how they provide invaluable feedback for model developers, illustrate areas where more work is needed (such as cross-parameter consistency), and show what form output could take (e.g. point-relevant EPSgrams, as an adaptation of ECMWF's most popular product).

Contributors to the above initiatives include: Fatima Pillosu (ECMWF, ecPoint); Estibaliz Gascon and Andrea Montani (ECMWF, MISTRAL); Michael Kern and Kevin Höhle (Technische Universität München, Waves-to-Weather).