

Dramatically improving accuracy.....



EUROPEAN CENTRE FOR MEDIUM-RANGE WEATHER FORECASTS

Numerical Weather Prediction





Machine learning at ECMWF

Research highlight: application in data assimilation

- Data-assimilation blends observations and the forecast model to generate initial conditions for weather predictions
- It is possible to learn model error when comparing the model with (trustworthy) observations

Two approaches:

- Learn model error within the 4DVar data-assimilation framework for "weak-constraint 4D-Var"
- Learn model error from a direct comparison of the model trajectory to observations or analysis increments using deep learning (column-based or three-dimensional)





CECMWF

Patrick Laloyaux, Massimo Bonavita and Peter Dueben @ ECMWF + Thorsten Kurth and David Matthew Hall @ NVIDIA

Research highlight: application in model component

To represent 3D cloud effects for radiation (SPARTACUS) within simulations of the Integrated Forecast Model is four time slower than the standard radiation scheme (Tripleclouds) **Can we emulate the difference between Tripleclouds and SPARTACUS using neural networks?**



Research highlight: application in post-processing

To learn IFS forecast error in 2m temperature and 10m wind with respect to station measurements (SYNOP) using three different machine learning techniques

Figures: Change in error for individual stations (left) and mean change for all stations (right)



i FAB

Default bias correction

Linear regression (815 params.)

Random forest (max depth=50) Neural network (2657 params.)

50

Research highlight: Learning how to make use of exascale computing \rightarrow The MAELSTROM project



MAELSTROM

MAchinE Learning for Scalable meTeoROlogy and cliMate The first datasets have been published! https://www.maelstrom-eurohpc.eu/content/docs/uploads/doc6.pdf https://www.maelstrom-eurohpc.eu/ @MAELSTROM EU

We have recently published our machine learning roadmap



A glimpse in to the future: First seasonal simulation at 1.4km resolution on SUMMIT

2018110100+18h

2018110100+18h







 \rightarrow Destination Earth



