Forecasting monthly numbers of hot days in Europe with a convolutional neural network

EMS2021, OSA1.8: Machine Learning and Computer Vision in Weather and Climate *07 Sep 2021*

Matti Kämäräinen, Kirsti Jylhä, Natalia Korhonen, and Otto Hyvärinen

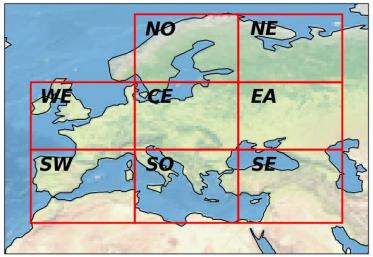
Definitions

Hot days (**HD**): days exceeding the **local** 90th percentile of T2M in summer months (JJA)

Number of **HD** in the next 30 days (**NHD30**) = target variable

Objective

Deterministic statistical prediction of the future **NHD30** in Europe as accurately as possible without using **dynamical models** at all



Data

Predictors: various **ERA5** parameters 1950–2019 over Northern Hemisphere + Tropics

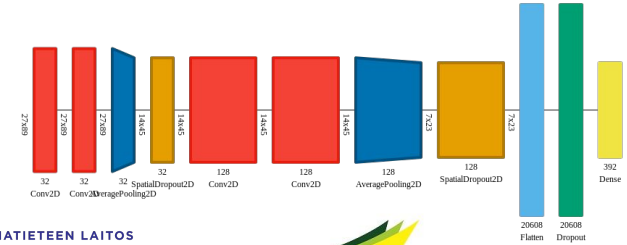
Target: **ERA5 NHD30** over Europe during extended summer (MJJAS)

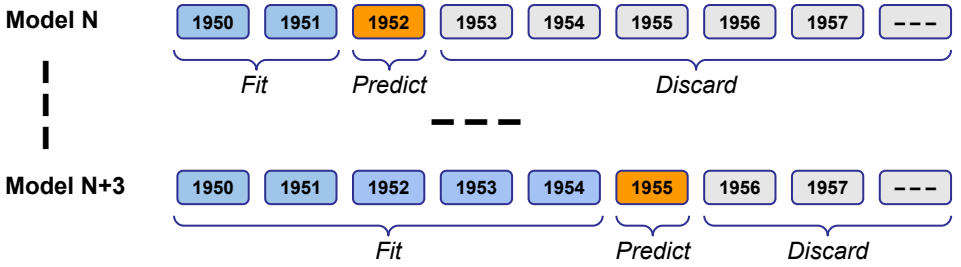
Methods

A new **machine vision** model based on **convolutional neural networks**

Optimization of the **input parameter combination** from a large set of potential parameters

"**Time series fitting**" approach to mimic the real life forecasting: for each year, a model fitted to data of the previous years





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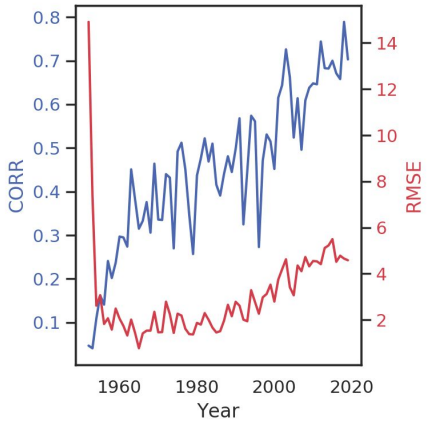
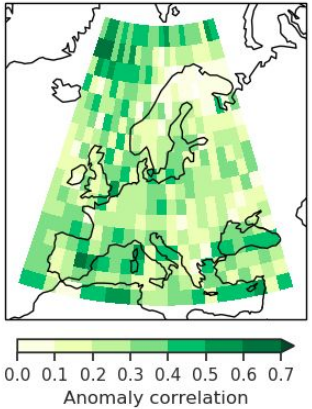
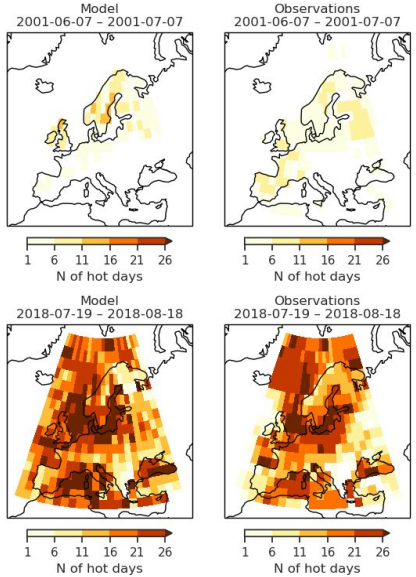
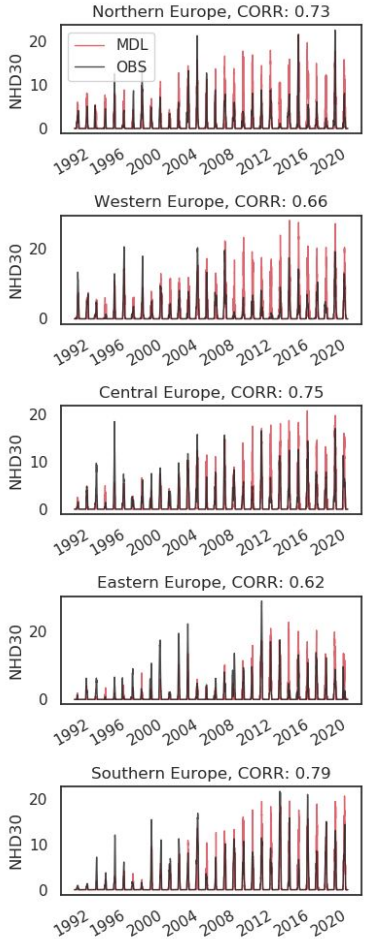
Results and Discussion

- The model learns and handles successfully the strong **seasonality** of the data
- Quite often the model can predict the **spatial pattern** of **NHD30**, but struggles with exact numbers
- A **steady** and **steep increase** in validation **correlation** as more data is used in fitting
- All regions have **positive bias** during the last years → **RMSE** begins to grow
- Most likely these results are better than the **NHD30** forecasts from dynamical models – but it has not been investigated thoroughly yet









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