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Geoscientific Model Development Discussions

Interactive comment on "IntelliO3-ts v1.0: A neural network approach to predict near-surface ozone concentrations in Germany" *by* Felix Kleinert et al.

Anonymous Referee #1

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Kleinert et al. present a machine learning (ML) method to predict surface ozone concentrations up to four days in advance. The method uses convolutional neural networks (CNN) trained on an extensive set of historical data (10 years) to forecast the daily maximum 8-hour average ozone concentration at more than 300 background measurement sites across Germany. Based on only a few input variables (concentrations of ozone and nitrogen oxides (NOx) and six meteorological variables), the ML ozone forecasts show good skills for the first two days but don't perform better than reference forecasts over longer time windows. This is a very nice paper that is well written and easy to follow. Minor comments are given below.

My only major comment is the issue with trends in the input data. Presumably, the 10-year training data of ozone and NOx – and possibly temperature – show a long-term

trend? I would expect this to create issues for the CNN since this trend is imprinted in the training data (even after normalizing around the interannual mean and standard deviation). Further, given the long-term trends in both ozone and NOx, the test samples (2010-2015) might represent a different 'environmental regime' that the CNN was not trained on. The authors should discuss this in the revised version of the manuscript.

Minor comments:

- Table 1: I suggest you include the study by Seltzer et al. (2020).

- Section 2.1.: (Variable selection): using the daily maximum 8-hour average for NO and NO2 seems like an odd choice to me. From a chemical perspective, one would rather want to use the 24-hour average or maximum one-hour concentration?

- Section 4.1 (Joint Distributions): While interesting it's not clear why this section is in the manuscript. It doesn't seem to have much relevance for understanding the paper?

- Section 5.2. (Comparison with competitive models): please add reference to Figure 6.

References:

Seltzer, K. M., Shindell, D. T., Kasibhatla, P., and Malley, C. S.: Magnitude, trends, and impacts of ambient long-term ozone exposure in the United States from 2000 to 2015, Atmos. Chem. Phys., 20, 1757–1775, https://doi.org/10.5194/acp-20-1757-2020, 2020.

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