

<https://doi.org/10.5194/amt-2023-116-RC2>

Dear Reviewer,

On behalf of the Authors, we would like to thank you for your valuable comments and comments. These were included in the revised manuscript

The Author discuss the use of Doppler sodar data to inform a PM10 forecasting model for the city of Krakow. A number of regression methods involving sodar data are proposed and evaluated with independent PM10 measurements made at air quality stations. In most cases the sodar data seem to produce some improvement in the predicted PM10 levels compared to a regression method not using such data. In general the paper needs a major language revision. In particular the explanation of the methods in Section 3.2 needs to be made more understandable. When it comes to the evaluation of the impact of using sodar data as an input for regression, it may be useful to look at how the metrics for the sodar-based regression differ to those of the one not using sodar data on a case-by-case basis. My impression is that the impact of the sodar data varies quite a lot from situation to situation.

MAIN COMMENTS

Section 3.2.3, which describes the core of the methodology, was the hardest to understand for me.

- L187-202. "Thus arose the function of real values, the argument of which is height", etc. I do not get what exactly is being done. Are you parameterising each of the quantities in the bullet points A, B, C, etc., as functions of h based on eqs. 1 and 2?

You get the point. Each spectrum coming from a given height is 32 numbers. Therefore, we try to characterize this 32-element sequence with a single value, e.g. an average. For each height (spectrum) we have one number, i.e. we get a function whose arguments are heights and ordinates are the values of a single characteristic. In addition, this function is called the ASP profile and is denoted by one of the capital letters A, B,...,I.

- Eqs. 1 and 2. What do these functions represent? Do you mean that each quantity in the points A-I is parameterised as $\Phi(h)$ with suitably chosen a , b and c using a least squares fit? What do you mean by "C profile"? Is the "regularity factor" just the correlation coefficient between data and model?

Exactly. Profiles A, B, D, E, F, G, H, I are approximated using the Φ function. Type C profiles have a different shape and are approximated by the Ψ function. The functions Φ and Ψ were chosen arbitrarily. The correlation coefficient squared $(r)^2$

- Eq. 4. What is MF? By comparison with eq. 3 I guess this somehow represents sodar data, but which variable do you actually use in the regression?

Evident error, it should be RF. Fixed

- Eq. 4-5. Here you show a regression equation for $PM_{10}(h+12)$ and one for its logarithm. Which one do you ultimately use? Or do you somehow use both?

This is the same equation in equivalent forms. A character from line 261 is used. The figure of line 259 is the result of linear regression.

- L254. *What do you mean by "the corresponding transformations led to a weather pattern"?*

Of course, not the weather, but forecasting

- L260. *Same question, just with "forecasting" instead of "weather"*

By forecasting pattern, we mean formulas directly used to calculate the forecast;

- *As I mentioned in the preamble, it may be worthwhile to discuss Figures from 9 to 12 in some more detail. For example, if I look at Fig. 9 and 10 I see a clear impact of sodar data in following the observed PM10 concentrations. If I look at Figure 12, the impact looks less clear, and I am not sure the sodar-based forecast are significantly different to those not using sodar. Can you elaborate a bit more on what the reasons for this could be?*

It is obvious that the current state of the atmosphere may have no effect on the state in 12 hours, but we have observed such a relationship quite often. The most important advantage of our forecasting is its ease and immediacy. The data comes from a single source (sodar) and the forecast comes down to substituting it into one formula. We get the forecast almost immediately after reading the sodar data.

- *Are the regression coefficients determined from the same data as those plotted in Figs. 9-12 or do they come from independent measurements?*

Regression coefficients were determined on the basis of data from 2017-2019. Examples of use are from 2021-2022

MINOR / TECHNICAL COMMENTS

- L7, "poms". *Possible typo? Could understand what word was meant to be there.*

Fixed

- L77-78. *There is some sort of error message in Polish, maybe a missing reference to some figure or table.*

Fixed

- L141, "wiatru" -> "wind"? *(I looked it up on a translator)*

Fixed

- L165, "the basic results... were used". *So, is this a sodar Doppler spectrum?*

Yes, it is a Doppler spectrum

- L175. *How is the "common part" defined? Is it the mean of the spectra at all altitudes?*

Yes

- L315, *"This means that the forecasts have been made as intended". I guess here you mean that your forecast has some added value as it does better than just using the mean value as a guess.*

That's your perfect reasoning.

- L325, *"the projections of these based.." -> "the predicted values based on the four considered methods..."*

Language-corrected wording

On behalf of all authors

Leszek Ośródk

Katowice, 27 December 2023