

Classification and quantification of low-visibility events using deep learning over eastern China

Authors: Yuting Liang et al

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General:

This study introduces a unified convolutional neural network (CNN) framework that integrates the geostationary satellite, meteorology, and fine particulate matter (PM_{2.5}) observation data to identify all types of LVEs. The classified and quantified LVEs, along with the established relationship with pollution, explicitly guide the air-quality policy for the co-benefits of improving air visibility and human health.

Overall, observations are not presented properly, fog definition is missing, Vis is not only due to fog but many others hydrometeors (see Gultepe et al 2019 PAAG, Nature). Conclusions are not clear to me, see comments below. You need a discussion section also, presently missing.

Deep learning ML application needs to be clarified, why you selected the one you used? What is the uncertainty of its usage? What are the issues related to various fog types and training analysis? How good it is and how can input can affect the outcome, uncertainties? You need more focused on the conclusions.

Decision: Major corrections

Major/minor issues;

Ln37/38 See Gultepe studies for Low Vis conditions and cold fog/ice fog ; you are only using a simple definition of low vis conditions. This can included drizzle , rain, snow, ice fog etc.

Ln48 see Gultepe et al for satellite use for fog (JAM)

Ln67; see Gultepe et al 2018 Atmos Res. paper for fog types and low vis conditions.

Section 2.2; integration of Pm_{2.5}, ERA5, and satellite data can have various issues, what is the uncertainty in this process?

Ln135; these definitions may not be correct because fog can occur over large size aerosols also. Discuss this.

section 3.2; averaging of all data in different areas with various pixel #s can lead to large uncertainty, did you look the errors among them?, provide this?

Verification; needs scatter plots of various parameters from each platform; this can show the bias in the estimations.

Fig4; y axis values as model??? Doesn't clear. (ii) plots show the scatter plots but they don't have good trends. It tells me large diffs between ob and predicted ones. But plots are not clear anyway....

Areal coverage comparisons seem ok but we know that anyway and errors in Fig4 indicates that there are large uncertainties in simulations.

Fig3; shows images but I need to see scatter plots of Vis observed versus others.

Conclusions;

You said this “Anchored by ground-station visibility data as the target truth, the framework achieved an identification accuracy exceeding 90%. Crucially, by integrating PM2.5 data, the model successfully disentangled the microphysical pathways of different LVEs, solving a persistent challenge in remote sensing over complex terrestrial and coastal environments.”

But fig4 shows completely different. If correlation 60% how can you get accuracy 90%?

Itemized your conclusions clearly, what are the findings? To me this section is not written properly based on findings.

Also you need a clear discussion section, presently is missing.