Review of

Predicting Contrails and Their Potential Climate Impact With Uncertainty in Mind, by Chloé Scholzen et al.

The paper describes and tests a new method for predicting the potential climate impact of aviation by causing contrails and CO_2 emissions accounting for uncertainty in the underlying weather prediction - humidity data. In view of the fact that aviation impacts the climate not only by CO2 emissions but also by the contrails formed, this is a relevant scientific question. Pre-tactical contrail avoidance methods are of general interest and need to be tested.

The paper describes a new pre-tactical contrail avoidance method using a Monte-Carlo method with random ensembles of humidity data. Among others, the use of the Perlin gradient noise algorithm is interesting.

The paper shows that the risks for causing expensive flight route planning errors gets reduced with the new method.

The paper is well formulated. Minor issues are noted below.

The paper presents several examples for a single flight and for a set of flights which support the interpretations and conclusions presented.

One major remark is as follows:

The method relies on ERA5 and CoCiP. Both methods have limited accuracies: ERA5 in respect to minor errors in humidity, temperature, wind, cloudiness and radiation fields, and CoCiP in computing contrail formation, dispersion, contrail RF and contrail EF. Also, the climate impact of contrail RF in terms of surface temperature change is uncertain, because CoCiP computes the top-of the atmosphere RF and not the ERF, nor the resultant surface temperature change, e.g. with the influence of changing sea surface temperature (Bickel et al., 2025). The present paper assumes that these methods and the published knowledge are accurate enough to build upon them. There is ongoing research questioning this, see e.g. (Teoh et al., 2026a; Teoh et al., 2026b) and Schumann and Seifert (2025). But I agree, that for the present state of understanding, and for the topic addressed, the assumptions used are justifiable.

The paper should be published, after minor revision in respect to the following remarks:

Line 38, insert “, as cited below,” after “Recent studies”

Line 47, add references to CoCiP (including the methods used to compute RF and ERF).

Line 65 states that “persistent contrails occur only where RHi>100%”. That is not true: Persistent contrails form when RHi>100% but they persist for considerable time also in subsaturated air masses. There are several studies on this in the literature (e.g, Lewellen (2014) and Li et al. (2023)). But you may assume that your method considers only the contrail parts when RHi>100%.

Line 116: As made clear in the acknowledgments, perlin-numpy is a Python code. Does it exist also as Fortran code?

Line 125: What is a “cropped” field?

Eq. (2): Please explain ”clip”.

Line 158: The ECMWF does not use the saturation function of Murphy and Koop (2005) but see Section **12.7 THERMODYNAMICS, SATURATION FUNCTION in IFS DOCUMENTATION – Cy48r1, Operational implementation 27 June 2023, PART IV: PHYSICAL PROCESSES.** (There might be mor recent versions; check the internet of ECMWF, IFS Documentation CY48R1 - Part IV: Physical Processes | ECMWF).

By using a saturation function different form that in ERA5, you introduce an error of order 1%. Here, it would be sufficient to mention that one should use the same saturation function as in IFS/ERA5.

Fig 1 is important and can be understood, but is not optimally colored. The red part, mostly below the blue part, is not clear to see. Perhaps you find a better alternative. One could also think about showing two panels, one with the deterministic and one with the ensemble mean results. But if you do not find an improved version, the present version is just acceptable.

Line 221. I do not understand which sign you changed. The flight direction?

Line 377: I do not understand why the code is proprietary. If it is, then the authors might have a conflict of interest (line 385).

References cited

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