Review of the paper « A method for random uncertainties validation and probing the natural variability with application to TROPOMI/Sentinel5P total ozone measurements » by V. Sofieva et al

The paper presents a method of validation of random component of uncertainty estimates in remote sensing measurements, using the 2-dimensional structure functions, and illustrates it on TROPOMI ozone total column data. The paper is clearly written, is straight to the point, and I strongly recommend it for the publication in AMT, provided the following minor issues will be addressed.

Detailed comments:

- Lines 53-55: the sentence "this concept assumes that the random field is locally homogeneous, which is the spatial equivalence of a random process with stationary increments" is misleading: the notion of the structure function exists for any random process, not necessarily for those with stationary increments. In return, for the real-valued process with stationary increments, the structure function is one of its two main characteristics (see for example Yaglom, 1987 or Kolmogorov, 1940). I would first instroduce $D(\rho)$ via Eq. 1, call it variogram and would give the reference to Wackernagel for details, than would explain its link to the structure functions, which are already covered by previous papers of the first author.
- Fig. 1. The red curve touching the $\rho=0$ line is misleading: if in eq.1 one writes $\rho1=\rho2$, the $D(\rho)$ is zero. Either the line should stop shortly before touching the coordinate line, or you should precise that the value of the estimated variability at $\rho=0$ is obtained by prolongation by continuity. The first solution would keep in line with general concise style of the paper, the second would be compliant with the formulation of your summary.
- Line 98: it would be better to align the term "pseudo-random error" with the terminology of (von Clarmann et al, 2020)
- Lines 123-124: what is the minimal separation distance of your sample, and of which size is corresponding subsample?

Language / formulation comments :

- line 31: are - > is
- line 36 : " … in the linearized model" can be thrown away
- Line 67: "1D" better to be written in words.
- line 101: "… to select ozone data…" -> "in which we select ozone data …"
- line 134: detail the abbreviation "rms"
- line 166: "… might especially BE useful…"

References:

Kolmogorov, A. N.: Wiener's spiral and some other interesting curves in Hilbert space, Dokl. Akad. Nauk SSSR, 26, 115–118, 1940.

Yaglom, A. M.: Correlation Theory of Stationary and Related Random Functions, Volume I: Basic Results, Springer, New York, 1987.