Comments to Authors:

This paper presents a data-driven in-orbit approach to improve microwave radiometer geolocation and footprint characterization using coastal crossings. By maximizing the correlation between observed brightness temperatures and modeled effective land fractions (ELF), the authors estimate along-track geolocation error (ELON), across-track error (ECRO), and full width at half power (FWHP). The study uses a large ensemble of global coastal crossings and a two-round iterative random-effects meta-analysis framework to reduce parameter interdependence and quantify uncertainties. The results demonstrate systematic geolocation biases and mission-dependent footprint characteristics, with implications for improving coastal wet tropospheric correction in satellite altimetry. Overall, I find this to be a technically strong and valuable study, and I would recommend the manuscript for publication after satisfactory responses to the comments provided below.

Major Comments:

1. Although the paper later evaluates footprint geometry and aspect ratios, the actual TB–ELF correlation optimization is still performed using a circular/symmetric Gaussian footprint model. This may be biased in cases where the true antenna response is elliptical or asymmetric. The manuscript would benefit from either incorporating elliptical footprint parameters directly into the optimization framework or providing quantitative evidence that the circular approximation does not significantly affect ELON, ECRO, and FWHP retrievals.

2. The methodology assumes that TB variations across coastal crossings are primarily controlled by land–water emissivity contrast. However, atmospheric humidity gradients, surface temperature variability, precipitation, and complex coastal morphology may also influence TB–ELF correlation maxima. A more detailed sensitivity analysis quantifying the impact of environmental heterogeneity on retrieval accuracy would strengthen confidence in the robustness of the approach.

3. The Mann-Kendall test is applied with N = 10 repeat cycles per mission and a relaxed significance threshold of α = 0.10, explicitly chosen to compensate for low statistical power (lines 538–541). With N = 10, the MK test has very limited power to

detect subtle monotonic trends: for a two-tailed test at $\alpha = 0.10$, the minimum detectable effect size (in terms of Kendall's τ) is large, meaning that moderate but physically meaningful drifts could easily go undetected. The paper correctly identifies one significant trend (ERS-2, 36.5 GHz ELON, $p = 0.03$) and attributes it to gyroscope failures, which provides important physical validation. However, for ERS-2's 23.8 GHz channel, split-period ELON estimates are provided (Table 4) showing a shift from 1.46 ± 0.13 km to 1.71 ± 0.13 km — a ~0.25 km change that, while not meeting the $\alpha = 0.10$ threshold ($p = 0.37$), is physically plausible given the same gyroscope event. The authors should report explicit power calculations or confidence intervals for the trend estimates and consider whether bootstrapped uncertainty bounds on the MK statistic would be more appropriate given the small sample size and potential serial correlation across adjacent orbital cycles.

Minor Comments:

1. The manuscript would benefit from a brief discussion of computational cost and runtime, particularly given the large number of coastal crossings and iterative optimization procedure.