Author comment to anonymous Referee 2

I thank the authors for their careful revision and detailed responses to the reviewer comments. The manuscript has clearly improved compared with the previous version. In particular, the workflow is now described more transparently, and regional validation results make the dataset more convincing. Overall, I think the dataset is potentially useful and suitable for ESSD after some remaining issues are addressed.

We sincerely thank the reviewer for the positive assessment of our revision and for the continued constructive feedback. We have carefully addressed all remaining issues raised in this round of review, with the detailed point-by-point response provided below. All changes are tracked with new and modified text highlighted in blue and deleted text in red in ATC file.

1. Abstract: The causal interpretation of regional trends should be softened. The observed decline or increase in detected platforms may be "consistent with" aging infrastructure or offshore development, but the dataset alone does not directly attribute these trends to specific policy or economic drivers.

The relevant sentences in the Abstract have been revised to reflect consistency with known patterns rather than direct causation.

> L14–16: From our analysis of this OOGP dataset, we observed that offshore platform activity has declined in regions like the GoM, consistent with documented trends of aging infrastructure and shifting energy investment, while it has expanded in the PG and CS, consistent with ongoing offshore development.

2. Section 1: The revised manuscript still uses expressions such as "high-accuracy algorithm." Since the workflow mainly combines adaptive thresholding, temporal persistence filtering, morphological processing, and multi-source validation, I suggest describing it as a "semi-automated mapping workflow" or "dataset-production framework" rather than emphasizing algorithmic novelty.

We agree with the reviewer's suggestion. We have replaced it throughout the manuscript with "semi-automated mapping workflow" and "dataset-production framework", which better reflects the nature of the approach.

> L74–L75: The key contributions of this study include (1) a semi-automated mapping workflow for large-scale OOGP detection based on Sentinel-1 SAR imagery
>
> L485: The validation and assessment results highlight the effectiveness of our dataset-production framework with high precision.

3. Section 1: At present, the Introduction devotes considerable space to different remote-sensing detection methods and may give the impression that the main novelty lies in algorithm development. However, the strength of this study appears to be the construction of a temporally consistent, multi-basin OOGP dataset using a scalable semi-automated workflow.

We have made two targeted revisions: a concluding sentence has been added to the methods review paragraph to link the limitations of existing approaches to the need for a temporally consistent dataset, and the contribution statement has been reordered to foreground the dataset as the central contribution. The revised text is as follows:

> L69–L76: These constraints collectively limit the feasibility of constructing temporally consistent, multi-basin OOGP datasets, highlighting the need for a scalable and annotation-free mapping workflow. In this study, we addressed this gap by constructing a comprehensive and openly available spatiotemporal OOGP dataset covering six major offshore basins from 2017 to 2023. To enable this, we developed a semi-automated mapping workflow that allows scalable and systematic platform mapping without requiring labelled training data or concurrent multi-sensor acquisitions. The key contributions of this study include (1) a semi-automated mapping workflow for large-scale OOGP detection based on Sentinel-1 SAR imagery, and (2) the construction of a comprehensive and openly available spatiotemporal OOGP dataset for analyzing spatial distribution patterns and temporal trends from 2017 to 2023.

4. Section 1, lines 62–68: Several references are listed without years, such as "Chen et al.; Pei et al.; Zhang et al., b; Ma et al.; Falqueto et al.; Zhang et al., a; Spanier et al." These should be corrected according to the journal's citation style.

We thank the reviewer for catching this formatting error. All affected references have been updated with their respective publication years, and the entire manuscript has been checked to ensure consistent citation formatting throughout.

5. Section 2.1, lines 80–90 and Figure 1: The discussion around methane plume data could be slightly reframed. Since methane plume detections are not uniformly available and extend beyond the 2017–2023 study period, they may be better presented as contextual motivation rather than direct support for the dataset construction.

The relevant passage has been revised to present these observations as contextual motivation for the selected regions rather than as methodological justification. The revised text is as follows:

L85–L88: These observations provide contextual evidence of active emission sources associated with offshore oil and gas operations in these regions, highlighting the broader need for accurate and up-to-date OOGP inventories to support emission monitoring and attribution efforts.

6. Section 3.2, Please check the adaptive threshold equation (Eq. 4). The text says that the threshold is the 90th percentile of monthly backscatter intensity, but the equation expresses it as 0.9 multiplied by a monthly average value. If the intended threshold is the 90th percentile, the equation should be revised accordingly, for example as Tm = P90(Am), with the percentile domain clearly defined.

We thank the reviewer for identifying this important inconsistency. We have corrected the equation to accurately reflect this percentile-based computation, and updated the surrounding text and variable definitions for clarity. The revised text is as follows:

L215–L220:

$$B_m = \begin{cases} 1, & A_m > T_m \\ 0, & A_m \leq T_m \end{cases} \tag{1}$$

$$A_m = \frac{1}{n} \sum_{i=1}^{n} BC_m^{(i)} \tag{2}$$

$$T_m = P_{90}(A_m), \quad m = 1, 2, \ldots, 12 \tag{3}$$

Where B_m is the monthly binary image, A_m is the monthly average backscatter image computed as the pixel-wise temporal mean of all Sentinel-1 VH acquisitions in month m, T_m is the dynamic threshold of the monthly Sentinel-1 VH image, $BC_m^{(i)}$ is the backscatter coefficient image of the i-th Sentinel-1 acquisition in month m, n is the number of Sentinel-1 images in month m, and P_{90} denotes the 90th percentile of the spatial distribution of pixel values in A_m.

7. Table 3: Since the dataset covers 2017–2023, could the authors clarify why the validation was conducted only for 2023? Please also indicate whether the reported accuracy metrics should be interpreted as representative of the whole period or mainly of the 2023 mapping results.

We thank the reviewer for raising this important point. The validation was conducted using 2023 data as reference inventories (BSEE, OGIM, and OESNS) were most complete at the time of the study. While a formal year-by-year validation is not feasible due to the limited availability of temporally resolved reference records for 2017–2022, the detection workflow and parameter settings are applied consistently across all years. The sensitivity analysis (σ_{OF} = 1.6–4.7%; Table S3) confirms stable mapping performance. The revised text is as follows:

> L315–L316: A total of 5,622 sample points covering six offshore regions were selected for validation in 2023, as reference inventories are most complete and up-to-date for this year at the time of the study.
>
> L331–L334: While a formal year-by-year validation is not feasible due to the limited availability of temporally resolved reference records for 2017–2022, the detection workflow is applied consistently across all years, and the OF threshold sensitivity analysis (σ_{OF} = 1.6–4.7%; Table S3) confirms that the mapping performance is stable with respect to parameter uncertainty.

8. Section 4.1.2: The reported mean error distance of 0.35 m, seems unusually small for a dataset derived primarily from Sentinel-1 GRD imagery. Could the authors clarify how this distance was calculated, what reference points were used, and whether the comparison is fully independent? Please also explain how sub-meter agreement should be interpreted given the spatial resolution of the satellite data and the positional uncertainty of the reference datasets.

The sub-metre error distance does not reflect absolute geolocation accuracy, but rather the centroid-to-point offset between each SAR-detected OOGP polygon centroid and the nearest reference point within a 10 m matching radius. Both reference datasets were used exclusively for validation and played no role in the detection workflow, ensuring the independence of the comparison. The sub-metre agreement reflects the spatial stability of the SAR backscatter signal for large, fixed platforms rather than sub-pixel geolocation precision, with the 10 m GRD pixel spacing representing the theoretical lower bound on positional uncertainty. We have revised Section 4.1.2 accordingly. The revised text is as follows:

> L336–L355: We spatially matched the dataset of OOGPs generated in this work with the BSEE dataset and the OGIM dataset based on the nearest neighbor distance. The distance metric represents the Euclidean offset between the centroid of each SAR-detected OOGP polygon and the corresponding point in the reference dataset, within a 10 m matching radius. The BSEE reference coordinates are derived from operator-reported survey data, and the OGIM coordinates are compiled from official government and industry sources, both registered to the same geographic coordinate system as our detections. Both datasets were used exclusively for validation, ensuring the independence of the comparison. It is important to note that this centroid-to-point distance reflects the spatial offset between the detected polygon centroid and the reference point location, rather than the absolute geolocation accuracy of the satellite-derived product relative to the physical platform location. Table 4

presents the distance error statistics of our OOGPs points and platform points in comparative products. Based on spatial analysis within a nearest neighbor distance of 10 m, 5,180 points were matched with the corresponding validation data points. The number of sample points in the GoM and PG was significantly higher than that in other regions, at 1,451 and 1,397, respectively. Overall, OOGPs achieved a mean error of 0.35 m, median error of 0.05 m, standard deviation of 0.64 m, maximum error of 3.29 m, and minimum error of 0 m. For large, fixed platforms that dominate the GoM dataset, the strong and spatially concentrated SAR backscatter signal consistently places the detected centroid within a few metres of the operator reported platform centre, which explains the exceptionally low mean error of 0.06 m and median error approximating 0 m observed in this region. The 10 m GRD pixel spacing of Sentinel-1 represents the theoretical lower bound on positional uncertainty, and the achieved centroid agreement reflects the spatial stability of the backscatter signal rather than sub-pixel geolocation precision. Regions with structurally more complex platforms (e.g., GoT, mean error 0.95 m) show larger offsets, consistent with greater uncertainty in centroid placement for such targets. The size of these offshore structures should be considered when validating their locations.