Response to Comments and List of Changes

Manuscript: "A new regional-scale multibeam echosounder bathymetric dataset of the Saudi Arabian Red Sea" — Earth System Science Data (ESSD)

We thank the referees and the community reviewers for their careful reading and constructive comments. Below we list each comment together with the corresponding change made to the manuscript. Original and revised wording is reported for each change. A second section lists further editorial corrections introduced during the revision.

Referee and community comments

1. Community Comment 2 — Title

Comment (CC1): "I only have a minor comment on the title: 'The first regional-scale multibeam echosounder bathymetric dataset of the Saudi Arabian Red Sea'. Given the number of publicly available high-quality datasets that already cover parts of the Saudi margin, including several cited in the manuscript, this feels a bit of an overstatement. I would simply suggest replacing 'first' with 'a new' or 'a comprehensive'."

Response: We have revised the title, replacing "first" with "new", and applied the same change in the Conclusions for consistency.

> ***Original (title) - line 1:*** The first regional-scale multibeam echosounder bathymetric dataset of the Saudi Arabian Red Sea
>
> ***Revised (title) - line 1:*** A new regional-scale multibeam echosounder bathymetric dataset of the Saudi Arabian Red Sea
>
> ***Original (Conclusions) - line 216:*** This study presents the first regional-scale, high-resolution multibeam echosounder bathymetric dataset covering the Saudi Arabian margin of the Red Sea…
>
> ***Revised (Conclusions) - line 231:*** This study presents a comprehensive regional-scale, high-resolution multibeam echosounder bathymetric dataset covering the Saudi Arabian margin of the Red Sea…

2. Community Comment 2 — Broader context and comparable datasets

Comment (CC2): "Its potential global dimension can be better addressed through adding references to other recently published datasets of the same kind… I suggest to include the following: High-resolution MBES surveys of Napoli Bay (Italy); MBES and other remote sensing datasets from Puck Bay (Baltic Sea, Poland); Regional high-resolution MBES surveys of the Southern Baltic Sea."

Response: We have added the three suggested datasets as references and a sentence in the Introduction that places our dataset within the broader, globally increasing availability of high-resolution MBES surveys. The three works are cited in the new Introduction paragraph reported under the next comment.

> ***References added - lines 47-52:*** Foglini et al. (2025) — Gulf of Naples; Janowski et al. (2024) — Puck Lagoon; Janowski et al. (2025) — Southern Baltic Sea.

3. Community Comment 2 — Seabed 2030 and regional vs global bathymetry

Comment (CC2): "Adding references to Seabed 2030 would increase the relevance and importance of the paper… 1- Small addition to the Introduction section contrasting regional and global bathymetry datasets. 2- A small summary statement in the Conclusion section that would put the paper into a wider context of global bathymetry."

Response: We have added an explicit reference to the Nippon Foundation–GEBCO Seabed 2030 Project (Mayer et al., 2018), a new paragraph in the Introduction contrasting regional and global bathymetric products (which also cites the three datasets requested above), and a closing statement in the Conclusions situating the dataset within global seafloor mapping efforts.

> ***Added (Introduction) - lines 46-52:*** This regional gap mirrors a global one. Global mapping initiatives such as the Nippon Foundation–GEBCO Seabed 2030 Project (Mayer et al., 2018) aim to produce a complete map of the world ocean floor by 2030, and they depend on the integration of regional and local high-resolution surveys to progressively replace coarse grids. In recent years, comparable regional-scale, high-resolution MBES datasets have been released and made openly available for other basins, including the Tyrrhenian Sea (Foglini et al., 2025) and the Baltic Sea (Janowski et al., 2024, 2025). The dataset

presented here extends this effort to the Saudi Arabian continental margin and slope, providing insights into these structurally complex and ecologically significant settings, which have until now lacked detailed bathymetric characterisation and remained absent from openly accessible high-resolution products.

Added (Conclusions) - lines 241-243: Beyond its regional relevance, this dataset contributes to global seafloor mapping efforts such as the Nippon Foundation–GEBCO Seabed 2030 Project (Mayer et al., 2018), adding openly accessible high-resolution bathymetry for a previously under-mapped sector of the world ocean.

4. Referee Comment 1 — Figure 2 resolution

Comment (RC1): "The letters inside Figure 2 are barely seen. Apparently, the figure was obtained from a low-resolution chart. I recommend redrawing the figure."

Response: Figure 2 has been redrawn at higher resolution, with consistent font sizes and legible labels across all panels.

5. Referee Comment 1 — Number of DBMs vs Figure 3

Comment (RC1): "In line 122, the authors state that 'After filtering processes, accepted soundings were gridded into 7 Digital Bathymetric Models (DBMs) (Figure 3)'. However, Figure 3 does not present seven DBMs. Actually, there are four multibeam mosaics."

Response: We have clarified, in both text and caption, that panel a integrates all seven DBMs into a single overview map, while the enlarged panels are selected examples rather than separate DBMs. The revised text and caption are reported under the next comment, where Figure 3 was also expanded.

6. Referee Comment 1 — Additional examples with feature descriptions

Comment (RC1): "Finally, it would be interesting to see more examples, each with at least a brief explanation of the features (channels, pockmarks, slumps, etc.)."

Response: Figure 3 has been expanded from four to eight example panels (b–i), two per expedition Leg, each accompanied by a brief description of the main geomorphological features. The text and caption were rewritten accordingly, and supporting references were added (Mitchell et al., 2010; Feldens and Mitchell, 2015; Augustin et al., 2016a; Feldens et al., 2016).

Original (text) - lines 127-132: …accepted soundings were gridded into 7 Digital Bathymetric Models (DBMs) (Figure 3). … The spatial distribution of the dataset is illustrated in Figure 3, which shows the full extent of gridded bathymetry across the Red Sea (panel a) alongside four representative subsets (panels b–e), one per expedition Leg. …

Revised (text) - lines 134-144: …the accepted soundings were gridded into seven Digital Bathymetric Models (DBMs). … Figure 3 shows the full extent of the gridded bathymetry across the Red Sea (panel a), which integrates all seven DBMs, together with eight representative examples of seafloor morphology (panels b–i), two per expedition Leg. These enlarged panels highlight the diversity of geomorphological settings captured by the survey. Erosive and gravity-driven processes are widespread along the margin, from gully fields incising the upper slope (panel b) to canyon flanks affected by slope instability (panel d) and a mass-wasting deposit related to a submarine landslide (panel g). Salt-related morphologies record the mobility of the widespread Miocene evaporites, expressed as a salt-flow lobate front (panel c) and as compressional ridges and flow lineaments related to salt movement (panel f) (Mitchell et al., 2010; Feldens and Mitchell, 2015). Volcanic and tectonic features characterise the deep central axis, including volcanic cones and extensional lineaments (panel h) and hummocky deposits related to lava flows in the Mabahiss Deep (panel e) (Augustin et al., 2016a). Finally, panel i shows a pockmark field formed by fluids expelled through the underlying evaporite sequence (Feldens et al., 2016).

Revised (caption): Figure 3: Final digital bathymetric models (DBMs) generated from RSDE multibeam surveys. Panel a, overview map integrating all seven DBMs, coloured by depth (metres). Panels b–i show representative examples of seafloor morphology, two per expedition Leg. Panel b, gully field on the upper slope (Leg 4). Panel c, salt-flow lobate front (Leg 4). Panel d, canyon flanks affected by slope instability (Leg 3). Panel e, hummocky deposits related to lava flows (Leg 3). Panel f, compressional ridges and flow lineaments related to salt movement (Leg 1). Panel g, mass-wasting deposit related to a submarine landslide (Leg 1). Panel h, volcanic cones and extensional lineaments along the central axis (Leg 2). Panel i, pockmark field (Leg 2). Scale bars in kilometres.

Additional changes

The following changes were introduced during the revision for accuracy and consistency. They do not respond to a specific referee comment.

Technical validation — IHO S-44 framing

Change: The description of the cross-check against IHO S-44 was reworded to present the Exclusive Order as a conservative numerical benchmark rather than as an applicable survey order, since S-44 restricts the Exclusive Order to shallow-water critical-navigation areas.

> ***Original:*** Results were evaluated against the IHO S-44 6th Edition Exclusive Order, the appropriate standard for deep-water survey applications (>200 m).
>
> ***Revised:*** Results were compared against the depth-uncertainty limits (THU and TVU) of the IHO S-44 Exclusive Order, used here as a stringent numerical benchmark rather than as an applicable survey order, since these limits are the tightest defined in the standard.

Reference list — formatting

Change: Four references were added (Mitchell et al., 2010; Feldens and Mitchell, 2015; Feldens et al., 2016; Augustin et al., 2016a) to support the new Figure 3 descriptions, in addition to Foglini et al. (2025), Janowski et al. (2024), Janowski et al. (2025) and Mayer et al. (2018).

Minor corrections

Change: Vessel designation corrected from M/V to R/V (OceanXplorer) throughout the document.