Dear Reviewer 2,

Many thanks for your insightful reviewer comments and suggestions. We feel they greatly enhance the structure and ethical framing of our manuscript. Please see below line-by-line responses to your comments (in blue). We look forward to the opportunity to upload our revised manuscript so these revisions can be seen in context.

Yours sincerely,
Jess Payne
(on behalf of all co-authors)

**Review - egusphere-2025-1836 (GC)**

**1 Summary of the manuscript**

This manuscript presents a qualitative investigation into the ethical challenges associated with the use of satellite remote sensing data in geohazard research, particularly in politically complex contexts. Drawing on thirteen semi-structured interviews and three focus group discussions with UK-based remote sensing professionals, the authors adopt a grounded theory approach to explore how researchers perceive ethical responsibility, data use, collaboration, and impact. The study identifies several key tensions: (i) between open-access data practices and the protection of vulnerable communities, (ii) between academic incentives and meaningful engagement with local stakeholders, and (iii) between the perceived ethical neutrality of remote sensing data and the broader societal implications of its interpretation and dissemination. The manuscript situates these findings within geoethical frameworks and Disaster Risk Reduction (DRR) paradigms, particularly the Sendai Framework, and proposes recommendations including targeted training and the implementation of a "light-touch" ethical review system.

Overall, the paper aims to contribute to ongoing debates on ethical AI and data-driven practices in geoscience by foregrounding the responsibilities of researchers working with increasingly powerful and accessible satellite data.

**2 Major comments**

**2.1 Originality and relevance to Geoscience Communication**

The manuscript addresses a timely and important topic at the intersection of geoscience, ethics, and communication, and I find it particularly relevant for *Geoscience Communication*. Its focus on satellite data practices in politically sensitive contexts is particularly relevant, especially given the increasing reliance on remote sensing in DRR.

The empirical grounding through interviews and focus groups is a strength, offering insight into practitioner perspectives that are often underrepresented in ethical debates. However, the manuscript's originality could be strengthened by more explicit engagement with contemporary ethical AI frameworks (e.g., fairness, accountability, transparency, explainability). While the discussion touches on issues such as digital colonialism and inequity, these are not consistently framed within broader AI ethics discourse, which may somewhat limit the interdisciplinary reach of the paper.

**2.2 Engagement with ethical AI and DRR frameworks**

The manuscript demonstrates familiarity with geoethics and DRR frameworks (e.g., Sendai Framework), but its engagement with ethical AI is implicit rather than explicit. Given the centrality of data-driven decision-making in remote sensing, the paper would benefit from:

- A clearer articulation of how satellite data practices intersect with AI-related concerns such as algorithmic bias, data governance, and accountability.
    - This study was not designed to explore ethical AI, nor did the participants raise ethical issues relating to AI and satellite data. However, the FATE framework offers useful principles to frame our study's discussion, due to, as the reviewer mentions, the data-driven aspect to remote sensing. Therefore, as well as reference to DRR and geoethics frameworks, we reference the ethical AI framework FATE principles in our discussion to identify ethical risks.
- A more systematic integration of ethical principles (e.g., transparency, inclusivity, harm minimisation) into the analysis of findings. For example, discussions of "misinterpretation of data" and "lack of feedback loops" (Discussion, Sections 4.3–4.4) could be reframed in terms of accountability and explainability in data-driven systems.
    - In relation to comment 2.4 below, we more deliberately tied our discussion to principles derived from ethical frameworks.
    - Following manuscript revision to incorporate Reviewer 1 comments, we have adjusted our discussion structure such that Sections 4.3 and 4.4 are not the same as the original draft. However, we have framed our discussion more using ethical principles rather than a purely descriptive synthesis of how our results relate to political, technological, and temporal contexts.

**2.3 Methodological rigor and limitations**

The use of grounded theory is appropriate for an exploratory study of this nature, and I find the overall design clearly explained (Section 2). However, several methodological issues warrant further clarification:

- Sample bias and scope: The exclusive focus on UK-based researchers, many of whom are affiliated with COMET, significantly constrains the generalisability of the findings. While this is acknowledged (Appendix B), the implications for the study's conclusions are not sufficiently discussed in the main text.
    - Building on our Limitations section added in response to comments from Reviewer 1 (Section 2.1.2), we have added a couple of statements in response to this recommendation. We reflect that, due to the limited geographic positionality of our participants, our findings and subsequent recommendations may not be generalisable, particularly due to the limited geographical positionality of our participants.
- Positionality and reflexivity: Although the authors note their embeddedness in the research community (Section 2), the analysis would benefit from a more critical reflection on how this may have shaped data interpretation.
    - We have added to our limitations section a reflection on our positionality within the UK geohazard remote sensing community. For example, our positionality supports the design of a study which is relevant to the remote sensing community, however our interpretations of results may incorporate unconscious bias.

- Analytical transparency: The coding process is described in general terms, but there is limited detail on how themes were derived, validated, or triangulated across interviews and focus groups.
    - We have adjusted our Methodology Section 2 to include a "Transcript Analysis" (Section 2.3) which more accurately describes our analysis approach, including more explicit description of theme derivation, validation, and triangulation.

**2.4 Clarity and coherence of the argument**

The manuscript contains a wealth of empirical material, but I find that the overall argument would benefit from stronger synthesis. This is especially important given the interdisciplinary scope of the journal. In particular, Section 3 (Results) is detailed but at times overly descriptive, making it difficult to identify the key analytical contributions. Moreover, the transition from empirical findings to normative recommendations in Section 5 feels somewhat abrupt; the recommendations are not always clearly grounded in the preceding analysis and could benefit from a more explicit link to the empirical findings. A more explicit structuring of the argument, e.g., through thematic subsections that link findings to specific ethical principles, would improve clarity. The recommendations would also benefit from being more explicitly grounded in specific empirical findings presented earlier in the manuscript.

- Our revised introduction outlines more clearly the manuscript aims with more reference to relevant literature, including that which has similar structure: exploration of ethics and potential ethical issues in a field followed by recommendations to address these issues (see author revisions at the end of this document for further context). This should ease the abruptness the reviewer felt between findings and normative recommendations.
- We have reduced the length and complexity of our Results section. We have also retitled Results sections with theme numbers and names, making the connection to the coding method more explicit. Result subsections layout more clearly various ideas which arose within each theme, reducing section length to support the reader. These section titles are now e.g.: Theme 1: The contested role of ethical review in remote sensing.
- We have also, at the start of the discussion, more clearly introduced ethical frameworks (geoethics and ethical AI framework FATE) and define their key principles. We then synthesise these principles with our results and literature. This synthesis highlights failures in adhering to various ethical principles, making clear areas where our recommended training would be valuable to fill deficits in aligning to various principles.
- We have also more explicitly grounded our recommendations in the empirical findings and resulting discussion areas where we see training and improved ethical awareness would benefit not only the value of geohazard remote sensing research, but also reduce ethical risks.

**2.5 Communication for interdisciplinary audiences**

As a submission to an interdisciplinary journal, the manuscript would benefit from clearer signposting and conceptual framing for non-specialist readers. Some technical discussions (e.g., InSAR processing, Section 3.5) may be difficult to follow without additional explanation. Conversely, key ethical concepts (e.g., "digital colonialism") are introduced without sufficient elaboration or citation (see also minor comments).

- We have added a small paragraph at the end of the introduction which explains for the non-expert technical terms related to SAR which are mentioned in the manuscript (SAR coherence, InSAR, InSAR time series analysis).
- We have increased citation throughout the manuscript. We have added two citations and a definition of digital colonialism in Section 4.4.

The manuscript would be strengthened by balancing technical detail with accessible explanations and clearer links to broader communication challenges in DRR.

**2.6 Practical implications and actionable recommendations**

The recommendations provided (Section 5) are relevant and potentially impactful, particularly the proposal for training and a light-touch ethical review system. However, as noted from Reviewer 1, the manuscript would benefit from more clearly identifying who is responsible for implementing these recommendations.

For instance:

- Should training be delivered by universities, professional bodies, or funders?
- Who would design and oversee the proposed ethical review system?
- How might these recommendations be operationalised in resource-constrained settings?

Clarifying these points would enhance the practical utility of the paper.

- We have, in line with these and comments from Reviewer 1, made our Recommendations more specific. We have specified that universities and educational bodies hold the most responsibility for delivering this training, as they are educational bodies with pedagogical expertise. However, in the context of geoethics, the professional body International Association for Promoting Geoethics has a responsibility as a leader in the discipline to guide training principles and resource creation. Already, material exists in scientific literature to guide geoethics teaching (e.g. Brabowsky et al 2017). It is educator's responsibility to ensure these principles are embedded in appropriate resources for their students.
- The proposed ethical review system should be designed by those within the geohazard remote sensing discipline who understand the experiences and perceptions of their colleagues. These individuals are best placed to create a light-touch review which is relevant, specific, and encourages true moral reflection. In this context, funders have a responsibility to ensure such a project receives funding and thus future geohazard remote sensing projects they fund can follow such a review system. This review system creation need only happen once and the system can be adapted and implemented in relevant institutions across the UK. Once created, it would be the institutions responsibility to manage the administration and oversight of the review system, including managing a specific ethical review board.
- In resource constrained settings, a review system could be even more light touch. Instead of a formal review board embedded in an institution which administers the review system, research groups or individuals would be responsible for participating in geoethical training or educating themselves in the importance of mitigating ethical risks in their field. Research groups could run the review system internally, with, for example, PhD students completing the review application before review with their supervisors. With the driver of this review system aiming to encourage ethical reflection, the scale of

the review system is perhaps redundant. The importance is that the training and review process reduce ethical risks in practice.

**3 Minor comments**

**3.1 General clarity and structure**

- Introduction (approx. lines 25–60): The concept of "political complexity" should be explicitly defined early on, as it is central to the framing of the study.
    - We have adjusted the title of the manuscript to reflect the adjusted focus of the Introduction as well as the Recommendations section. On reflection, monitoring any region of the world comes with a need to understand "political complexities" of the local society. As such, understanding political complexity is implicit to any remote sensing study, and ethical questions arise no matter the perceived political challenge. The revised title reflects this change in framing, instead focusing on "international" geohazards, as is the research focus of all this study's participants. Revised title: "Perceptions and recommendations: Exploring the ethics of using satellite data to understand, monitor, and publish research on international geohazards"
- Lines 50–53: I would suggest reconsidering the use of the term "conventional" to describe geohazard communication. As the manuscript itself later acknowledges, the field has undergone significant evolution. A formulation that reflects this historical development (e.g., "Historically, geohazard communication has been…") may be more appropriate and accurate in the current context.
    - We have revised the use of conventional as per this recommendation: "Historically, disaster risk reduction research study design processes often focus on co-creating and co-producing geohazard research with local stakeholders…"
- Section 3 (Results): Consider adding summary tables or thematic diagrams to synthesise findings across interviews and focus groups, particularly where multiple perspectives are presented in sequence without synthesis.
    - As per this and Reviewer 1's recommendation, we have shortened the Results section, adding focus group exchanges to speech bubbles (Figures 2 and 3).
- Lines 120–140: Provide a clearer justification for the sample size and its adequacy for grounded theory.
    - We have expanded this methodology section to include justification for the relatively small sample size in relation to reflexive grounded theory (reaching theoretical sufficiency) and the intensive nature of the study.
    - In response to Reviewer 1 comments, we have added a Limitations section (Section 2.1.3). This section states there is a risk that some perspectives may not be captured given our small sample size, even though we perceive theoretical sufficiency was reached.
- Line 185: There appears to be a numerical inconsistency. The reported mean value (49 minutes) exceeds the stated maximum of the range (38 minutes). This may be a typographical error and should be clarified.
    - This typographical error has been amended to: "We conducted thirteen semi-structured one-on-one interviews ranging in length from 37 to 59 minutes with a mean length of 49 minutes"
- Lines 230–233: The discussion of transcription as potentially "wasting time" would benefit from clearer relevance to the study's methodological choices.

    - We have adjusted our Methodology section and on review adjusted our description of transcription as during the analysis, we realised that verbatim transcription more accurately maintains the perceptions of our participants. We now say “We transcribed interviews and FGDs verbatim, ommitting non-lexical fillers, to maintain accurate representation of our participants”.
- Appendix A: The histograms presented in Figure A are currently difficult to compare across groups. For each parameter (e.g., gender, age, nationality), the three histograms representing the different groups should use identical x-axis categories and maintain the same ordering. At present, differences in category/range ordering and/or axis structure make cross-group comparison unintuitive. Standardising both the categories/ranges displayed and their order across all histograms would substantially improve readability and facilitate comparison between groups.
    - We have followed these suggestions and standardised categories and ranges on this Figure.

**3.2 Results and discussion**

- Section 3.1: The emphasis on privacy as the dominant ethical concern among participants is important, consider explicitly contrasting this with broader ethical dimensions earlier in the section.
    - We have adjusted the structure of Section 3 and broken it into smaller subsections to aid readability and navigation. To reflect this suggestion, we have explicitly contrasted the view that you have no privacy on leaving your home (Section 3.1.5) with that of other participants who were concerned with the ethics of satellite imagery once resolutions were very high such that privacy is not possible (Section 3.1.1).
- Section 3.3: The discussion on whether “data” or “interpretation” carries ethical risk is particularly insightful and could be further developed analytically.
    - We developed analytically interpretation of this idea in Section 4.6 with reference to positionality literature.
- Section 4.2: The critique of “checklist-style” ethical review is compelling but would benefit from engagement with existing literature on research ethics governance.
    - We have added references to ethics governance literature, specifically focusing on “ethics creep”.

**3.3 Language and style**

Several sentences are overly long and could be simplified for clarity (e.g., around lines 300–310).

- In response to Reviewer 1, sentences throughout the manuscript have been simplified and shortened.

Minor typographical issues appear throughout (e.g., repeated phrases, punctuation errors), which should be addressed in revision.

- These errors have been corrected.

**4 Recommendation**

**Minor revisions**

*Justification*

The manuscript addresses an important and timely topic with clear relevance to Geoscience Communication, and it demonstrates strong potential through its empirical basis and interdisciplinary ambition. However, some revisions are required to:

- sharpen the conceptual framing of ethics,
- improve methodological transparency,
- align scope and structure more coherently, and
- strengthen the practical applicability of recommendations.

With these revisions, the paper could make a meaningful and timely contribution to ongoing discussions on ethical geoscience practice and the responsible use of emerging data technologies in DRR contexts.

**Author revisions**

**Following feedback from Payne's PhD viva, we have adjusted the introduction again after revision 1:**

We have investigated a wider selection of related literature. We have firstly included literature from the critical remote sensing field. This field has developed largely over the last few years and, whilst recognising the improved environmental understanding gained from remote sensing, encourages researchers to employ reflexivity in their research of geohazards using remote sensing. Secondly, we also included references to literature from other disciplines which have similar structure to this manuscript: explores ethical issues within a research discipline and then presents recommendations to address these issues.

We added a clearer explanation of how we ended up researching this manuscript's topic- ethics of geohazard remote sensing. We explain our initial aim was to explore best practice advice on conducting and disseminating research on geohazards in societies which are politically or socially challenging for UK-based researchers to interact with.