Data collection: On 10/17/2023, DL used Web of Science to collect academic publications related to XAI in climate science. The following selection criteria are satisfied simultaneously:

- Journal selection: "BAMS" or "JAMES" or "GMD." (*Artificial Intelligence for Earth Systems*, at the time of data collection, was not included in the Web of Science, hence excluded from this survey)
- Topic[1] includes "XAI" or "explainable AI"
- Abstract includes "climate"

203 records were produced.

Data cleaning: DL further removed irrelevant records by scrutinizing the abstracts and constrained the publication date to 2000 and onwards, resulting in 178 records.

Data classification: These records were classified into four categories:

- Blackbox AI applications: research focused on AI model performance. Typically, researchers define training tasks and metrics for success, describe training data and process, and report outcomes, without explicating the explainability or interpretability of AI models.
- Explainable AI (XAI): research that primarily employs XAI methods such as gradient-based methods, LIME, layerwise relevance propagation, SHAP, etc.
- Interpretable AI: research that explicitly describes the interpretable components of AI models with a clear architecture purpose of interpretation.
- Reviews: review state-of-the-art AI applications.
- Miscellaneous: other types that do not fall into these categories. They include: workshop reports, perspective pieces, and others.

Results:

1: AI/ML publications in BAMS, JAMES, and GMD are predominantly "blackbox applications" (132 out of 178 records). Both XAI and Interpretable AI emerged in 2020 and are in their infancies by comparison.
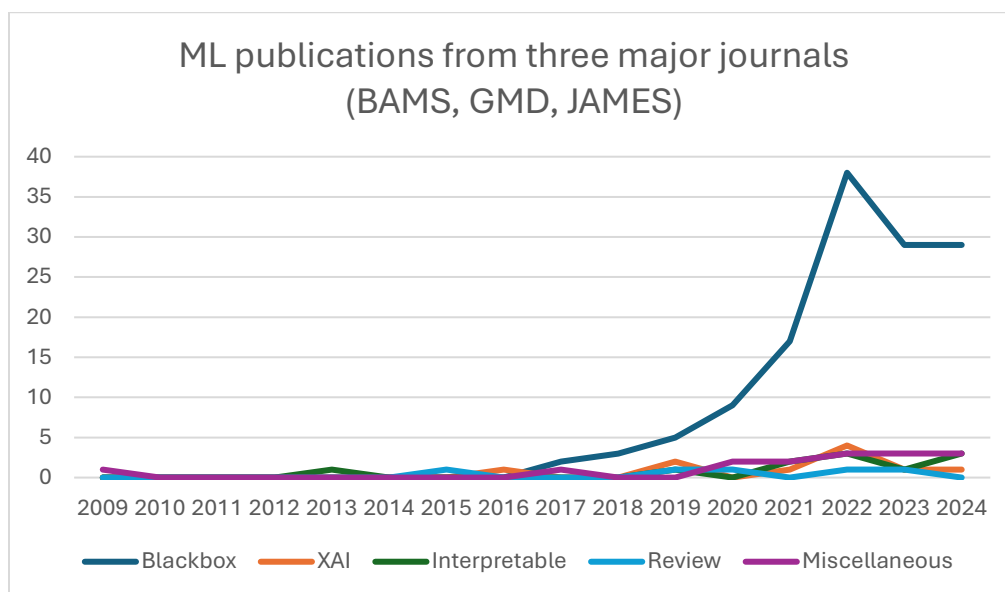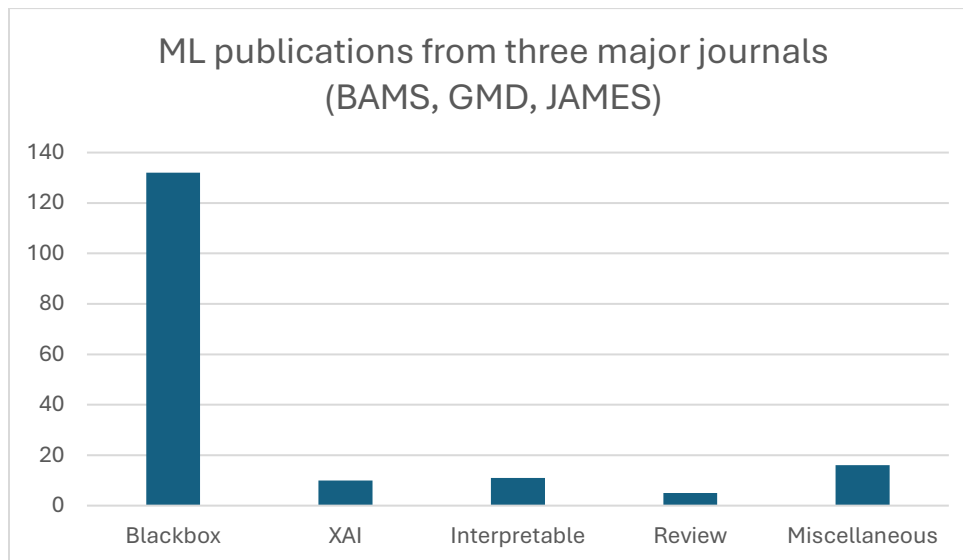
2: Blackbox AI applications are on the rise. (The dip in 2023 and 2024 can be explained away by data collection methods. Data were acquired in October 2023 and included only

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[1] "Topic" defined by Web of Science searches in the following fields within a record: "Title" "Abstract" "Author Keywords" "Keywords Plus."
(https://images.webofknowledge.com/images/help/WOS/hs_advanced_fieldtags.html, accessed 11/04/2024)

forthcoming or preprints. Thus, this data cannot capture the full scale of publications in 2023 or 2024).

ML publications from three major journals (BAMS, GMD, JAMES)

ML publications from three major journals (BAMS, GMD, JAMES)

Methodological flaws:

-   Selection bias: the data excluded journals such as *Artificial Intelligence for Earth Systems* because Web of Science did not include AIES at the time of data collection. This may cause potential bias in sample representation.
-   Labeling bias: the data were labeled by one of our authors, causing potential bias in data classification.