

The manuscript presents the ISTD, a database of sediment transport measured along Italian rivers. The text reads clearly, and the presented material is very interesting and useful in many applications.

A few comments that I hope will be useful in further developing an already good manuscript:

- lines 94-101: here you address limitations in terms of data connected to total sediment transport. It would be good to see a more extended discussion on the influence of natural and human-driven pressures on suspended and bedload, and on the need for proper, but separated, datasets to actually understand different processes. This might help in further connecting this paragraph to the following one on collecting suspended sediments data in Italy

We thank the reviewer for this useful suggestion. We agree that the original paragraph treated sediment transport too generally and did not sufficiently distinguish between suspended load, bedload, and total sediment transport. We have therefore expanded the Introduction to clarify that these components are controlled by partly different processes and may respond differently to natural and anthropogenic pressures. In particular, we now discuss how suspended sediment transport is commonly linked to fine sediment mobilization, runoff generation, vegetation cover, soil erosion, and catchment connectivity, whereas bedload transport is more dependent on coarse sediment availability, channel morphology, transport thresholds, and high-energy flow events. We also added a sentence stressing the need for separate and well-documented datasets for suspended load, bedload, and total load, in order to correctly interpret hydro-sedimentary processes and sediment budgets. This revision also improves the connection with the following paragraph, which introduces the historical collection of suspended sediment data in Italy.

- l.107-108: can you name these virtuous cases?

We thank the reviewer for pointing this out. We agree that the expression “in some virtuous cases” was too generic. We have revised the paragraph by explicitly mentioning examples of basins and research observatories where sediment transport monitoring persisted or was continued through repeated monitoring initiatives after the dissolution of SIMI. In particular, we now refer to the Adige River basin and the Piave River basin, including the Rio Cordon instrumented catchment, as well as additional datasets from northern and central Italian basins such as the Po, Tagliamento, Arno, Ombrone, and Versilia rivers. We also clarified that these examples do not imply homogeneous national continuity, but rather document local and research-based monitoring efforts with variable temporal and spatial coverage.

- l.143-147: standards on sediment transport data are very much limited, but the sentence “This participatory process enabled the identification of the most effective approaches to standardize data formats and ensure consistency and interoperability across heterogeneous datasets.” sounds a bit too risky, as questions might arise on how “most effective” was evaluated. Did you consider other approaches? What was the rationale behind the process of standardisation? Do you think that different stakeholders might have led to different standards? More details on this would help, especially if other scholars would like to replicate the approach in other regions

We thank the reviewer for this useful comment. We agree that the original wording was too strong, particularly the expression “the most effective approaches”, as no formal comparative assessment of alternative standardization procedures was carried out. We have therefore revised the sentence to clarify that the participatory process supported the development of a pragmatic and shared standardization strategy, rather than the identification of a universally optimal approach. We also

added a clarification on the rationale behind the adopted strategy, namely to organize heterogeneous datasets within a common relational structure while preserving the traceability of original data sources, measurement methods, instruments, units, and access conditions. Finally, we now explicitly state that the proposed structure should be considered a flexible and reproducible framework, suitable for the available datasets and adaptable to future contributions from different institutions or monitoring traditions.

- sec. 2.1: in describing the database, it would help knowing a bit more about sustainability (where is the server hosted and how its long-term functioning will be guaranteed, to avoid problems that happened in the past?) and quality control (how are the different roles established? do you have guidelines?). The quality check procedure might be even more important in the case of newly measured data

We thank the reviewer for this important suggestion. We have expanded Section 2.1 to provide additional information on the sustainability of the database infrastructure, user roles, and quality-control procedures. We now clarify that the database and web application are hosted on dedicated server machines provided by the University of Pisa and specifically configured for this project. This institutional hosting solution allows the platform to operate without direct maintenance costs for individual researchers, while the archived release deposited on Zenodo provides a frozen and citable version of the dataset and database structure, ensuring reproducibility and long-term accessibility independently of the dynamic web application.

We have also clarified how user roles are established. Newly registered users are assigned a viewer role by default, allowing data consultation while preventing uncontrolled modifications or imports. When users intend to contribute new datasets, an exchange with the database administrators is carried out during the activation or role-upgrading phase to evaluate their affiliation, expertise, type of contribution, and consistency of the proposed data with the database structure. Recognized contributors can then be assigned an editor role.

Finally, we added a more explicit description of the current quality-control approach. At this stage, quality control is mainly based on data traceability, controlled vocabularies, mandatory metadata fields, and consistency checks before records are written to the database. We also clarified that, for historical datasets, the database cannot remove all uncertainties inherited from the original sources, but it makes them explicit and traceable through the relational structure. For newly measured data, the same controlled workflow represents a first level of quality assurance, while the development of more detailed and documented quality-control guidelines is identified as a priority for future updates of the platform.

- before describing the results, it might be good to provide a map of Italy with both rivers and river basins reported in the database. Even if accessible online, such a map could help readers see how monitored rivers are distributed across the country. This might supplement the detail given at lines 386-389

We thank the reviewer for this useful suggestion. We agree that a spatial overview of the monitored rivers and river basins can help readers better understand the geographical coverage of the database before entering the detailed description of the data records. Accordingly, we added a new figure at the beginning of the Results section showing the distribution of monitoring stations, the river network, and the corresponding watershed boundaries included in the database.

The new figure provides a visual summary of the spatial distribution of the available observations across Italy and complements the information previously reported at lines 386–389. We also added a short introductory paragraph in the Results section to describe the figure and to highlight its role in linking the data records to their hydrographic and basin-scale context.

- l.298-303: I fully agree on the need for metadata to obtain reliable and interpretable results, and this loss of details questions the reliability of the data associated with “unknown”. It would help to have some comments on the quality of those data, and their limits of applicability. Authors are encouraged to provide more critical feedback on the database

We thank the reviewer for this important comment. We agree that the presence of records associated with an “unknown” instrument required a more explicit and critical discussion. We have therefore expanded the Results section to clarify that this classification does not necessarily imply low-quality or unreliable measurements, since many of these data may derive from historical sources or previously processed datasets considered valid by the original data providers. However, we now explicitly state that the absence of information on the measurement instrument limits the possibility of assessing methodological comparability, instrumental uncertainty, and potential biases among datasets.

We also clarified the limits of applicability of these records. Data associated with an “unknown” instrument can still be useful for exploratory analyses, historical reconstructions, and broad assessments of spatial and temporal data availability, but they are less suitable for detailed comparisons among measurement techniques, uncertainty analyses, or model calibration procedures requiring fully documented metadata. We have also emphasized that the database does not remove the limitations inherited from the original sources, but makes them explicit and traceable.

Following this point, we further strengthened the Discussion by highlighting that the database is not only a repository of existing records, but also an operational tool to improve future monitoring practices. By making data gaps, missing metadata, and inconsistencies visible before new field campaigns or monitoring activities are planned, the platform can help define a minimum set of information that should accompany newly collected data. In this perspective, future data collected within or in relation to this framework can potentially achieve higher levels of metadata completeness, traceability, and reusability than many historical datasets.

- is Figure 7 (and the related analysis) influenced by the temporal coverage of the data, for example with old data monitored less frequently?

We thank the reviewer for this important observation. We agree that the interpretation of the temporal coverage figure can be influenced by the heterogeneous temporal coverage and monitoring frequency of the datasets included in the database. In particular, older records may be less frequent, less regular, or less standardised than more recent datasets, depending on the original monitoring programme, data source, and parameter considered.

We clarified this point in the revised manuscript. Specifically, we now state that Figure 8 represents annual data availability and does not imply homogeneous monitoring frequency within or among years. We also clarified that Figure 8 should be interpreted together with the monitoring-frequency

analysis reported in Figure 7, which specifically describes the typical sampling frequency and temporal resolution of the records included in the database.

Therefore, Figure 8 should be interpreted as a descriptive overview of temporal data availability, rather than as a direct measure of uniform monitoring effort or sampling frequency through time. We have added this clarification to avoid possible misinterpretation and to emphasise that differences in temporal coverage and monitoring frequency are an inherent characteristic of the compiled database. These aspects are now explicitly mentioned as factors that should be considered when using the dataset for comparative, temporal, or trend-based analyses.

- L. 372: I would not call it “temporal complementarity” as I see this term too positive, while, in my opinion, the lack of contemporary measurements hinders many analyses. But I leave this point to the authors

We thank the reviewer for this useful comment. We agree that the expression “temporal complementarity” may give an overly positive interpretation of the heterogeneous temporal coverage shown in the figure. We therefore revised the sentence and replaced this term with the more neutral expression “heterogeneous temporal coverage”.

We also added a sentence to explicitly acknowledge that this heterogeneity, and particularly the lack of contemporary measurements among some parameters and monitoring stations, may limit integrated analyses of hydrological, physicochemical, and sediment transport processes. This clarification better reflects the limitations of the compiled database while maintaining the descriptive purpose of the figure.

- please consider moving Fig. 8 and its description as the first point of sec. 3.1, to first describe where the data were measured, and then what they look like

We thank the reviewer for this useful suggestion. We agree that the spatial distribution of the monitored rivers and basins should be presented before describing the structure and temporal characteristics of the data records.

To address this point, we added a new figure at the beginning of the Results section, before the detailed description of the data records. The new figure shows the spatial distribution of the monitoring stations, the river network, and the corresponding watershed boundaries included in the database. This provides readers with an immediate overview of where the data were measured and helps contextualise the subsequent figures and analyses describing the characteristics, frequency, and temporal coverage of the records.

Accordingly, rather than moving the original Fig. 9, which specifically describes the temporal coverage of the dataset, we introduced a dedicated spatial overview figure at the start of the section. We also added a short introductory paragraph and caption to describe this new figure and to clarify its role in linking the data records to their hydrographic and basin-scale context.

- please adjust the alignment of the first panel (Watershed with Sediment data) in Fig. 9

We thank the reviewer for noticing this issue. We adjusted the layout of Fig. 10 to ensure that the first panel is aligned consistently with the other panels. The misalignment was due to the different

legend/colorbar structure of the first panel compared with the remaining panels. In the revised figure, the panel layout has been harmonised, and the first map is now aligned with the rest of the figure.

- l. 451-452: please explicitly state which EU directives

We thank the reviewer for this comment. We agree that the previous formulation was too generic. We have revised the sentence to explicitly mention the relevant European directives, namely the INSPIRE Directive 2007/2/EC and the Open Data Directive (EU) 2019/1024. These directives are directly relevant to the topics discussed in the manuscript, as they address spatial/environmental data infrastructures, interoperability, metadata, accessibility, and the re-use of public-sector data. The revised sentence now more clearly specifies the European policy framework to which the database approach refers

- l. 487-490: I agree on the need for data quality assurance and documented procedures. But, from your sentence, it is not fully clear how the “rapid visualization and analysis of temporal distribution and data gaps” in your database contributes towards these aspects. I suggest rephrasing this paragraph

We thank the reviewer for this helpful comment. We agree that the original sentence did not clearly explain the link between the visualisation of temporal coverage and data gaps and the broader issue of data quality assurance.

We have rephrased the paragraph to clarify that the database supports preliminary data-quality assessment rather than replacing formal quality-control procedures. In the revised text, we specify that the visualisation of temporal coverage, acquisition frequency, and data gaps helps identify discontinuities, irregular sampling intervals, and periods requiring further verification. These diagnostics provide a basis for documenting the effective completeness and regularity of each time series and for guiding subsequent quality-control procedures.

- l. 493-495: please check the language

We thank the reviewer for pointing this out. We have revised the sentence to improve clarity and avoid the ambiguous parenthetical construction. The revised text now reads: “Central Italian basins are less represented, although data are available for some smaller river basins, such as the Versilia River (Francalanci et al., 2013). Southern Italian basins are almost entirely absent from the database.”

- l.504: this is the first time you spoke about the “data call”. I suggest adding more comments in the Introduction, as readers might get confused

We thank the reviewer for this useful suggestion. We agree that the term “data call” needed to be introduced earlier and more clearly explained. We have therefore added a short clarification in the Introduction to define what we mean by “data call” in the context of this study.

In the revised manuscript, we now explain that the data call consisted of a targeted request for existing sediment transport and related hydrological datasets and metadata from public institutions, research groups, river basin authorities, and monitoring agencies. We also clarify that this step was aimed at identifying and integrating datasets that were not already available through open repositories or standardised national platforms.

- l.513-519: you presented here a few significant limitations. What are the plans to address them? I suggest integrating this paragraph with the following one, presenting actionable steps and not

remaining too vague. Accountability and bureaucracy might also be major obstacles, and authors are encouraged to provide critical comments on this

We thank the reviewer for this important suggestion. We agree that the previous version of the paragraph identified relevant limitations but did not sufficiently explain how these limitations could be addressed in practice. We have therefore integrated this paragraph with the following one and revised the text to include more concrete future actions.

In the revised manuscript, we now specify that future development of the database will focus on defining a minimum metadata template for new data contributions, implementing semi-automatic validation procedures, and using the platform as an operational reference to identify data gaps and harmonise future monitoring activities. We also clarify that validation procedures should help detect missing metadata, inconsistent units, duplicated records, anomalous values, and temporal gaps before data are integrated into the database.

Following the reviewer's suggestion, we also added a more critical discussion of governance and institutional constraints. In particular, we now acknowledge that bureaucratic constraints, fragmented responsibilities among agencies, the lack of formal data-sharing obligations, and unclear accountability may remain major obstacles to the long-term development of a comprehensive national sediment transport archive. We further state that strengthening collaboration with public authorities, river basin districts, regional agencies, and research institutions will be necessary to move from voluntary data contributions toward more structured and documented data-sharing workflows.