Review of the manuscript essd-2023-363 '*A global dataset of the shape of drainage systems*' by *He et al.* submitted to *ESSD*.

Recommendation: ACCEPT

Focus of the paper: differentiating on drainage basins which delineate the Earth's land surface into individual water collection units.

Relevance: The presented study is the original primary research within scope of the journal.

Title: the title and abstract of this paper clearly reflect its content.

Abstract is well written and clearly describes the undertaken study.

Structure: The article is well organized with structured sections. The structure of the manuscript conforms to the journal standards and discipline norm. It has the following standard sections: Introduction, Methodology, Results, Discussion, Conclusion, References. Some sections are divided into the minor subsections and paragraphs for a better structure. The numeration of the sections is correct and consecutive.

Logic: Overall, the presentation of the work clear, with regards to language and grammar. The clarity of the text logic and organization of the paper is sufficient. It demonstrates the consistent interpretation of the results with detailed explanations and comments. A comparison of the results with those in previous studies is presented.

Introduction presents a background, defines research goals and provides a clear statement of research problem. The introduction presents the purpose of the research investigation and the purpose is supported by the pertinent literature. The Introduction well describes the research. Introduction and background show context of the article. Literature is well referenced and relevant.

Study area: is described with sufficient details.

Research questions and goal are identified. Objectives are relevant to the study aim.

Literature regarding the relevant topics is reviewed, formatted according to the journal rules and appropriately referenced. Major sources include published papers on hydrology and GIS.

Research gaps and weakness in former works are described: a high-resolution global dataset for the boundaries and geometry of basins is still missing.

Motivation is explained: Basin shape and river sinuosity determine water and sediment dynamics, affecting landscape evolution and connectivity between ecosystems and freshwater species.

English language: acceptable. Clear, unambiguous, professional English language used throughout.

Data used in this study are described: 90-meter resolution DEM. Data are explained, sources are mentioned.

Methods: Using a 90-meter resolution digital elevation model, the authors measured the areas, lengths, widths, aspect ratios, slopes, and elevations for basins greater than 50 km2 globally. Thus, methods described with sufficient detail and information. The workflow is well structured and clearly described with sufficient information to reproduce the approach.

Results are reported: The authors calculated the lengths and sinuosities of the longest river channels within these 0.67 million basins and measured the areas, lengths, widths, aspect ratios, slopes, and elevations for basins. The Results are presented with clarity. The results are relevant to the initial research goals and objectives and highlights major achievements of this study.

Discussion interpreted the major outcomes of this study: the authors discussed the useability of their new dataset. Basin90m, available in Shapefile format, can be used in various GIS platforms, including QGIS, ArcGIS, and GeoPandas. The advantages of the obtained results are described. The Discussion described the issues of methodology and results.

Conclusion The importance of this paper is well summarized as follows: The authors built a new global dataset, Basin90m, to present the basins and rivers, as well as their morphological metrics. The conclusions are appropriately stated and connected to the original questions. Conclusions are well stated, linked to original research question, limited to supporting results and summarized the study with interpretation of facts.

Actuality, novelty and importance of the research is clear: by comparing with HydroSHEDS, Goole Earth images, and a few other datasets, the authors have demonstrated the high accuracy of Basin90m. Basin90m has substantial application prospects in geomorphology, hydrology, and ecology.

Academic contribution: to highlight the use cases of Basin90m, the authors explored differences between the nine stream orders, spatial distribution of drainage systems, and correlations between morphological metrics, such as Hack's law.

Figures The authors presented maps and figures which are of acceptable quality, easy to read, relevant and suitable. Figures are labelled and appropriately described. They illustrate the results of the undertaken study.

Recommendation: This manuscript can be ACCEPTED based on the detailed report above.

With kind regards,

- Polina Lemenkova.

20.11.2023.