Review of the manuscript '*Dams in the Mekong: A comprehensive database, spatiotemporal distribution, and hydropower potentials*' by *Ang et al.* submitted to *ESSD*.

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Recommendation: <mark>ACCEPT</mark>

Focus of the paper: The authors presented an open-access and unified database of dams which have increased along the Mekong due energy demands from economic development and capital from private companies.

Relevance: The presented study is the original primary research within scope of the journal since it presents Earth System Science Data.

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.

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 present 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, hydrological issues of the Mekong Basin and water management papers.

Research gaps and weakness in former works are described: swift dam evolution has rendered many databases outdated, in which mismatches arise from differing compilation methods.

Motivation is explained: Without a comprehensive database, up-to-date spatial assessment of dam growth is unavailable.

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

Data used in this study are described: The dam count of 1,055 is more than twice the largest existing database, with many hydropower dams generating a boom in hydropower capacity. Moreover, the Mekong dam database is publicly available with provided link: DOI: 10.21979/N9/ACZIJN.

Methods: Methods described with sufficient detail and information to replicate. The methods are described sufficiently to allow the research study to be repeated by other parties in similar research. Modifications of the existing methods are mentioned briefly. The workflow is well structured and clearly described with sufficient information to reproduce the approach.

Results are reported: The authors offer an open-access and unified database of 1,055 dams. They performed a spatiotemporal analysis of dams on a sub-basin and country level from the 1980s to the post-2020s. Moreover, they assessed a grid-based theoretical basin-wide hydropower potential, using present-day discharge from the CaMa-Flood model (2011-2015, 0.05 degree),

and future discharge from the WaterGAP2 model used for ISIMIP2b (2021-2030, 0.5 degree). The authors also compared the spatial difference: while China had the largest capacity , Laos has the most planned dams and the highest projected growth.

Discussion interpreted the major outcomes of this study: the authors commented, among others that hydropower potential specifically within the Mekong remains to be systematically evaluated. In view of this the value of the presented study is clear.

Conclusion Based on present-day discharge, the authors estimated a basin-wide hydropower potential in the study are, where Laos is the highest. Conclusions are well stated, linked to original research question, limited to supporting results. The authors also conclude that based on future discharge modeled with climate change, hydropower potential could grow to over 2 M MW. Laos and China are the highest, together forming over 80% of the total potential.

Actuality, novelty and importance of the research is clear: the novel database facilitates research on dam-induced hydrological and ecological alterations, while spatiotemporal analysis of hydropower capacity could illuminate the complex transboundary electricity trade.

Academic contribution: Through both spatiotemporal and hydropower potential evaluation, the authors addressed the current and future vulnerability of countries to dam construction, highlighting the need for better planning and management in the future hydropower hotspot Laos.

Figures The authors presented 7 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.