

This study constructs a long-term (1930–2024) and high-resolution dataset of global lime production CO₂ emissions and carbonation sinks, covering 11 major lime-producing countries and including blast furnace slag (BFS) for the first time. The research topic is important, the method is rigorous, the data quality is high, and the results are reliable. It effectively fills the gap of lime carbonation sink in the global carbon budget and has important scientific significance and application value.

However, minor revisions are needed regarding data description, parameter explanation, figure annotation, and partial expression. After minor revisions, the manuscript meets the publication standards of *Earth System Science Data*.

1. The manuscript involves many abbreviations and symbols in the equations, it is better to provide a list of abbreviations to let the readers easy to look up.
2. Line 262-264: “Beyond the production stage, nine industrial byproducts and materials are incorporated across three sectors: metallurgy (SS, BFS, RM), chemicals (PCC, CS, SUG, LM), and construction (LSS, MOR)”. Why focusing on these nine industrial byproducts and materials? Do you have a reference to support the products selection?
3. The format of equations should to be consistent. For example, Line 255 is (3), while others are labeled as “Eq (4)”. Also, there are many equations appears in the text, and not numbers. For example, an equation in Line 300 and all equations in section 2.3.2. Please double check the formatting requirement of ESSD and revise them accordingly.
4. There are several typo errors, such as “CO2” should be “CO₂”.
5. Section 3.4: Strengthen the mechanism explanation of the time- lag effect in the discussion to clarify why historical carbon sequestration keeps rising.
6. It is recommended to add “future work” to illustrate how to make the research better. For example, future scenario projections (2025–2050) will to studied to support global and national carbon neutrality goals.