

## Peer Review Report

# Review Report on Global mean and relative sea-level changes over the past 66 Myr: Implications for Early Eocene ice sheets

Original Research, Earth Sci. Syst. Soc.

Reviewer: Sean Gulick

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### EVALUATION

#### **Q 1** Please summarize the main findings of the study.

This paper represents a tour de force of methodological and comparative arguments for barystatic sea level changes in the Eocene which is critical for understanding pre-Oligocene climatic conditions. In particular, I appreciated the careful discussion of other SL curves, of ways to spot check the data in terms of specific records, and of interval checks between backstripped, proximal locations.

#### **Q 2** Please highlight the limitations and strengths.

Below are a series of line-by-line suggestions largely in wording to help improve the clarity of the manuscript and suggestions for more careful use of acronyms. However, these suggestions are truly minor as I found the arguments, methodology, and comparisons with past efforts to reconstruct sea level compelling.

#### **Q 3** Please comment on the methods, results and data interpretation. If there are any objective errors, or if the conclusions are not supported, you should detail your concerns.

Recommend publishing this manuscript after minor revisions and suggest that this argument for the presence of periods of significant ice volume within the supposedly ice-free Early Eocene is important to get out into the literature so that further discussion of climate dynamics can ensue.

#### **Q 4** Check List

Is the English language of sufficient quality?

Yes.

Is the quality of the figures and tables satisfactory?

Yes.

Does the reference list cover the relevant literature adequately and in an unbiased manner?

Yes.

Are the statistical methods valid and correctly applied? (e.g. sample size, choice of test)

Yes.

If relevant, are the methods sufficiently documented to allow replication studies?

Yes.

Are the data underlying the study available in either the article, supplement, or deposited in a repository? (Sequence/expression data, protein/molecule characterizations, annotations, and taxonomy data are required to be deposited in public repositories prior to publication)

Yes.

Does the study adhere to ethical standards including ethics committee approval and consent procedure?

Yes.

If relevant, have standard biosecurity and institutional safety procedures been adhered to?

Yes.

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**Q 5** Please provide your detailed review report to the editor and authors (including any comments on the Q4 Check List):

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Line-by-line

12: Suggest "...barystatic sea-level (BSL) changes..."

19: Is this sentence the result of this work or background to set up the next sentence. If the former it works as is. If that latter then maybe: "We show that peak..." and edit line 21 to be "However, the Early Eocene included several..."

20: Suggest "...at specific times in..."

26: Why not use RSL here since you introduced the term? So "Both the BSL and RSL estimates..."

75: Suggest "Although this ..."

81: Suggest adding "...(RSL).." since first time used in main body

88: Clearer would be "In this paper we address..." or "Here we address"

99-100 and elsewhere/refs: More correct would be Gulick, Shevenell et al., 2017 here since it's a co-first author pub.

114: "...has ruled thought.."- Interesting phrasing, could say "...has been largely assumed..."

124: Define GMGSL since first time use in main text.

127: Suggest "...the first BSL estimate ..."

179: Pushed ice sheets back is an odd turn of phrase, perhaps "...have suggested continental ice sheets were present in the Oligocene, as opposed to initiating in the middle Miocene, or even as early as the middle to late Eocene".

181: Long sentence so suggest starting the next one with "However, this leaves open..."

250, 258: Just use the acronym?

268: I think an errant tab here (as in still part of same paragraph)

276: spell out CCD

298 v 300: why different earlier Paleocene ages?

333: "...al. (2020)."

371: when not where

442: extra "in"

466: should be a comma not a semicolon

468: "...differences that these slopes..."

542: should be  $\pm 6.5$ m

553: BSL

564: Suggest "...for only half of the 8 Myr-long Early Eocene.."

573: Suggest changing "tills" to "glacial deposits on an East Antarctic shelf (Gulick, Shevenell et al., 2017)."

649: Suggest "these" instead of "they"

809 and 812: Not sure who "their" refers to here? 2021 model or 2022?

888: Perhaps insert "supposed" before "ice-free"

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**QUALITY ASSESSMENT**

**Q 6** Originality



**Q 7** Rigor

**Q 8** Significance to the field

**Q 9** Interest to a general audience

**Q 10** Quality of the writing

**Q 11** Overall quality of the study