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Ocean Science Discussions

Interactive comment on "Technical Note: Estimation of global loss of freshwater based on sea level changes over geological time" *by* Gaspar Banfalvi

Anonymous Referee #2

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This article is substantially based on a previous publication of the author, Banfalvi (2017). Comparing the two, I see the same kinds of arguments and conclusions, I see very similar figures and table values. Frankly, after reading, it appears difficult to me to find what in the new paper is really new and original compared to the former one. The author should briefly mention the results adopted from other publications, and then very clearly start formulating the core of the new article with new arguments and novel conclusions. As the Abstract says, the article's topic is that "The escape of hydrogen through the planetary air leak cannot be reliably judged. Our estimation of global freshwater loss used another approach based on the sea level changes that continuously fluctuated over geological time." However, a quick

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Discussion paper

look at Wikipedia, https://en.wikipedia.org/wiki/Atmospheric_escape, shows that a current estimate of gravitational escape is 3 kg/s of hydrogen. The author neither critically reviews such previous estimates nor even mentions them; apparently, he simply ignores those by declaring them “not be reliably judged”. He does not even attempt to estimate their uncertainties or discuss their weaknesses. On the other hand, his own conclusion does neither come up with an alternative new quantitative estimate for the escape rate, nor with any demonstration of reduced uncertainties by his suggested approach. The numerical result presented in the conclusion is the fluctuation of global sea level, adopted from a figure of another Wikipedia article, https://en.wikipedia.org/wiki/Past_sea_level#/media/ , in which two different estimates indicate vast uncertainties. But, in contrast to the author’s claim, sea level changes cannot simply be associated with gravitational escape rates. Sea level is not immediately related to water volume as long as it is unclear to what datum the level gauge did refer to in the very past. Sea level may change at constant volume also by dynamical changes of the hypsometric curve, due to continental drift or sea-floor deformation, due to earthquakes or emerging islands such as Iceland or Hawaii. And, in turn, even volume is not proportional water mass, as thermal expansion may change their mutual relation depending on paleo-temperatures, and ice may form and be deposited on land. The water mass at the Earth’s surface may also change as a result of volcanic ejections, by continental subduction or by impact of icy celestial bodies, just to mention a few aspects beyond gravitational escape. Radioactive processes deep below the surface may produce additional protons. The Earth’s water inventory is very effectively protected by the “cold trap” tropopause, before surface water may escape from the stratosphere or above. Are transfer rates across the tropopause consistent with the author’s loss rates? Partially compensating the loss of H+ ions, Earth is also receiving protons from the solar wind and cosmic radiation, as beautiful Auroras visibly prove. Evidently, there are numerous sources of uncertainties involved before sea level estimates may be considered as reasonable proxies for atmospheric escape rates. The author may want to carefully review and assess all such relevant processes in order

to make his claims more plausible and, ultimately, also quantitatively available. As a final remark, the quantity and unit of “osmolality” may be common in physiology and medicine, but it is not among the SI units. Papers in Ocean Science should strictly prefer SI units, however.

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