



Comment on **essd-2021-266**

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Referee comment on "100+ years of recomputed surface wave magnitude of shallow earthquakes" by Domenico Di Giacomo and Dmitry A. Storchak, Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2021-266-RC1>, 2021

Surface wave magnitude is the only scale to measure global earthquake size for more than a century. Currently, seismic moment is considered to be the best parameter to quantify the earthquake size, and moment magnitude M_w , another way to express seismic moment, is used for recent earthquakes. To calculate seismic moment or M_w , seismic waveform modeling is required, but such waveforms are systematically available only after 1960's. On the other hand, magnitude scales (including M_S) are based on reported values of amplitude and period, that are available for more than a century. The authors have digitized the old seismological station bulletins (reports of arrival times, amplitudes and periods of seismograms) at the International Seismological Centre, and made M_S catalog since 1904 for global earthquakes.

The paper is basically well written and almost publishable as is in Earth System Science Data. I provide some comments, which the authors may want to consider for making final manuscript.

- Title: a keyword "global" may be added to express the global distribution of earthquakes.
- Introduction well summarize the M_S scale and previous catalogs. In line 42, "over 46,000 earthquakes with $M_S \geq 4.5$ " may be somewhat misleading, as Figure 10 shows that M_c is much larger in the early period.
- Before Section 2 (Recomputing M_S), moving some parts of Section 3 (Station data) on collection of station bulletin at ISC, i.e., the first three paragraphs (up to line 100) or seven paragraphs (up to line 118), would be beneficial for readers. Such reorganization would require renumbering of figures, but solve appearance of "reporters" in line 57 before defined as "hereafter also referred as reports or data contributors" in line 89.
- Line 120: "secondary gap" may need more explanation, e.g., "the largest azimuthal gap in which only one station exists, and the error of this station may bias the

solution". It may be also worth mentioning that unlike body waves which radiates three-dimensionally and the stations are ideally distributed in the focal sphere, station coverage for surface waves are evaluated only in azimuthal direction, and radiation patterns of surface waves are symmetric (either two-lobed or four-lobed).

- Figure 10 is one of the important results of this paper. While the authors attributed the gap of small earthquakes ($M < 5.5$) between 1940 and 1950 to the World War II, similar (actually wider and clearer) gap is seen in magnitude timeline (bottom figure) between 1960 and 1979. Any explanation of this gap ?
- "Saturation" issue (Figure 12) is also important. The authors mention that variation in MS saturation (difference between M_w and M_S) is larger for earthquakes $8 < M_w < 9$ than those with $M_w > 9$. If we ignore 1946 Aleutian (typical tsunami earthquake) and 1952 Kamchatka (GR and Abe gave larger M_S values), the difference may be within the scatter of smaller magnitudes. Incidentally, Maule earthquake is 2010, not 2018 (line 219 typo), and neither 1965 Rat Island or 2005 Nias earthquakes is considered as "tsunami earthquake"