Posted on 3 Jan 2023 — The copyright holder is the author/funder. All rights reserved. No reuse without permission. — https://doi.org/10.22541/essoar.167276417.78056130/v1 — This a preprint and has not been peer reviewed. Data may be preliminary.

No observable temporal change of seismic properties in the Earth's outer core in a reported SKS dataset

Xin Zhang[1] and Lianxing Wen[1]

[1]Affiliation not available

January 3, 2023

Recently, *Zhou* (2022) reported temporal change of seismic velocity in the Earth's outer core based on relative travel time differences of SKS phase between some "doublets". The study further suggested existence of a possible 2-3% density deficit in the outer core and a localized transient flow with a speed of ˜40 km/year. We examine the seismic data of the best-quality "doublet" (event pair 19970503-20180910) reported in the study. We relocate the "doublet" based on a master-event relocation method (*Wen* , 2006) using the seismic data of the compressional waves that travel outside the outer core, including P or P*diff* , pP or pP*diff* , pPn, PP or P*diff* P*diff* , and PcP waves recorded at the global seismographic network. The later event (20180910) is found to be located 14.20 km away, 204.33°NW, of the earlier event (19970503) with a source depth 1.45 km deeper. After correction for the effects of relative source location and origin time, SKS signals exhibit no discernable relative travel time differences between the two events at the frequency band [?]0.2 Hz at all the four most anomalous stations (COLA, INK, ULN, YAK) reported in *Zhou* (2022). However, SPdKS-SKPdS phases, which start bifurcating from the SKS phases at the distance range of those four reported anomalous stations, exhibit evident changes of waveform and travel time between the events. The "SKS signals" used in*Zhou* (2022), which had a 50-s time window and were filtered from 0.01-0.05 Hz, contain signals of SKS and SPdKS-SKPdS phases. It is the changes of SPdKS-SKPdS phases, not that of SKS phases, that generate the apparent time shift in the low-frequency filtered "SKS signals" reported in *Zhou* (2022). The SPdKS-SKPdS phases of those reported anomalous stations sample a lowermost mantle region populated with ultra-low velocity zones (ULVZs). The separation of the two events is large and the SPdKS-SKPdS phases would sample ULVZs with slightly different paths between the two events, yielding different waveform and travel time (*Wen & Helmberger* , 1998). We conclude that there is no observable temporal change of seismic properties in the Earth's outer core in the seismic data used in *Zhou* (2022) and the reported relative travel time difference in the "SKS signals" in *Zhou*(2022) is caused by waveform and relative travel time changes in SPdKS-SKPdS phases due to slightly different sampling paths to the ULVZs at the bottom of the mantle between the events.

References:

Wen L, Helmberger D V. A two-dimensional P-SV hybrid method and its application to modeling localized structures near the core-mantle boundary[J]. Journal of Geophysical Research: Solid Earth, 1998, 103(B8): 17901-17918.

Wen L. Localized temporal change of the Earth's inner core boundary[J]. Science, 2006, 314(5801): 967-970.

Zhou Y. Transient variation in seismic wave speed points to fast fluid movement in the Earth's outer core[J]. Communications Earth & Environment, 2022, 3(1): 1-9.

iPoster for AGU22FM

AGU - iPosterSessions.com

Posted on 3 Jan 2023 — The copyright holder is the author/funder. All rights reserved. No reuse without permission. — https://doi.org/10.22541/essoar.167276417.78056130/v1 — This a preprint and has not been peer reviewed. Data may be preliminary.