EGU24-4521, updated on 09 Dec 2024
https://doi.org/10.5194/egusphere-egu24-4521
EGU General Assembly 2024

Multidisciplinary Implications from the post-2015 Chandler Wobble Anomaly

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Given the disappearance of the 6-year beat in recent polar motion data, we have pointed out that the Chandler Wobble (CW) has not been excited since 2015 and further examined if the presently available Earth-system-modeling data can explain the anomaly (Yamaguchi and Furuya 2024, doi:10.1186/s40623-023-01944-y). Here we discuss its implications from meteorological and geodynamical points of view.

We confirmed that two independent atmospheric angular momentum (AAM) data from ERA5 and JRA-55 were almost in perfect match with each other in terms of their persistently smaller contributions to the CW excitations in recent years. We thus examined the temporal changes in the regional contributions to the global AAM, using JRA-55 reanalysis data. While the mass term exhibited no significant changes in any latitude zones throughout the analysis period, the motion term in some latitude zones exhibited larger amplitudes since 2015 than before. We speculate its possible connections to the recent anomalies of the quasi-biennial-oscillation in 2015/2016 and 2019/2020.

Another important conclusion in Yamaguchi and Furuya (2024) is that the quality factor (Q) of the CW is not as high as 100, which has been preferred in previous studies, whereas there have been a couple of times differences even in the recent Q estimates; e.g., from 49 by Furuya and Chao (1996), 97 by Seitz et al (2012), 127 by Nastula and Gross (2015). While Smith and Dahlen (1981) preferred Q~100 and quantitatively interpreted the period and Q in terms of a frequency-dependent mantle anelasticity, the lower Q than previously thought will suggest a need to revise the theory and have an implication for the lower-mantle rheology.