The First-time Absence of Chandler Wobble since 2015 in the Observation History

*Ryuji Yamaguchi[1], Masato Furuya[2]

1. Department of Natural History Sciences, Graduate School of Science, Hokkaido University, 2. Department of Earth and Planetary Sciences, Hokkaido University

The Chandler wobble (CW), one component of the Earth's polar motion is a so-called free motion excited by mass redistribution of the atmosphere and ocean and their motion relative to the solid Earth (Gross 2015). The observed Chandler period is 433.7±1.8 days (e.g., Furuya and Chao 1996), and has been regarded as a single value of "free oscillation" and does not vary with time. Okubo (1982) simulated that the Chandler period could seem time-variable depending on the prescribed Q, in which a Gaussian random process was assumed for the excitation. Meanwhile, there is no previous work based on modern space geodetic data on whether the Chandler period is time-variable or not.
In this study, we first investigated whether the Chandler period is variable or not based on the minimum excitation assumption (e.g., Wilson and Vicente 1990).
Unexpectedly, the Chandler period seems to have been shortened since 2005 and apparently reached around 380days, which is in conflict with the previous theoretical studies. In addition, the 6-years-period beat of the polar motion itself has been obviously weaker than before after about 2005. These observations suggest some anomalies in either/both the atmosphere or/and ocean or possibly inland hydrologies after 2005. Therefore, we performed the least squares modelling of the polar motion data with and without the Chandler component.
First, we fitted the polar motion data with the "standard" model that consists of annual wobble, the Chandler wobble (whose period is varied from 380 days to 450 days by every day), and the quadratic long-term motion. Next, we examined the residual between the model and the data. The result of this analysis shows that the standard 3-component model cannot explain the polar motion after 2005 because the residuals become larger over time.
Similarly, the 2-component model that excludes the CW was fitted to the data, changing the temporal coverage of polar motion. As a result, the 2-component model is well fitted to the data particularly after 2015. These results suggest that the CW had begun to behave abnormally in 2005 and been completely damped in 2015. In other words, we may conclude that the CW is not excited since 2015. Although the amplitude of the CW has been known to be small in the 1920s (e.g., Vondrak 2005), this is the first-time absence of the CW in the history of polar motion observations.
To seek the cause of the "missing" CW, we next examined the power level of the atmospheric and oceanic angular momentum functions (AAM and OAM) that are available from the Paris Observatory. The AAM and OAM are based on the NCEP reanalysis data and the output from the ECCO model, respectively. To examine the temporal changes in the excitation level of the AAM and OAM, we first clipped the 10 years' of AAM and OAM function data from the entire period and examined if the noise level has changed over time. The result did not show any reduction in the noise level even after 2005 when the Chandler wobble started to be disappeared. Furthermore, we integrated the AAM and OAM function setting zero initial values to see if the CW excitation has changed over time. As a result, we could not observe the fore-mentioned recent changes in CW, suggesting that the currently available AAM and OAM functions are not able to explain the recent CW excitation processes. It is important to note that the power level of both AAM and OAM does not show any significant temporal changes, despite the amplitude of the CW is almost zero after 2015. We speculate that other unaccounted processes are still not included in either/both AAM or/and OAM.

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