Chandler wobble and LOD variations in recent epochs

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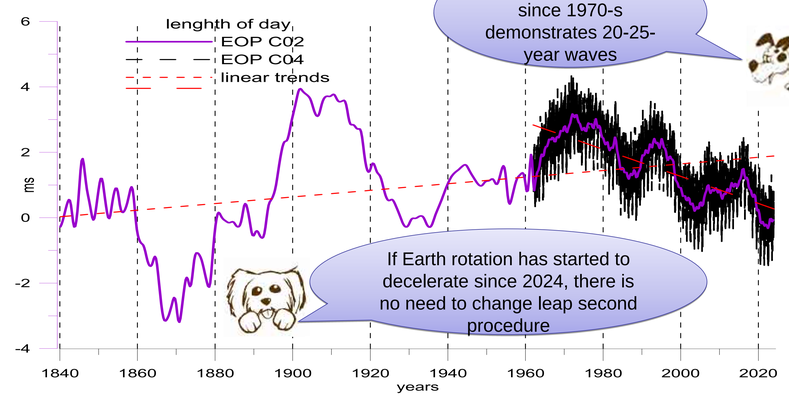
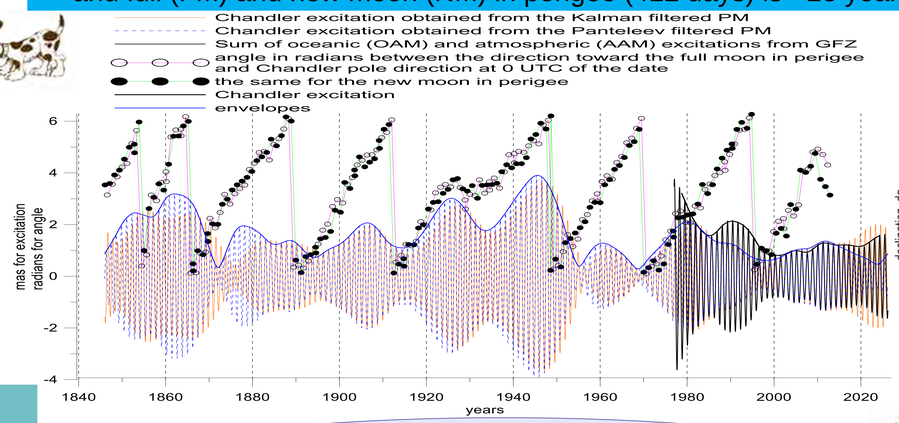
Abstract: In 2020s the greatest minimum of the length of day (LOD) since 1930s and Chandler wobble (CW) amplitude drop have been recorded. Some researchers relate these anomalies to the processes at the core-mantle boundary, to the deceleration of the inner core, and to global warming, others – to the mutual destruction of the atmospheric and oceanic excitations. We point out to another circumstance: the epochs of alignment of the line of lunar nodes, line of apse, and line of equinoxes, occurred in 1920-30s and 2010-20s. We think that asymmetry of the distribution of new and full moon in perigee events over celestial hemispheres and orientation of the plane of lunar orbit with respect to equator is able to change the amplitude of tides and produce effects in the ocean, atmosphere, and core, responsible for CW decay and some other global geophysics.

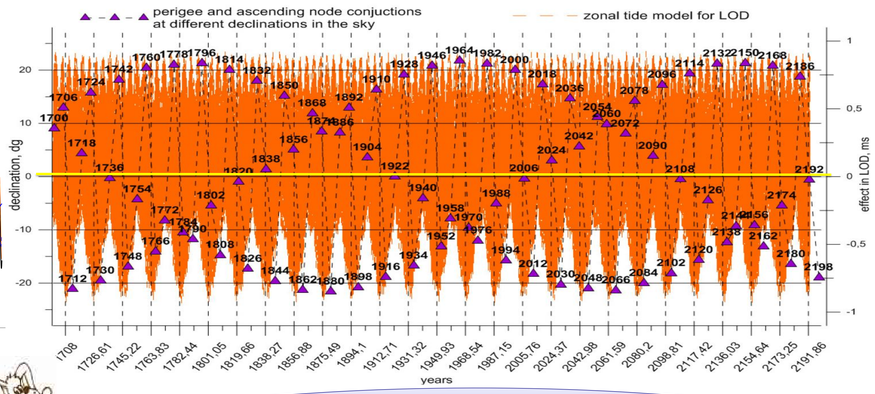
Length of day LOD variations



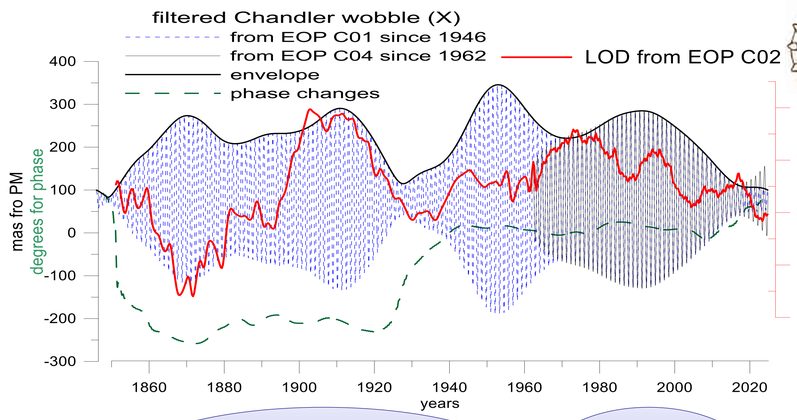
The modulation (beating) period between the Chandler period (433 days) and full (FM) and new moon (NM) in perigee (412 days) is ~23 years



Every 6 years perigee meets lunar ascending node at different declinations in the sky (left scale) which influence the tide (upper and bottom envelope)



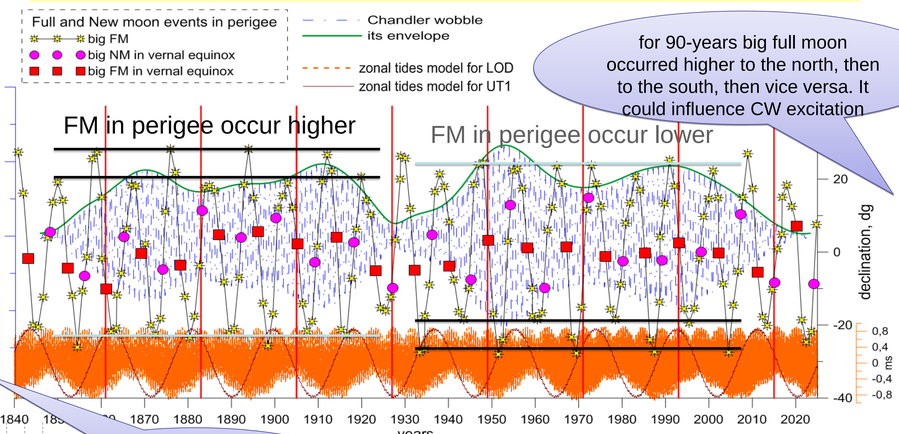
Chandler wobble (CW) X-component (Y- similar) changes



Chandler wobble excitation obtained as inverse problem solution shows 23-year beat in good correspondence with the angle between the perigee and pole directions at noon

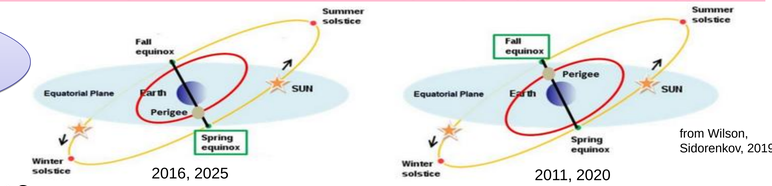
In the 1922 and 1940 ascending node and perigee met in autumn equinox, in 2006 and 2024 it happened in vernal equinox, which correspond to the epochs of LOD and CW minima. Next co-alignment will be around 2110

Hemispherical asymmetry of FM in perigee (yellow stars) events corresponding to the Chandler wobble rise and falls

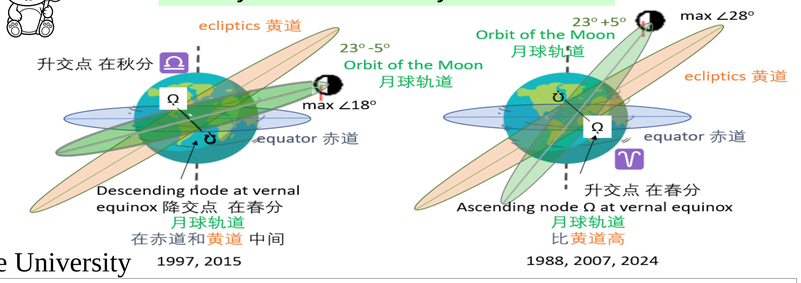


for 90-years big full moon occurred higher to the north, then to the south, then vice versa. It could influence CW excitation

8.85-year eastward cycle of perigee (line of apses)



18.6-year westward cycle of nodes

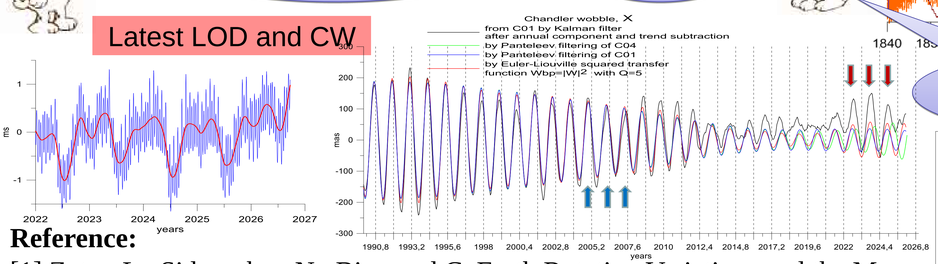


CW amplitude decreased in 1920-30-s and 2010-20-s when LOD was at minima, CW phase at that changed by π

It is seen with necked eye that CW has started upset down

CW rise when FM goes 3 times up, 2 times down and vice versa

Latest LOD and CW



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Conclusion: We believe that Chandler wobble (CW) amplitude changes are non-random. Rise and falls occur with ~23-year intervals, which could be in result of modulations caused by the perigee cycle of the Moon. The largest drops of LOD and CW amplitude in 2030-s and nowadays occur at epochs of collinearity of line of apse, nodes and equinoxes. Phase inversions of CW could be caused by asymmetry of new and full moon events in perigee declinations between the hemispheres over 90-year intervals. Such events produce the strongest tides and could have some unknown fingerprints in the oceanic currents, atmosphere and core, exciting resonant CW.

Reference:

[1] Zotov L., Sidorenkov N., Bizouard C. Earth Rotation Variations and the Moon Apsidal-Nodal Effects, in: Problems of Geocosmos-2024. Switzerland: Springer, 2026. P. 289-312. https://doi.org/10.1007/978-3-031-92928-1_21