

On Ice Ages and the Earth's Dynamical Ellipticity

**Mohammad Farhat
Jacques Laskar
Gwenaël Boué**

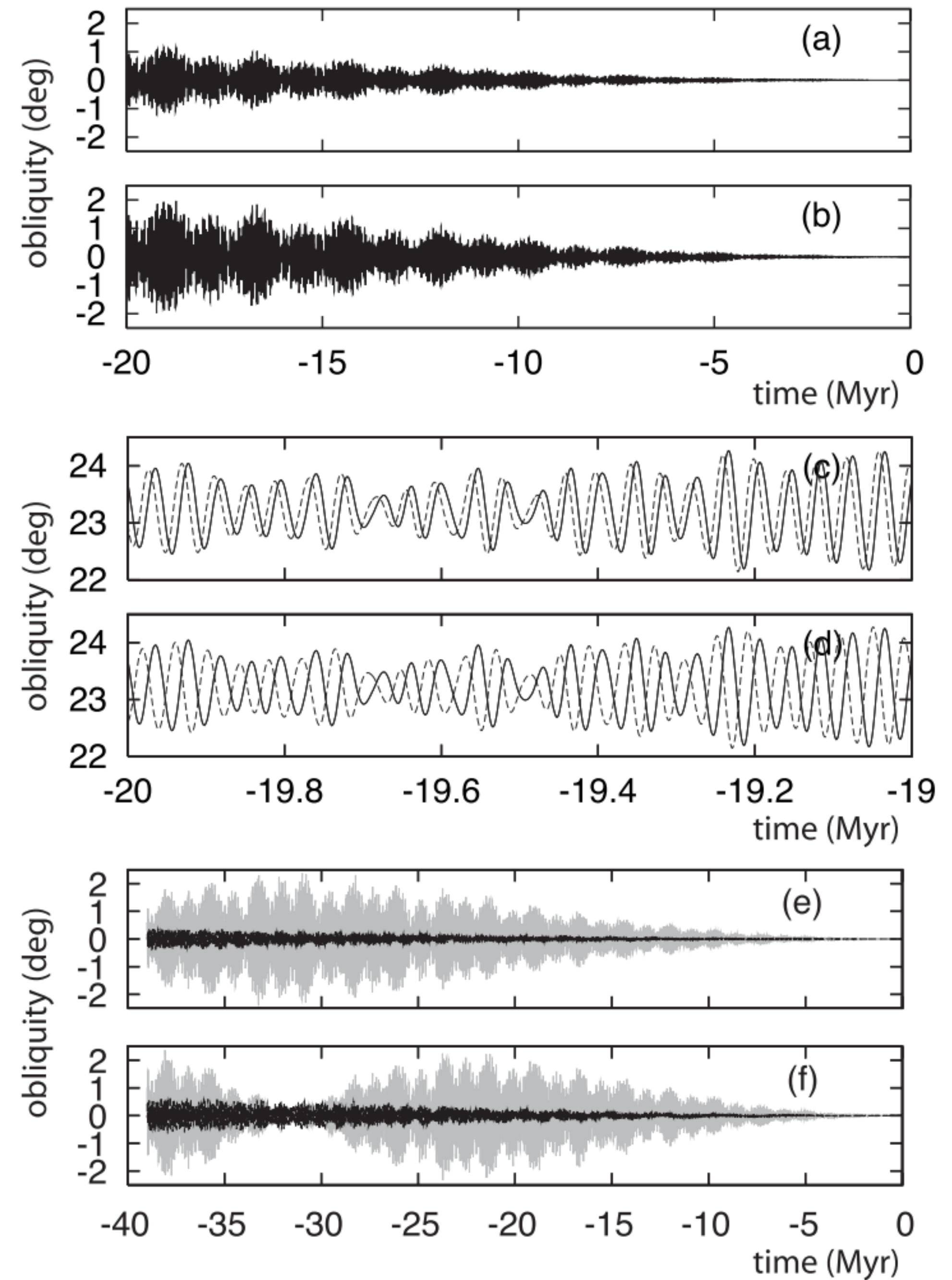
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EGU22 - May 24, 2022

Lost in Deep-Time...

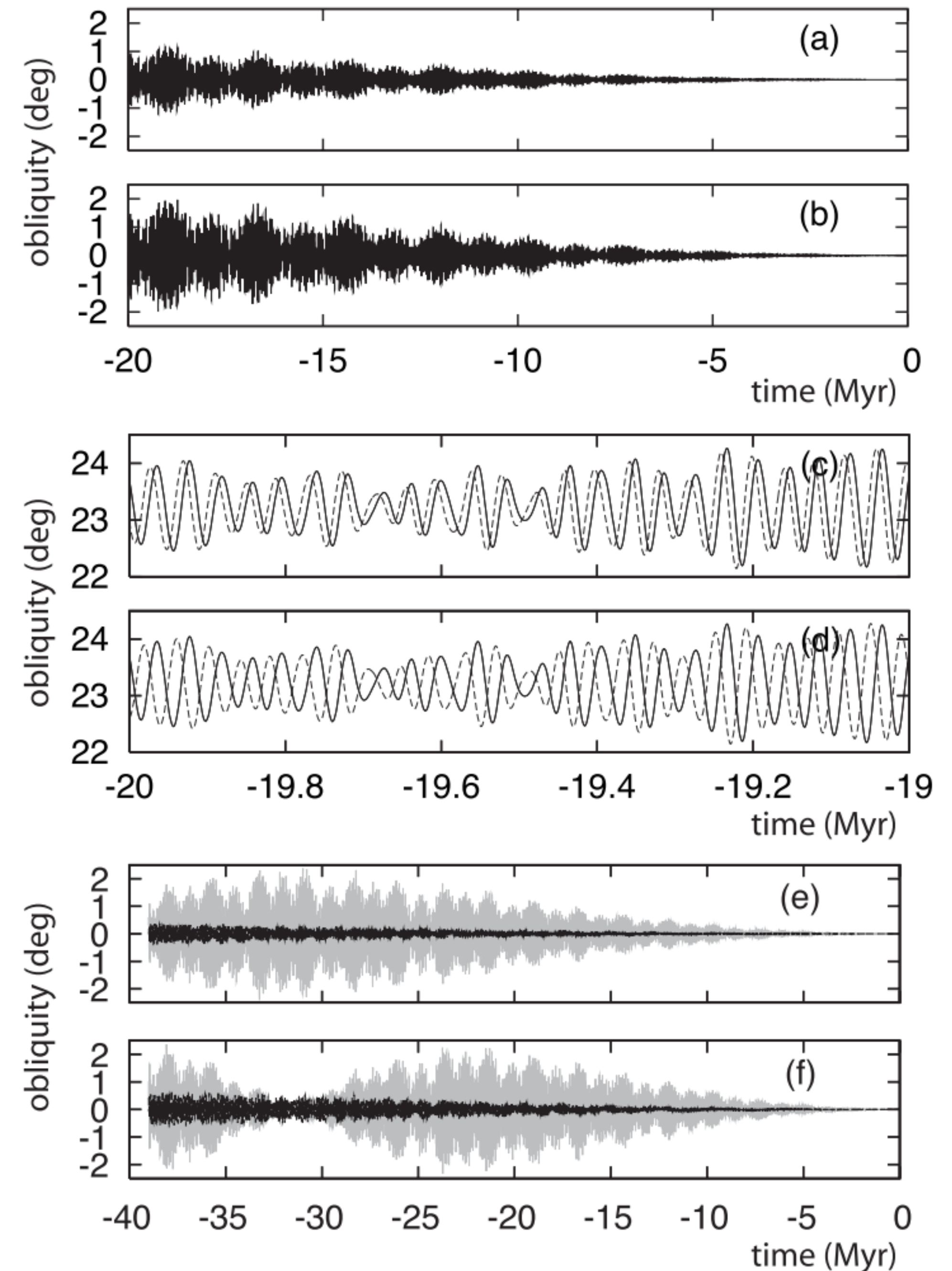
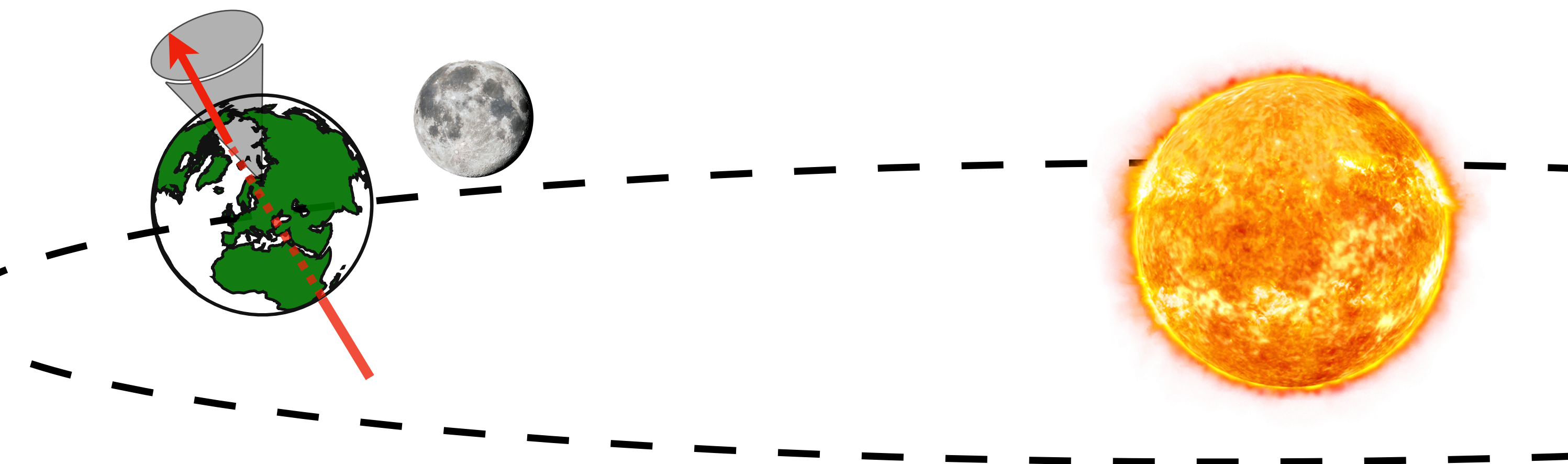


Laskar et al., (2004)

Lost in Deep-Time...

*The precession
“constant”* → *The precession
frequency* → *Milankovitch
Cycles*

$$\alpha \sim H_{\text{Earth}} \cdot \frac{n_{\text{Moon}}^2}{\omega_{\text{Earth}}}$$



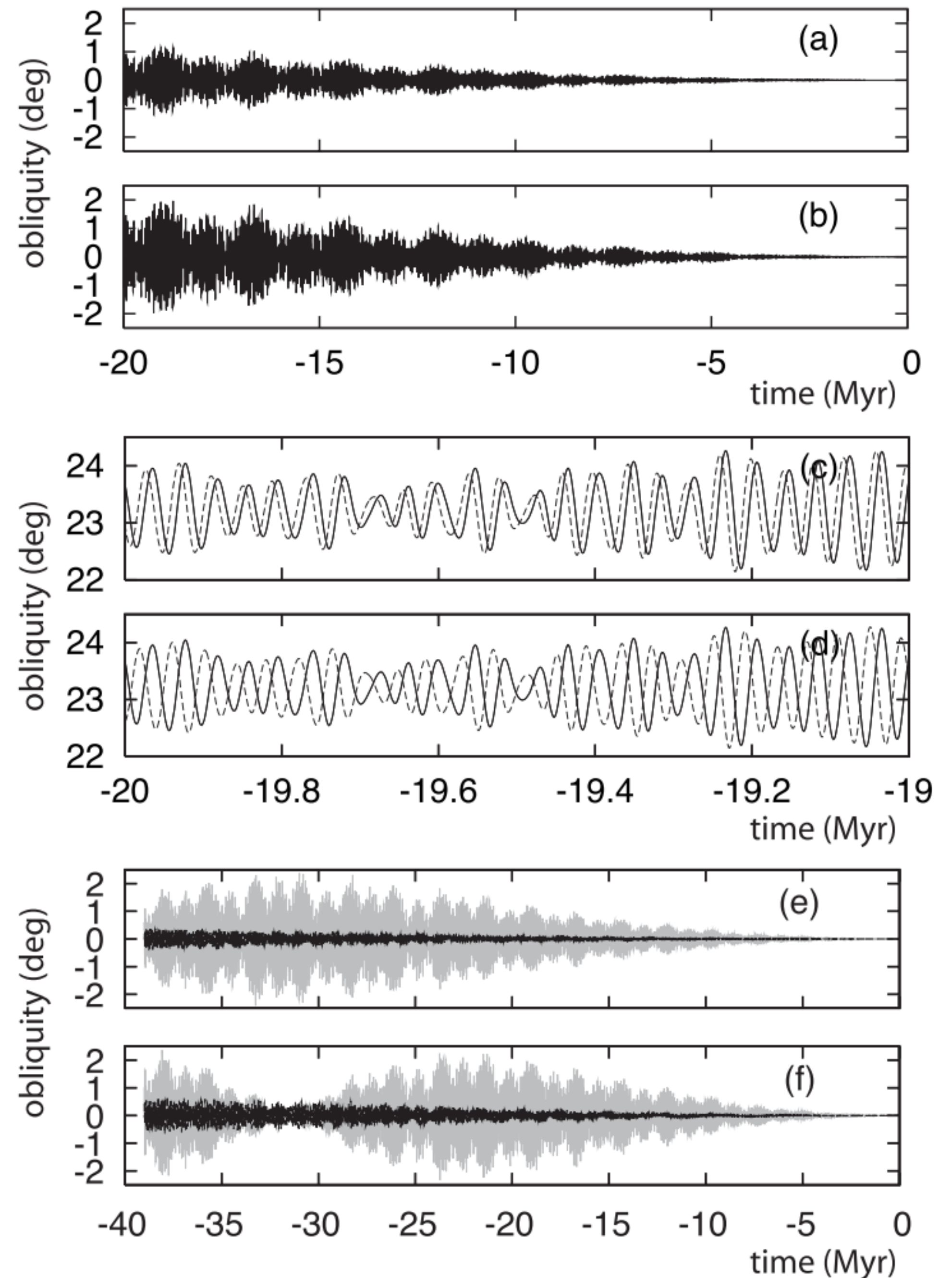
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*Evolution of length of day
and lunar distance
(Tidal Evolution Model)*



Laskar et al., (2004)

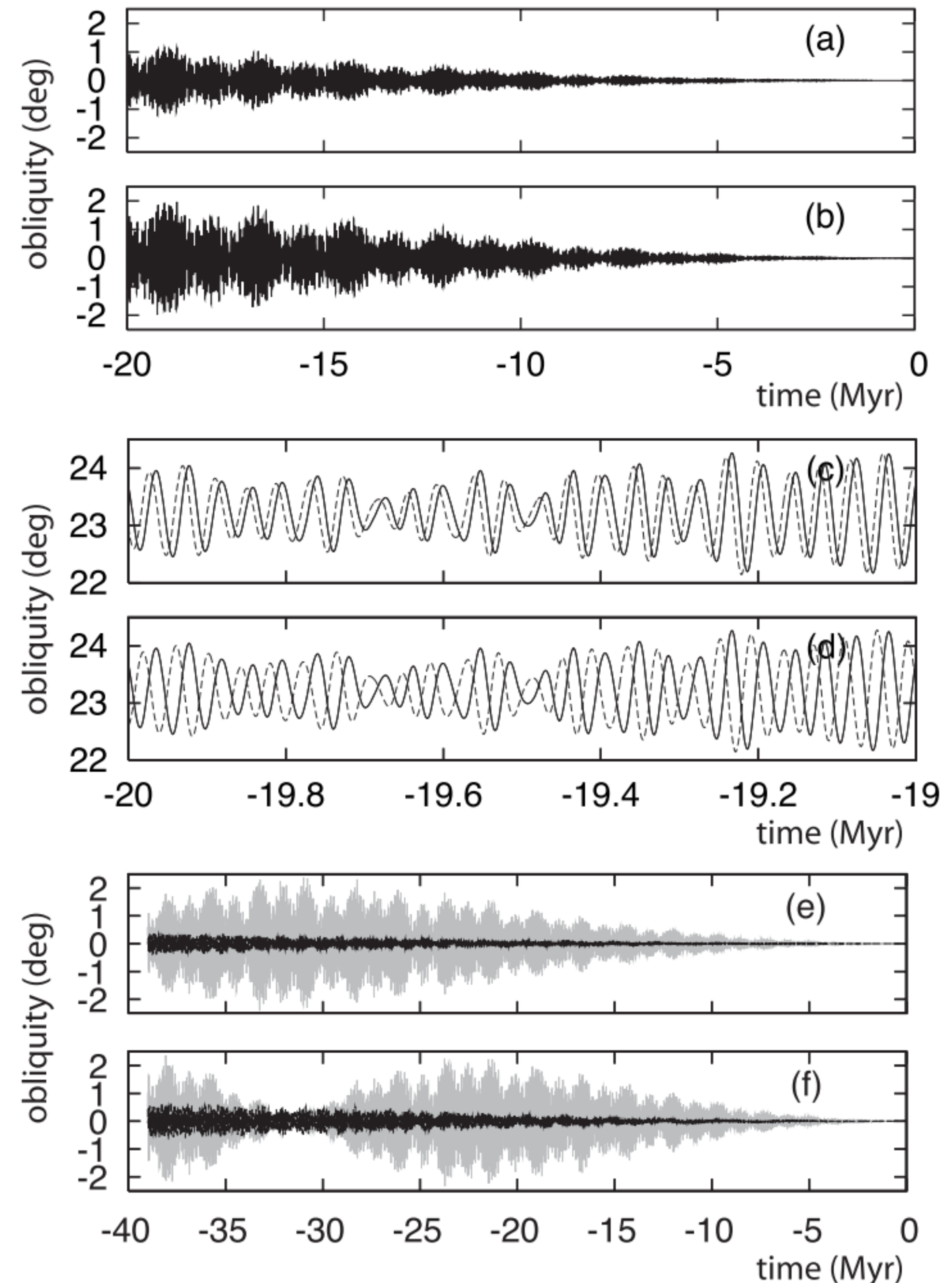
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*Evolution of the Earth’s
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Laskar et al., (2004)

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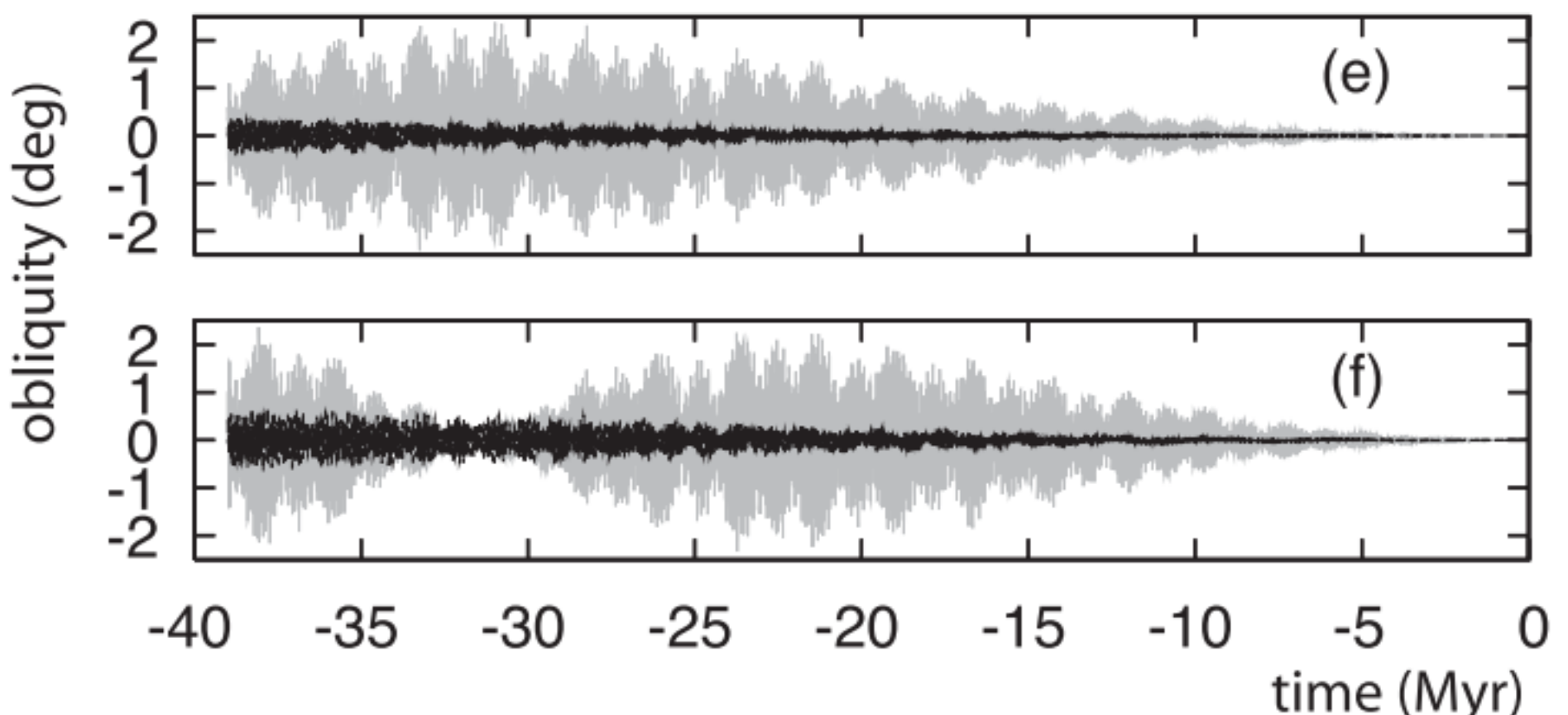
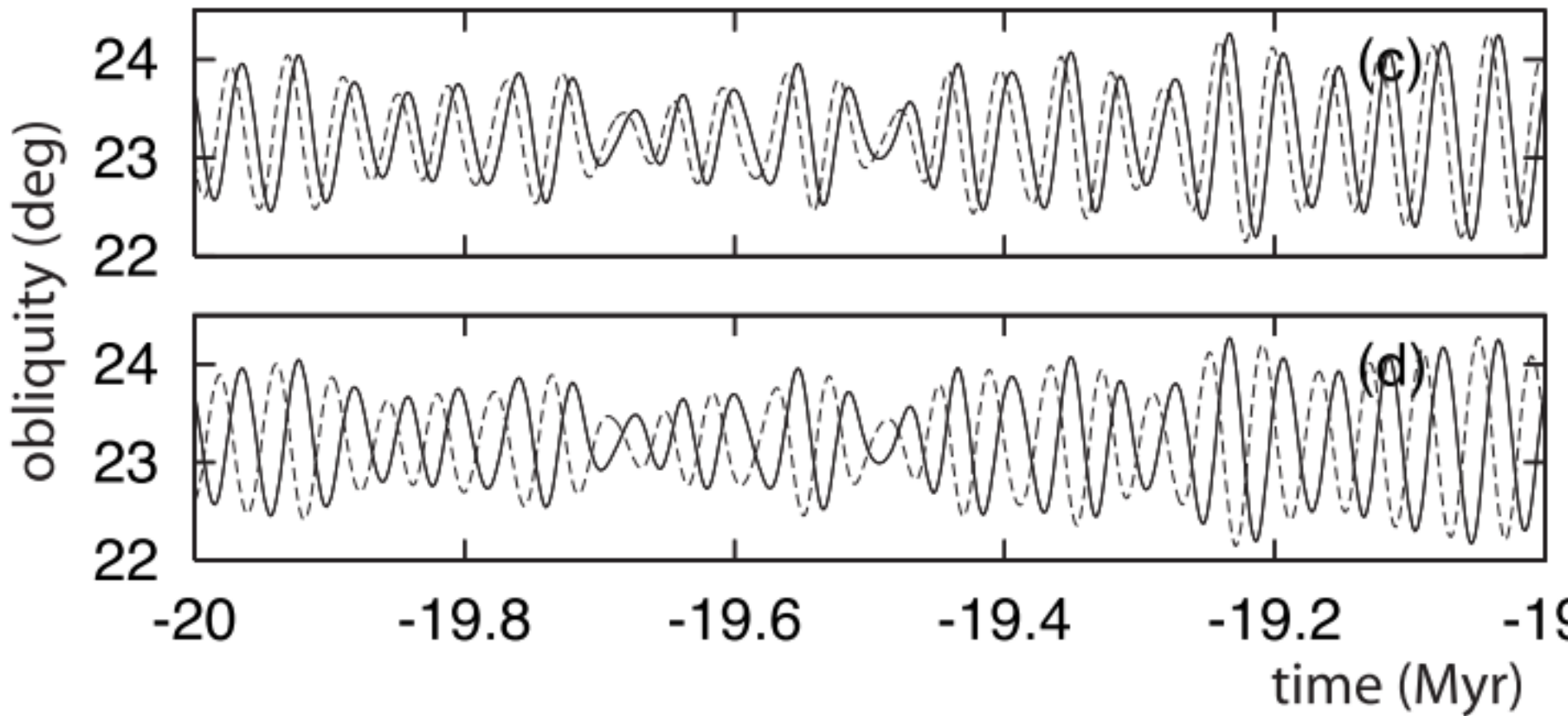
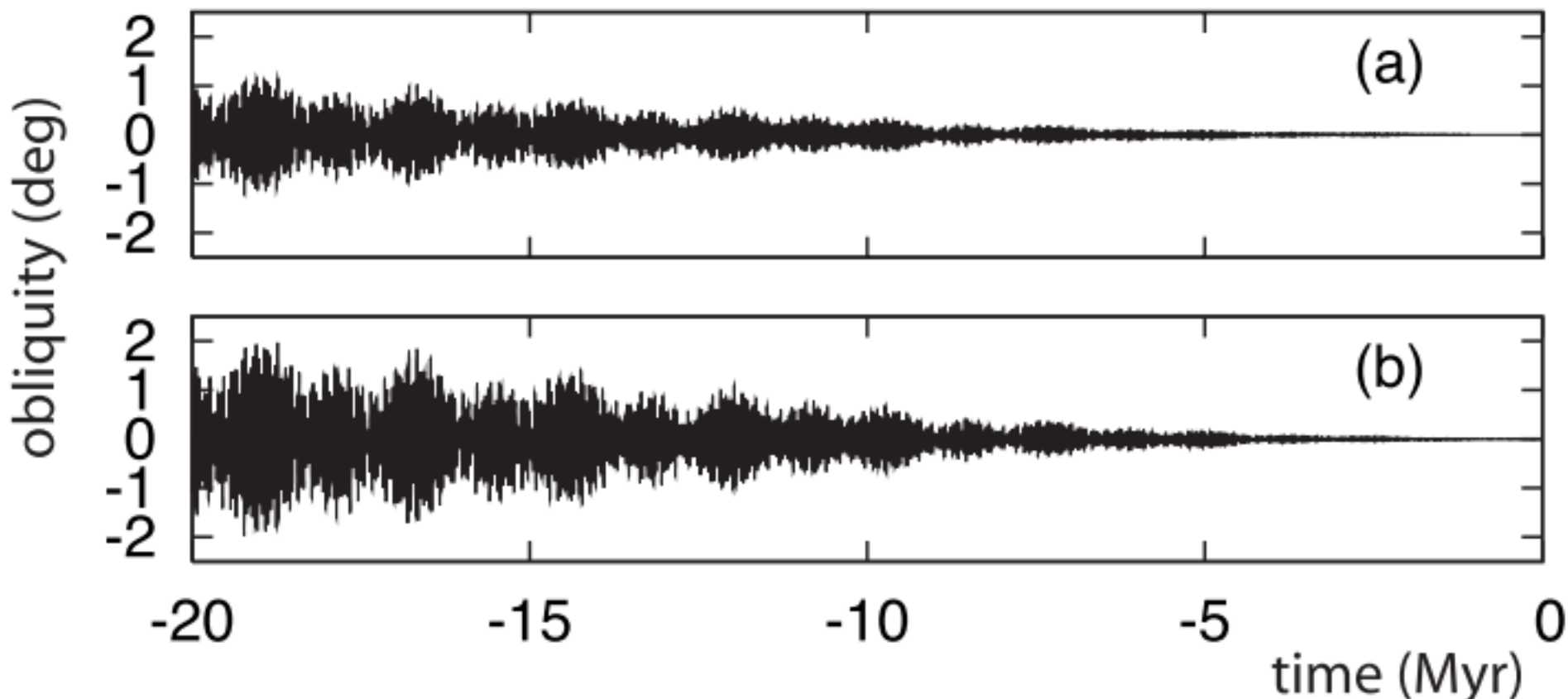
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(Tidal Evolution Model)*

*Evolution of the Earth’s
figure
(Dynamical Ellipticity)*

*Interior Mass Distribution
(Mantle convection)*

*Surface and internal
Mass Distribution
(Glacial Cycles)*



Laskar et al., (2004)

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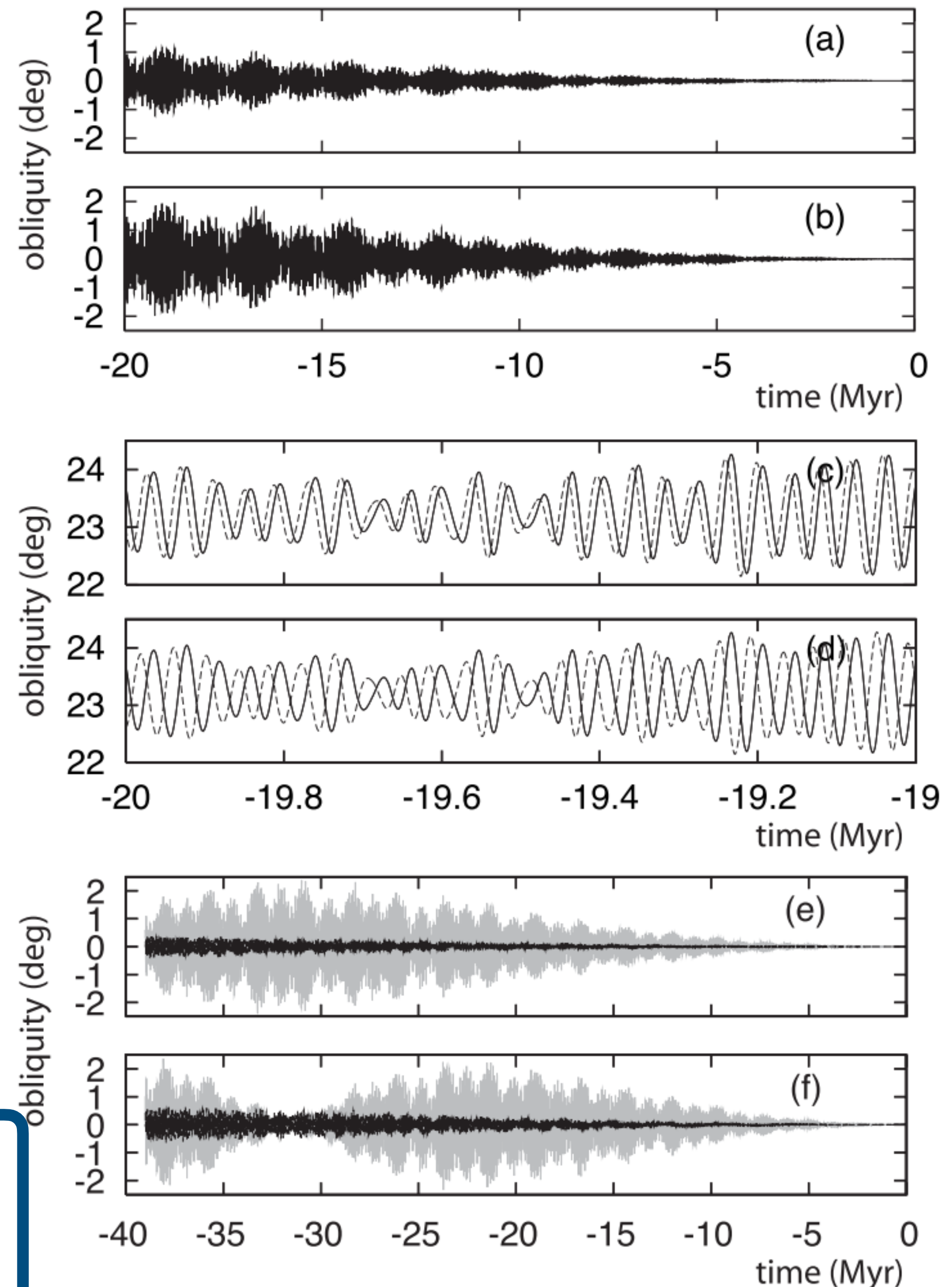
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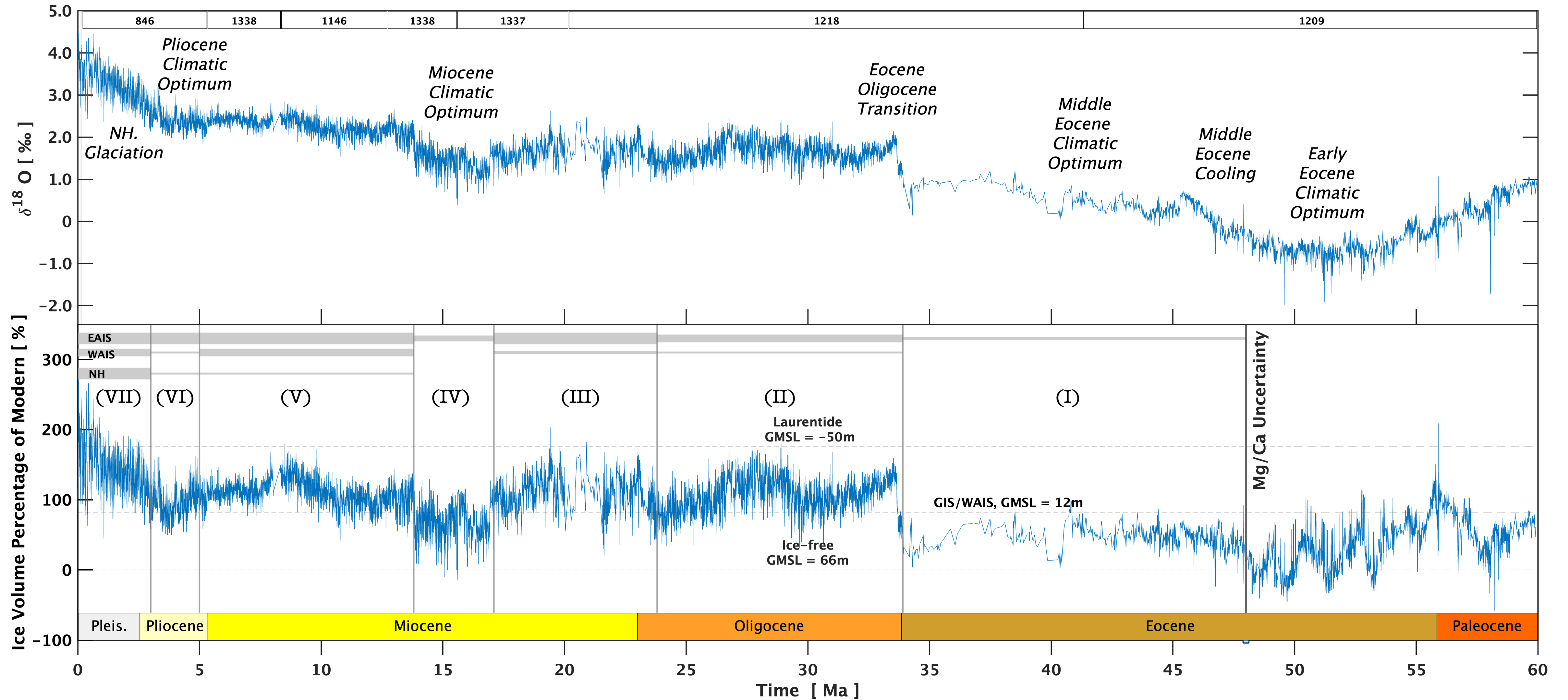
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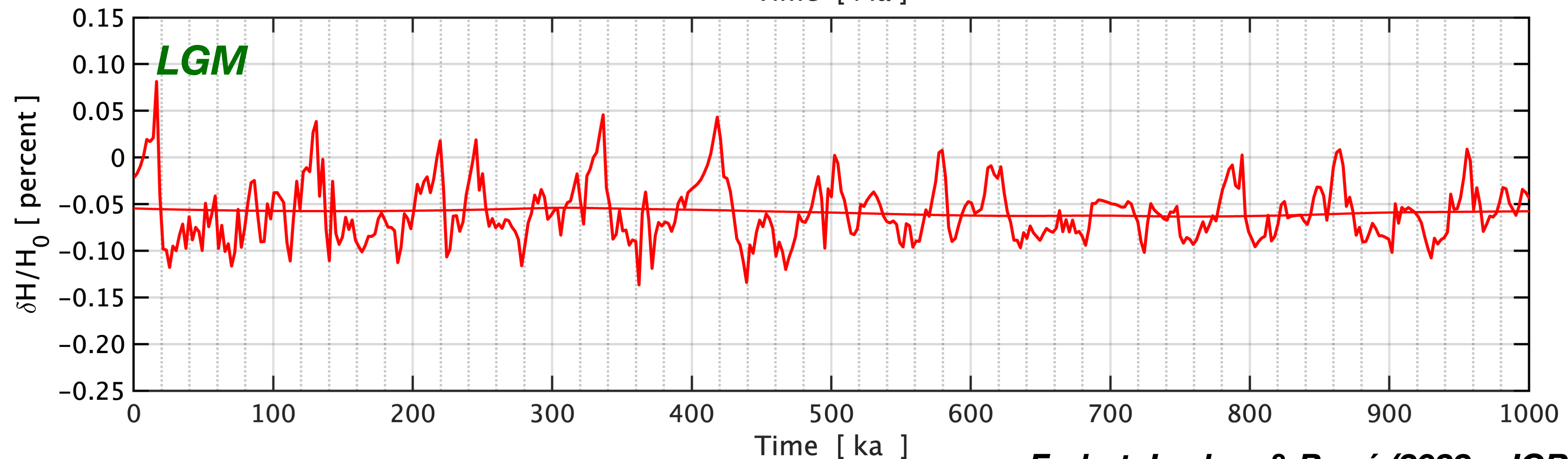
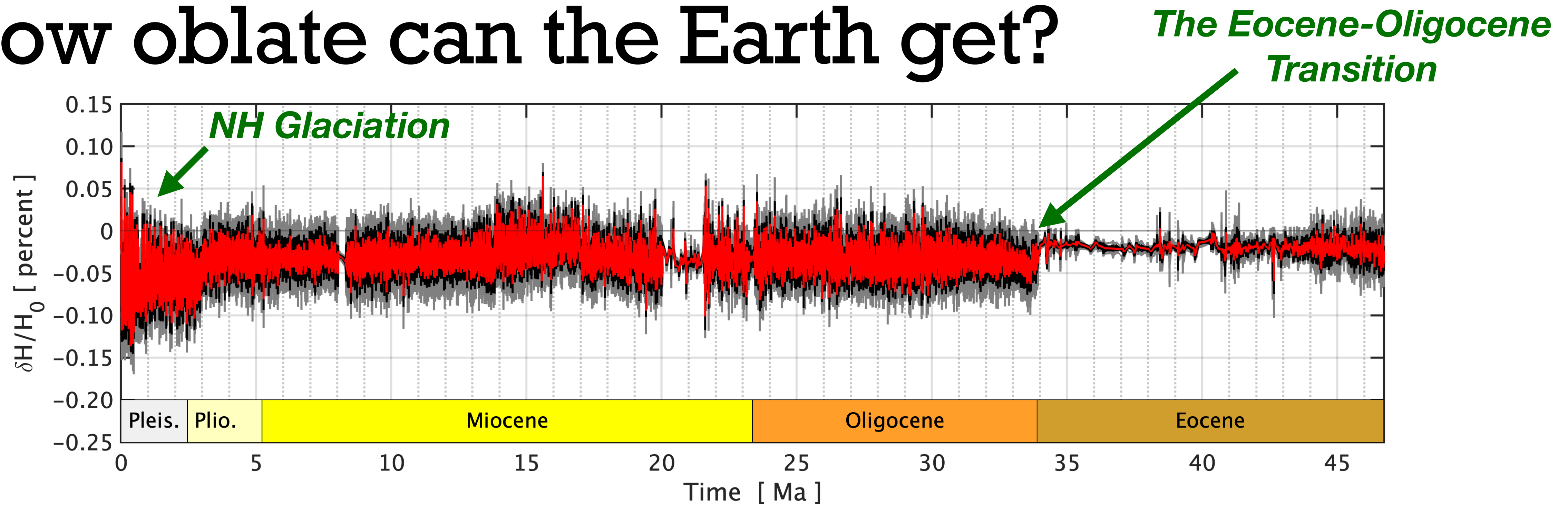
Laskar et al., (2004)

Found in Deep-Time...



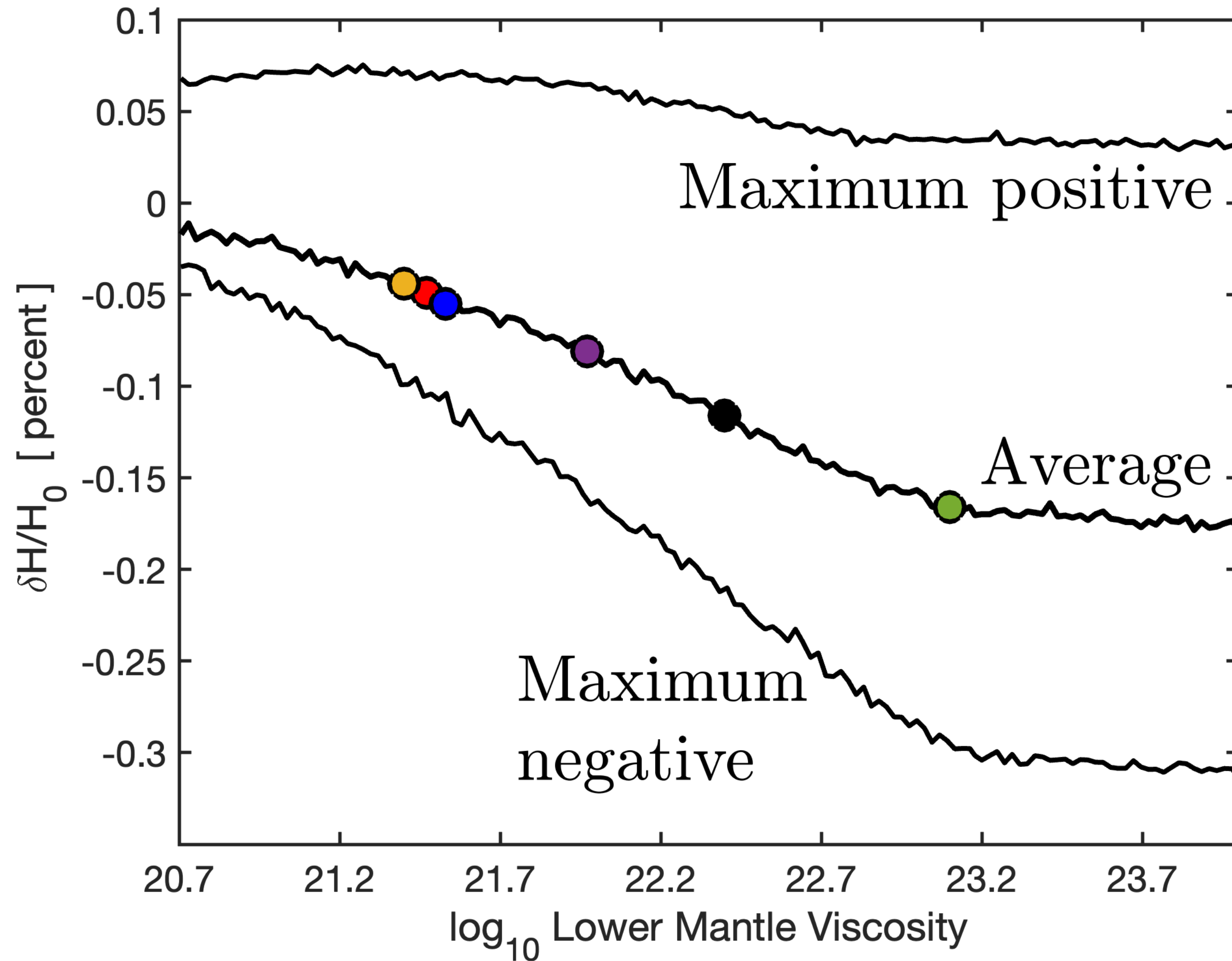
Farhat, Laskar, & Boué (2022 - JGR Solid Earth)

How oblate can the Earth get?



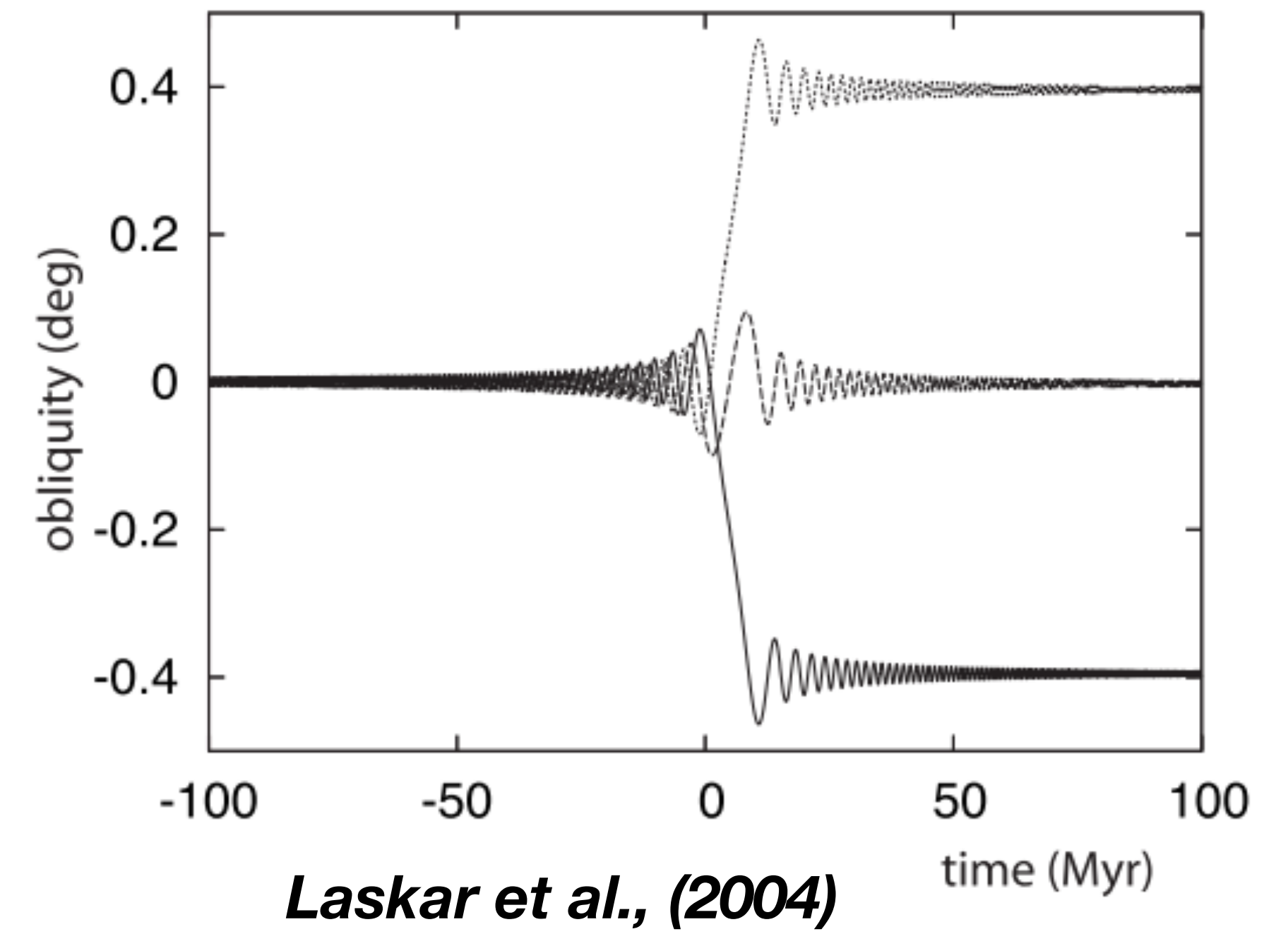
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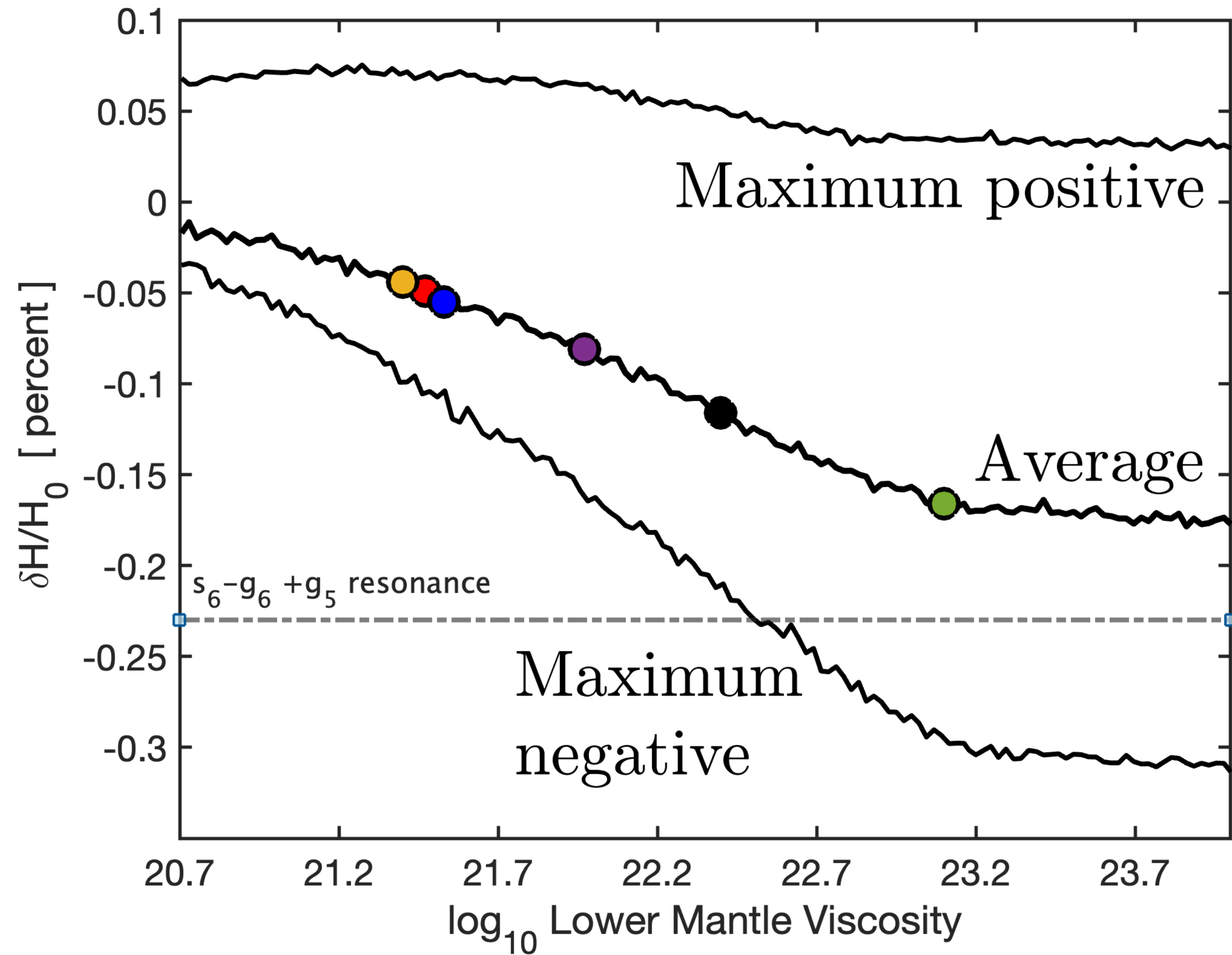


Jupiter and Saturn?

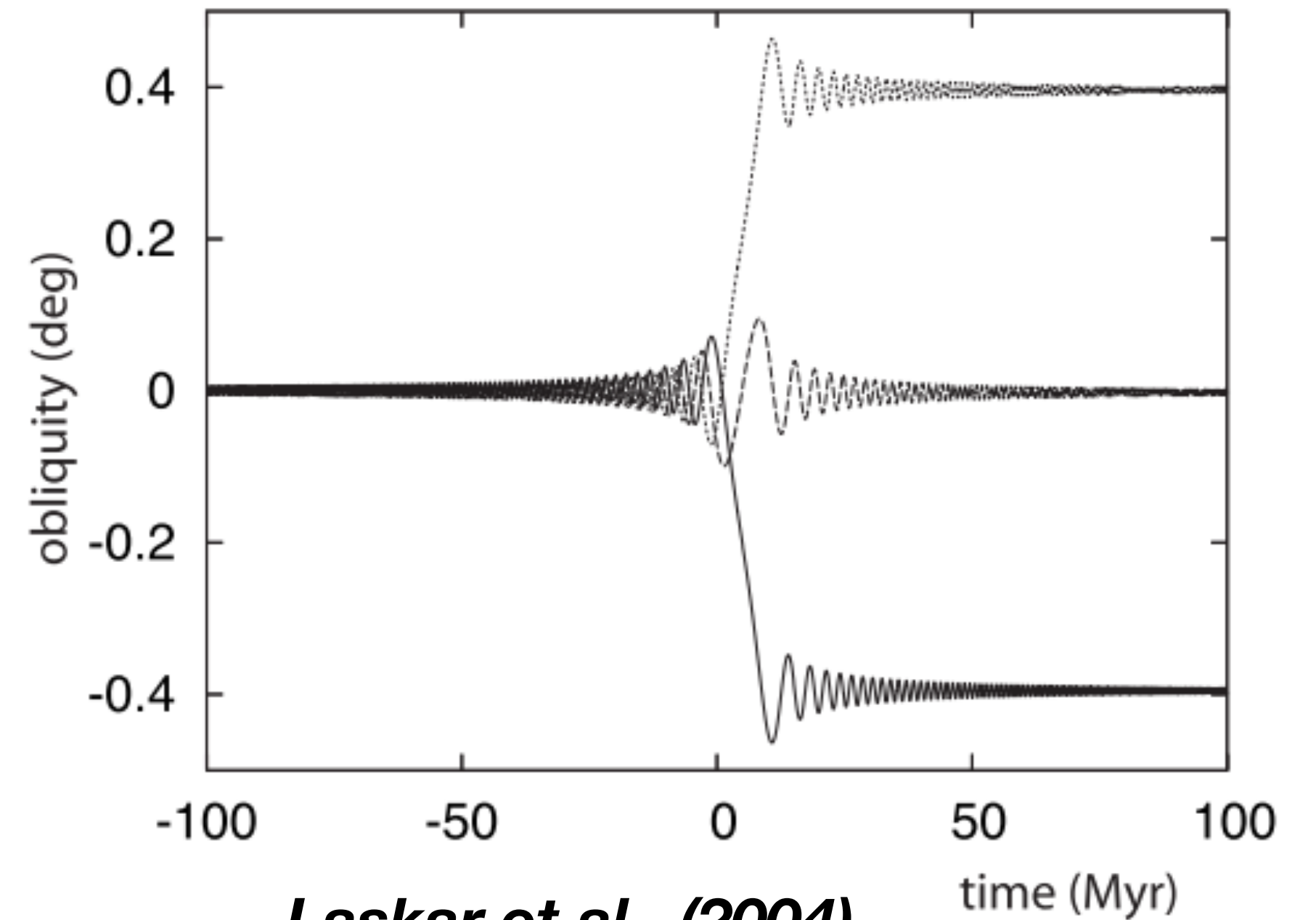
$$\delta H/H_0 = -0.23 \%$$



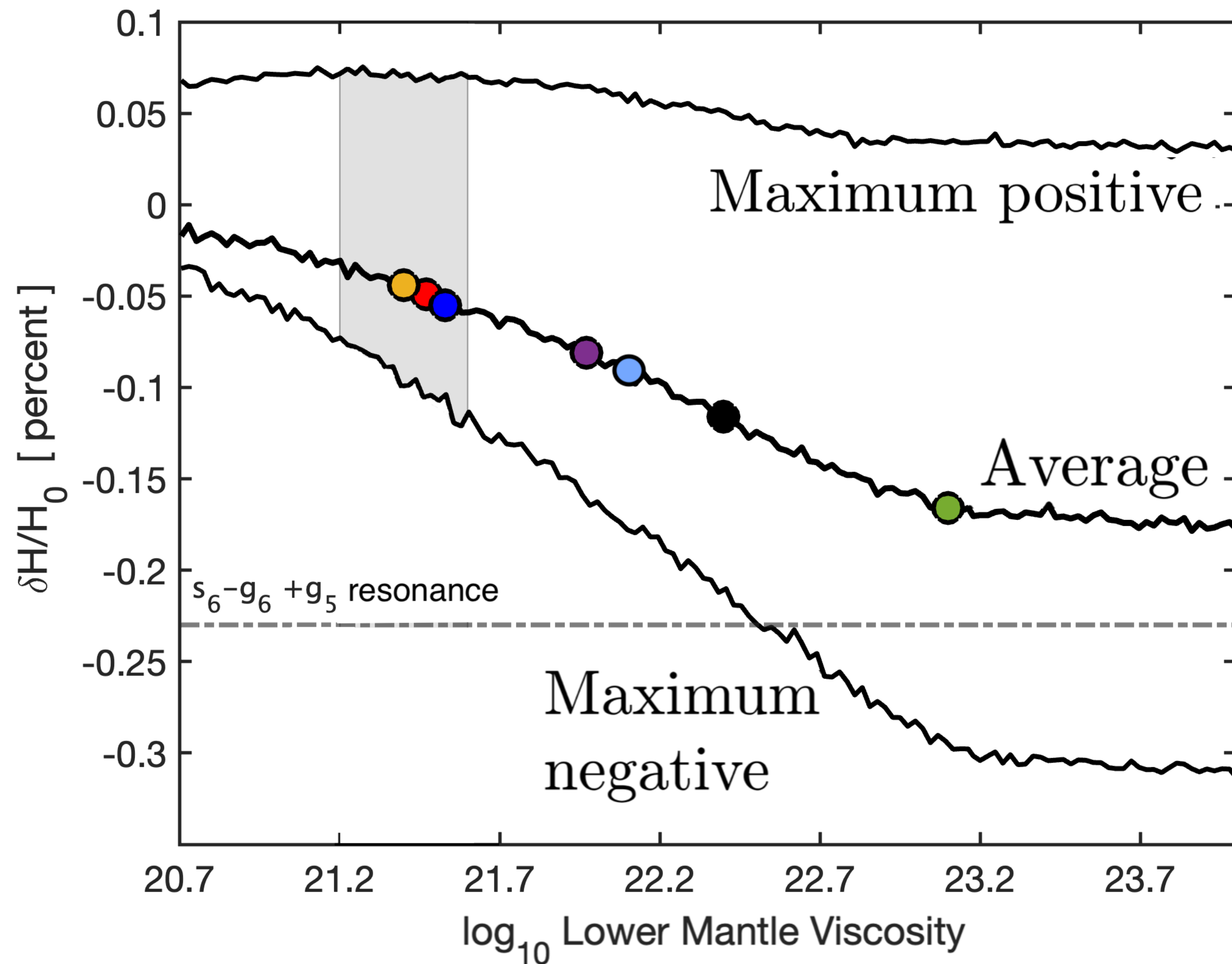
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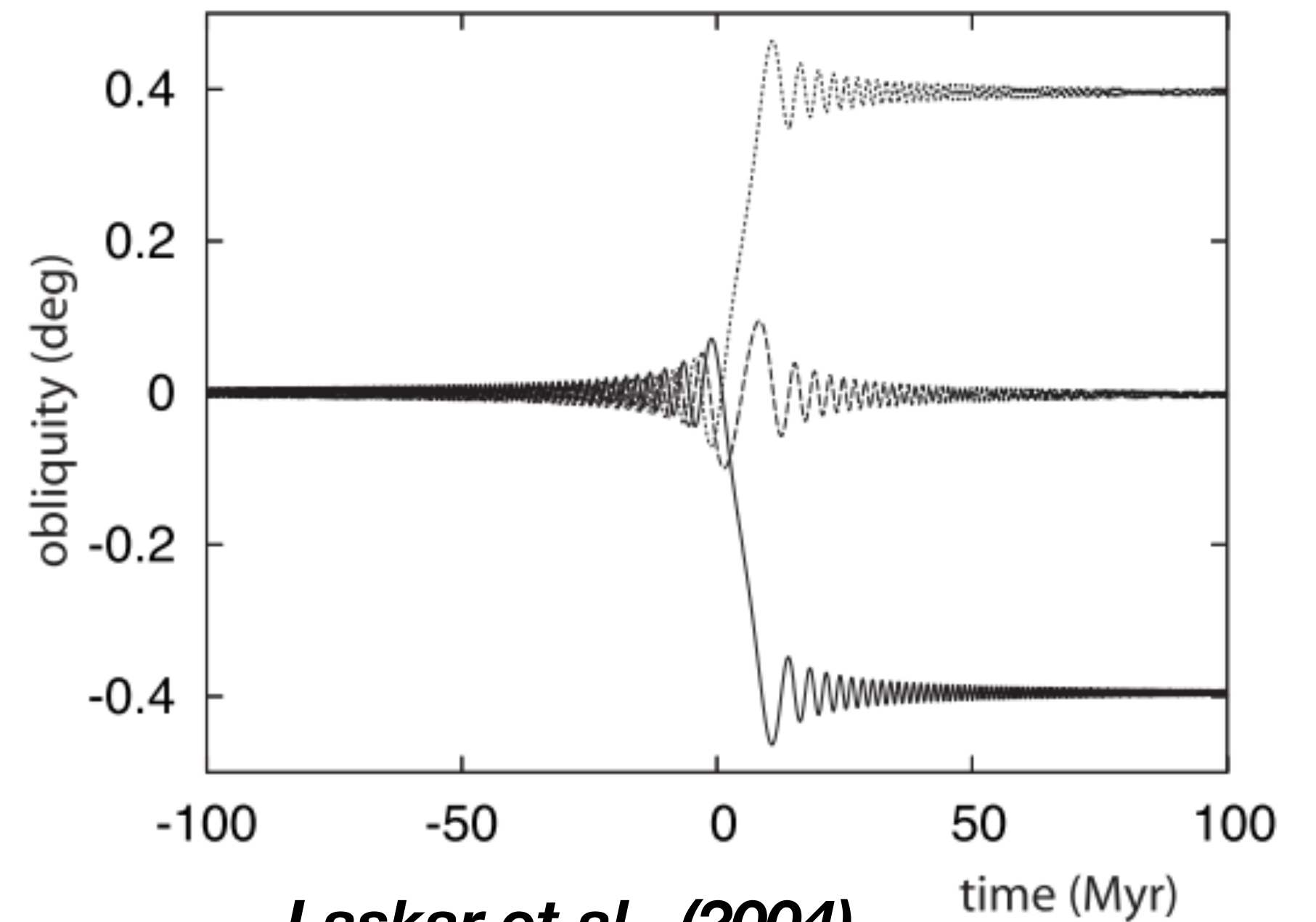
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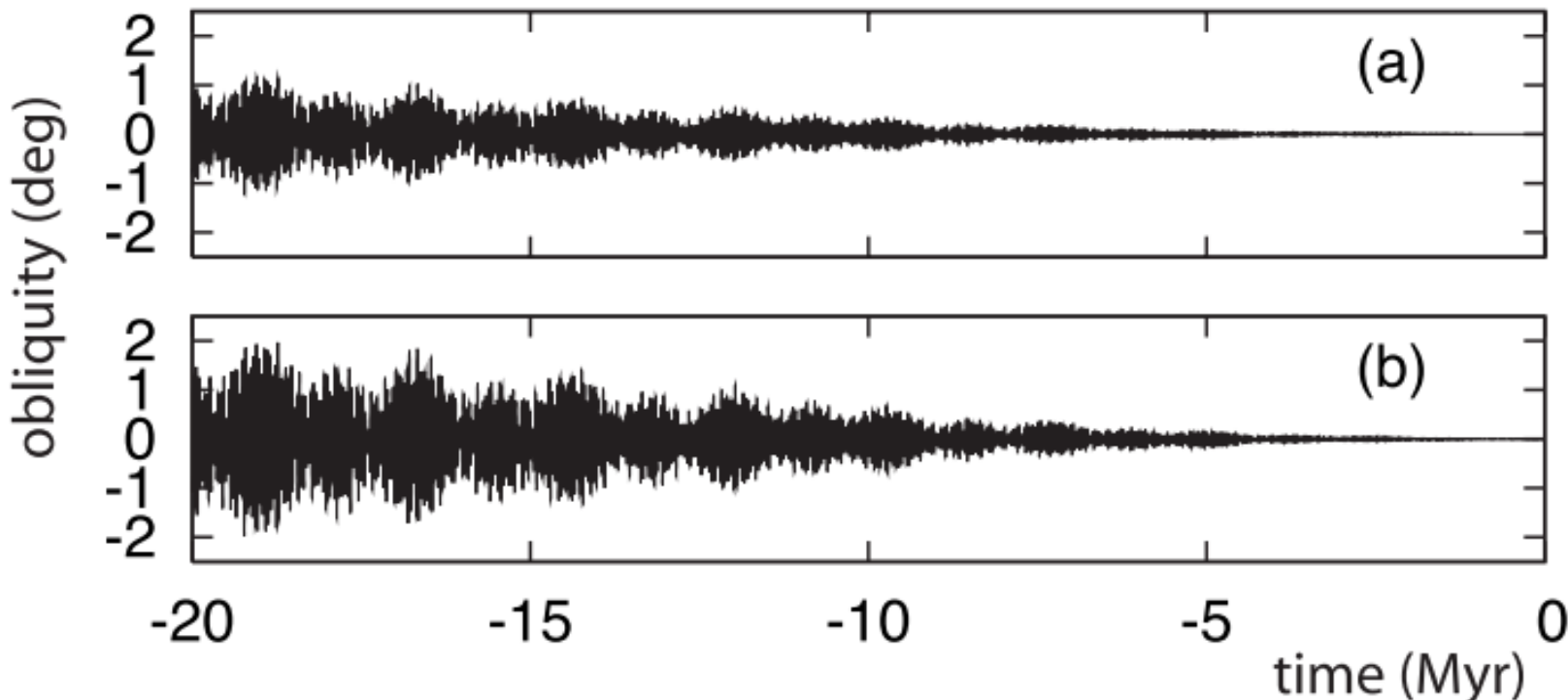
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Retrieved from Deep-Time...



Laskar et al., (2004)

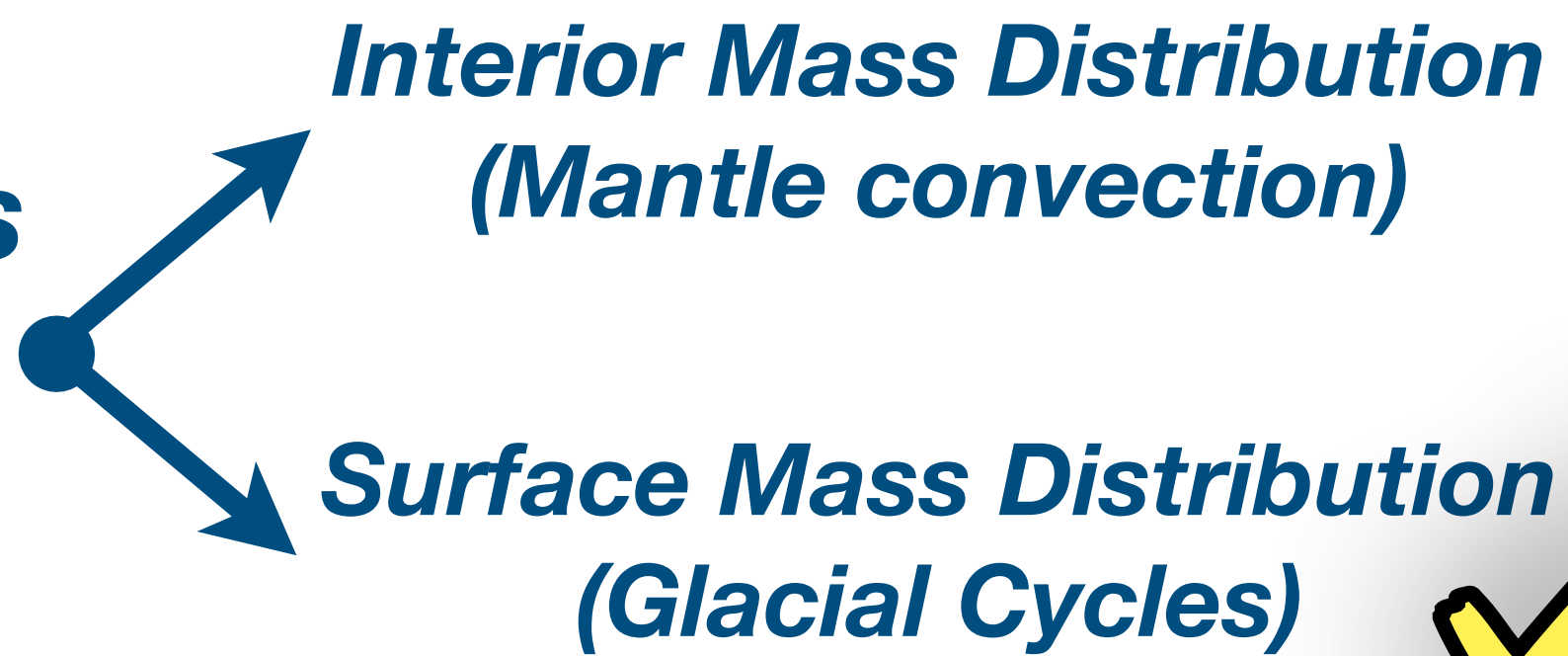
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Evolution of length of day
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Farhat et al., (2022) - Submitted
Astronomy & Astrophysics

Evolution of the Earth's
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Farhat, Laskar, & Boué (2022)
JGR Solid Earth

