EART290Q 2020

WEEK #8 – TRUE POLAR WANDER

Topics/Concepts

Fossil bulge, Gold’s beetles

Principal-axis rotation, minimum energy state

“Inertial interchange” true polar wander

Positive gravity anomalies migrate towards the equator, negative towards the poles

Reorientation is a competition between the applied load and the fossil bulge

Equations

Degree of reorientation \( \theta_R \)

\[
\sin 2\theta_R = \frac{Q}{n} \sin 2\theta_L
\]

\[
\theta_R = \theta_L + \theta_R
\]

\( n=1 \) for planets; \( n=1-4 \) for satellites, depending on longitude of load

Dimensionless load \( Q \)

\[
Q = \frac{GM}{R^2} \frac{3\sqrt{5}G_{20}}{R \omega^2 (k^2_2-k_2)}
\]

Zonal coefficients

\[
G_{n0} = -\frac{2n+1}{2} \int_{-1}^{1} g(\theta) P_n(\cos \theta) \sin \theta \, d\theta
\]

\[
g(\theta) = \sum_{n=0}^{\infty} G_{n0} P_n(\cos \theta)
\]

References
