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New insights on Mantle Convection and Ice Age True Polar Wander

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True Polar Wander (TPW), the slow motion of the Earth rotation axis with respect to the mantle, is due to perturbations of the inertia of the planet resulting from internal and surface mass rearrangements. It is generally taken as evidence of Ice Sheet melting and Mantle Convection. Owing to the ability of rotational bulge to relax and readjust to perturbations of rotation axis on timescales T of $1 - 100\,\mathrm{kyr}$, TPW studies often assume that rotational bulge readjusts instantaneously to the Myr timescale of mantle convection, implying the coincidence between the Earth rotation axis and the Maximum Inertia Direction of Mantle Convection (MC-MID). This approximation is herein overcome and our new linearized treatment of the Earth's rotation shows that such an approximation missed a fundamental aspect of TPW dynamics, namely the stabilizing effect due to the bulge from mantle convection being smaller than the rotational bulge. Such a smallness inhibits the viscoelastic readjustment of rotational bulge by increasing the timescale T to values comparable to those of mantle convection. With respect to previous estimates, TPW rates from mantle convection are now reduced and sizeable offsets of degrees are obtained between the axis of rotation and the MC-MID for realistic viscosity profiles of the mantle. These new findings impact the interpretation of present-day TPW data in terms of the relative contribution from Mantle Convection and from Ice Ages. Furthermore, they allow to estimate the degree-2 Stokes coefficients C_{21} and S_{21} of the present-day geoid anomalies in a self-consistent way with TPW dynamics.