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Exploring the relationship between internal dynamics and True Polar Wander

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The long term evolution of the rotational axis of a planet or a satellite is most likely controlled by internal mass redistribution within the interior. The reorientation of the rotation axis, referred as True Polar Wander, has long been suspected on Mars in response to the rise of Tharsis bulge (Willemann 1984) and more recently has been proposed to explain the location of a very active hotspot at the South Pole of Saturn's moon Enceladus (Nimmo and Pappalardo 2006). On Earth, the presence of large upwellings in the mantle, termed superswells, is also expected to induce significant polar wander (Greff-Lefftz 2004). Several recent studies investigated the polar wander mechanism and mainly focused on either rotational (e.g. Matsumaya et al. 2007) or internal dynamics aspects (e.g. Roberts and Zhong 2007). Here we propose to self-consistently investigate the role of internal dynamics on the inertial tensor and its consequence for the evolution of the rotation axis. Using the OEDIPUS code (Choblet et al. 2007), we systemically explore the conditions to initiate low-degree convection and derive the surface deformation and inertia tensor perturbations resulting from the mantle density heterogeneities and resulting solide-state flow. By solving the Liouville equation, we then compute the temporal evolution of the rotational axis parameters of the body. The preliminary results will be compared to pre-existing solutions.