

## Accepted Manuscript

Scaling rates of true polar wander in convecting planets and moons

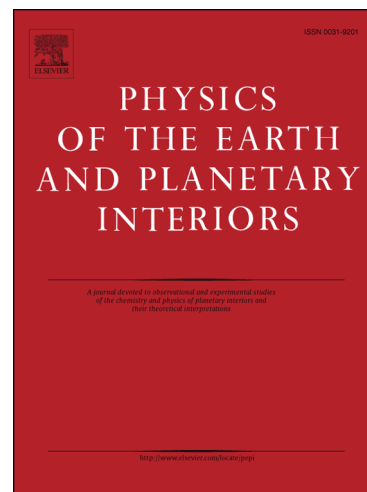
Ian Rose, Bruce Buffett

PII: S0031-9201(16)30138-8

DOI: <https://doi.org/10.1016/j.pepi.2017.10.003>

Reference: PEPI 6092

To appear in: *Physics of the Earth and Planetary Interiors*



Please cite this article as: Rose, I., Buffett, B., Scaling rates of true polar wander in convecting planets and moons, *Physics of the Earth and Planetary Interiors* (2017), doi: <https://doi.org/10.1016/j.pepi.2017.10.003>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

# Scaling rates of true polar wander in convecting planets and moons

Ian Rose<sup>1,\*</sup>, Bruce Buffett<sup>1</sup>

---

## Abstract

Mass redistribution in the convecting mantle of a planet causes perturbations in its moment of inertia tensor. Conservation of angular momentum dictates that these perturbations change the direction of the rotation vector of the planet, a process known as true polar wander (TPW). Although the existence of TPW on Earth is firmly established, its rate and magnitude over geologic time scales remain controversial. Here we present scaling analyses and numerical simulations of TPW due to mantle convection over a range of parameter space relevant to planetary interiors. For simple rotating convection, we identify a set of dimensionless parameters that fully characterize true polar wander. We use these parameters to define timescales for the growth of moment of inertia perturbations due to convection and for their relaxation due to true polar wander. These timescales, as well as the relative sizes of convective anomalies, control the rate and magnitude of TPW. This analysis also clarifies the nature of so called “inertial interchange” TPW events, and relates them to a broader class of events that enable large and often rapid TPW. We expect these events to have been more frequent in Earth’s past.

*Keywords:* Rotational variations; polar wobble, Paleomagnetism, Models of interior structure, Planetary interiors, Convection currents and mantle plumes,

*PACS:* 91.10.Nj, 91.25.Ng, 91.35.Cb, 91.45.Bg, 91.45.Fj

---

\*Corresponding author, [ian.rose@berkeley.edu](mailto:ian.rose@berkeley.edu)

<sup>1</sup>University of California, Berkeley

Download English Version:

<https://daneshyari.com/en/article/8915769>

Download Persian Version:

<https://daneshyari.com/article/8915769>

[Daneshyari.com](https://daneshyari.com)