Core-mantle coupling

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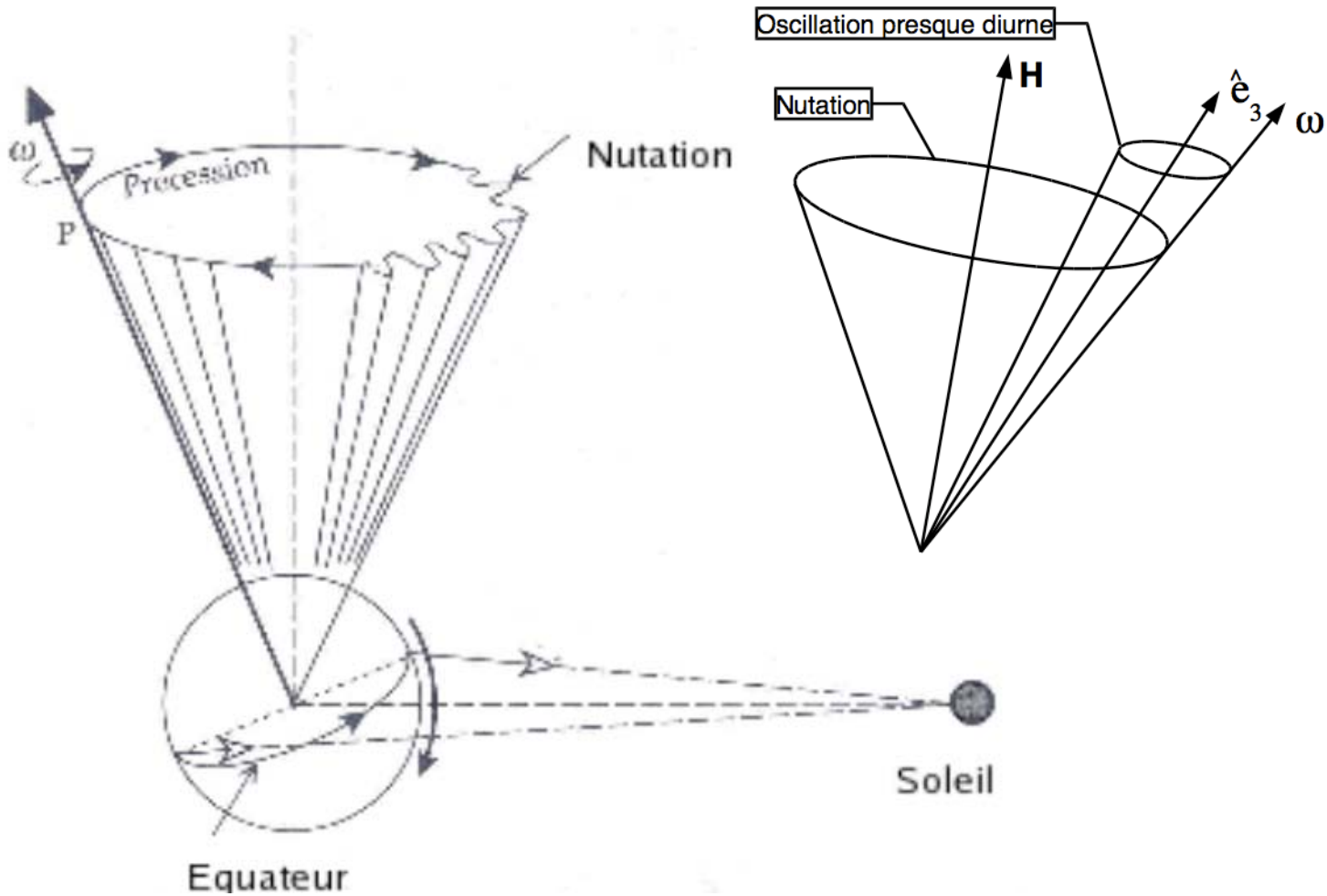
Nutation data



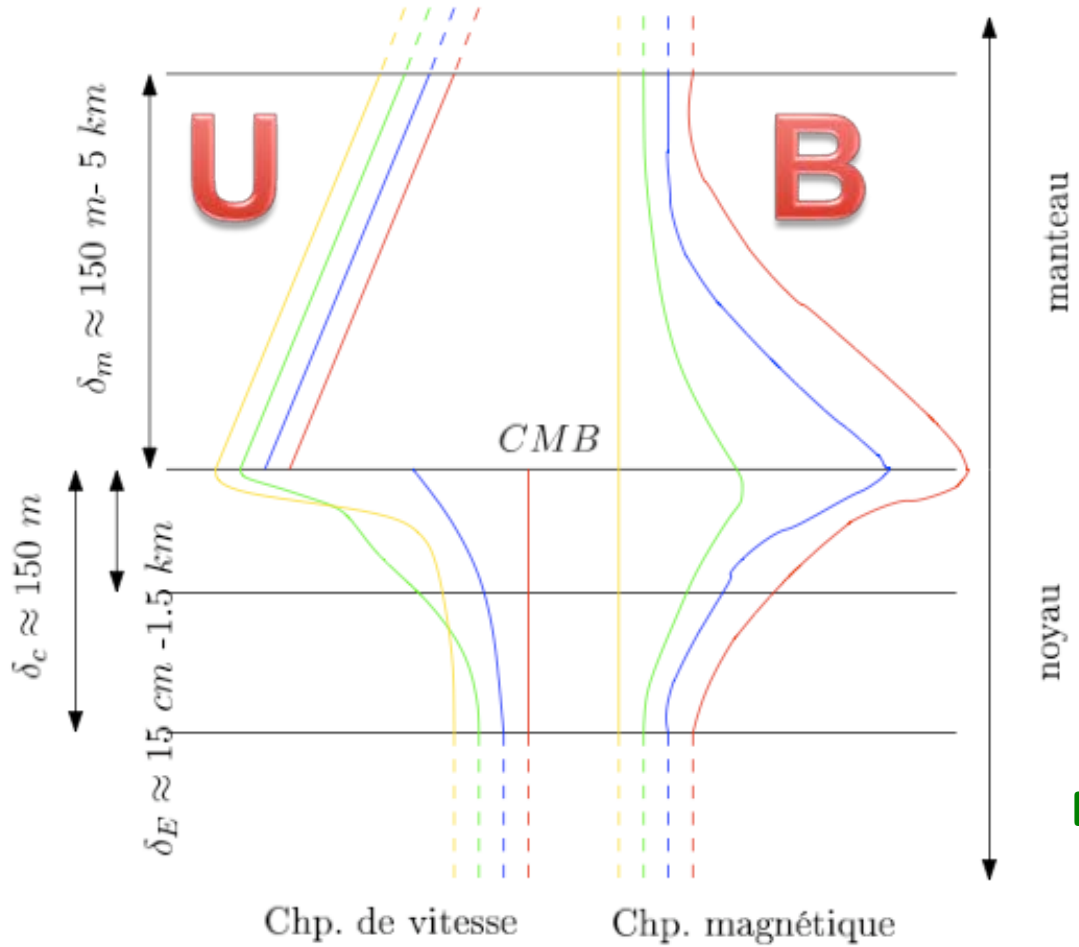
Retrograde Free Core Nutation

$$K^{CMB} = \frac{\Gamma}{iI\delta\omega_M}$$

$$\mathrm{Im}\left(K^{CMB}\right) = (1.85 \pm 0.1) \cdot 10^{-5}$$

Matthews et al, 2002

Coupling mechanisms



Greenspan, 1968

Buffett, 1992

Buffett et al, 2002

Matthews & Guo, 2005

Deleplace & Cardin, 2006

A camel thru the eye of a needle

- To explain the observed dissipation, one needs:
  - *Magnetic coupling*: a lowermost mantle with the electric conductivity of the core *and* a B_r^{rms} of 0.69 mT

    (only 0.31 mT observed l<13)

or
  - *Viscous coupling*: a core with a viscosity of 0.03 m^2/s

    (only 7 10^{-6} m^2/s expected)

or
  - *Inertial coupling*: a stress of 10^{-3} Pa

    (while $\rho V^2 = 10^{-4}$ Pa)

or

Deleplace & Cardin, 2006

Buffett & Christensen, 2007