Consequences of updated geodesy data on interior structure models

Detection of the Chandler Wobble of Mars from Orbiting Spacecraft

Alex. S. Konopliv[1], Ryan S. Park[1], Attilio Rivoldini[2], Rose-Marie Baland[2], Sebastien Le Maistre[2], Tim Van Hoolst[2], Marie Yseboodt[2], Veronique Dehant[2]

doi: 10.1029/2020GL090568

[1]Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109 USA

[2]Royal Observatory of Belgium, Avenue Circulaire 3, B-1180 Brussels, Belgium

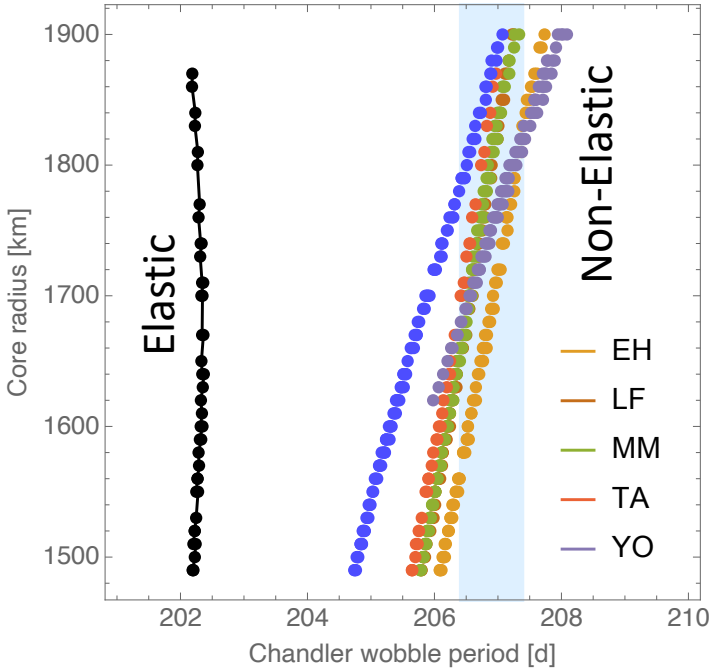
- **First** time determination of Chandler Wobble (CW) of a solar system body other than the **Earth**
  →CW is a rotation normal mode (describes a rotational motion of the mantle)
  →continuously excited by the atmosphere (most likely mechanism)
  →decay time between 7-63 years (Earth 28-299 years)
  →amplitude on surface ~10 cm, period=206.9d, and Q_{CW}=40-350 (Earth: 433.d, Q_{CW}=74-789)

- Updated precession rate
  →MOI=0.36340±0.00006 (2016: MOI=0.3638±0.0001) (RISE paper MOI=0.3637±0.0001)

- Updated value of semi-diurnal solar tidal Love number
  slightly larger than 2016 value mainly because of updated atmospheric correction
  →k_2=0.174±0.008 (2016: k_2=0.169±0.006)

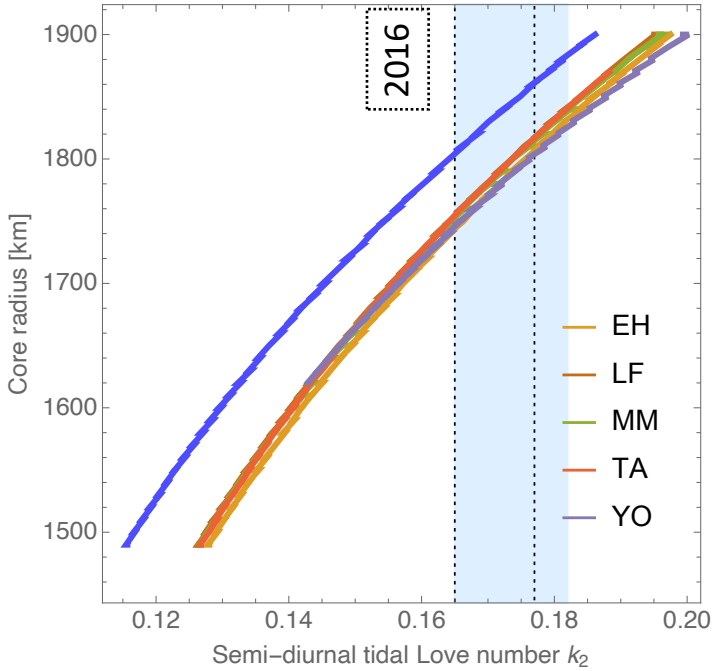
Consequences of updated geodesy data on interior structure models

Chandler Wobble and rheology



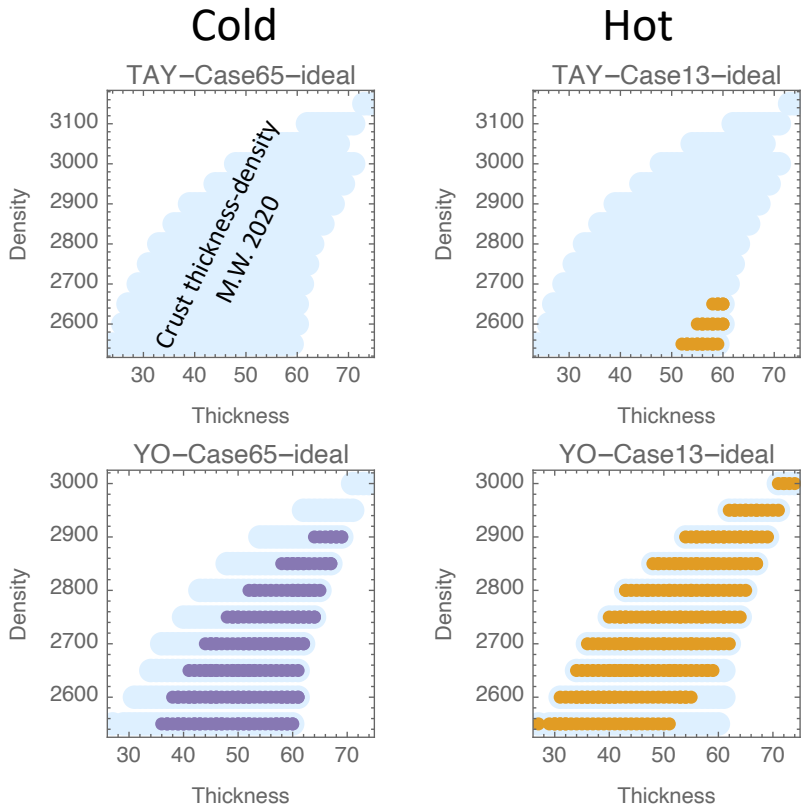
- almost no constraint on core radius (CW period depends on mantle m.o.i. and k_2 but effects are opposing)
- strong dependence on mantle non-elasticity
- constraints long period (~200d) dependency of mantle rheology

Effect of k2 on core radius



- core radius 1750-1880km
  ⇒slightly larger core radius than with 2016 value

Effect of MOI and k_2 on crust



- MOI⇒Taylor composition only possible for hot mantles and thick crusts
- MOI and k_2 favor thick crust for (TAY, LF, EH45) compositions except Yoshizaki (YO)