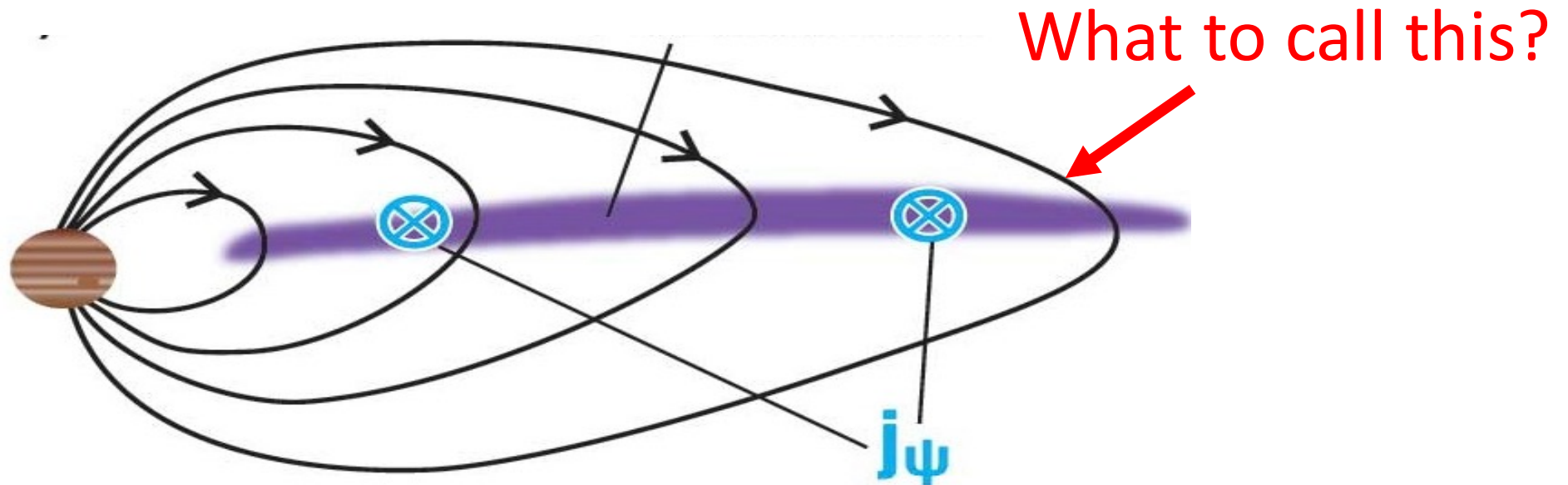


Labelling Jupiter Magnetic Field Lines



Fran Bagenal & Drake Ranquist

University of Colorado, Boulder

October 14th 2016

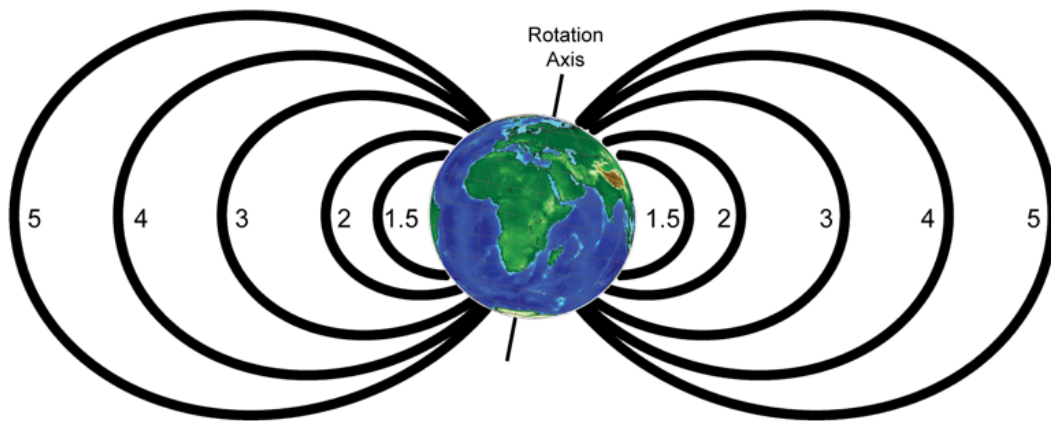
MWG telecon

Coordinates for Mapping the Distribution of Magnetically Trapped Particles

CARL E. McILWAIN

*Department of Physics and Astronomy
State University of Iowa
Iowa City, Iowa*

Magnetic L-Shell



The magnetic shell parameter L is now defined for a point in the earth's magnetic field by the equation

$$L^3 B / M = F(I^3 B / M) \quad (6)$$

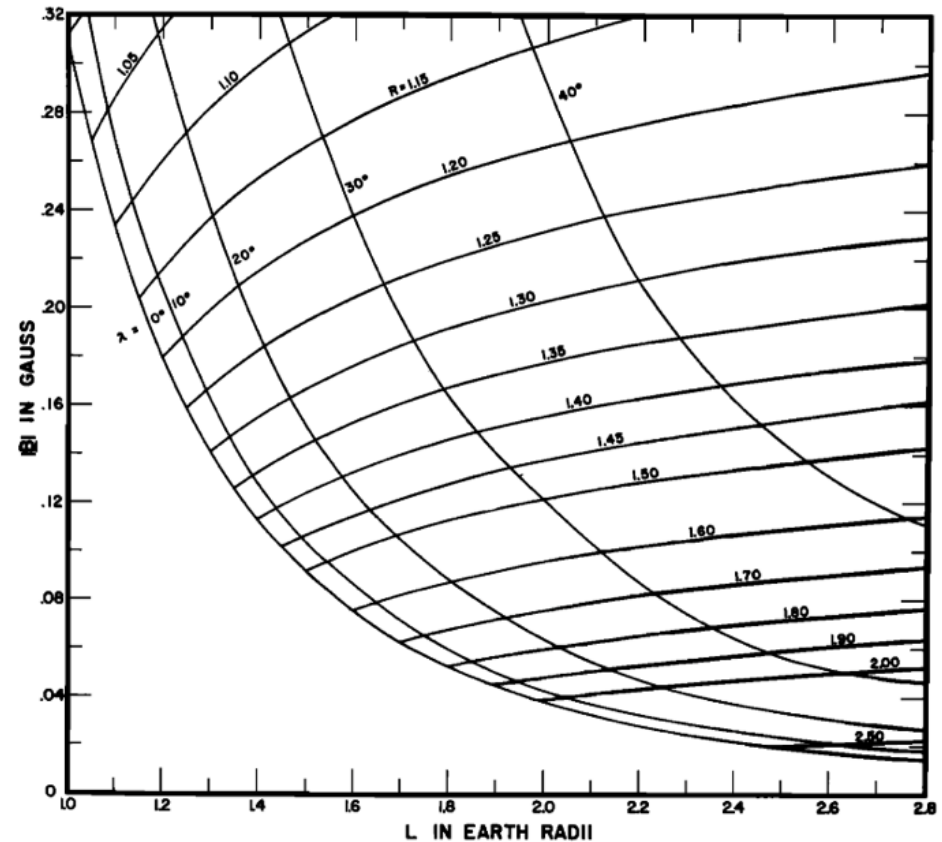
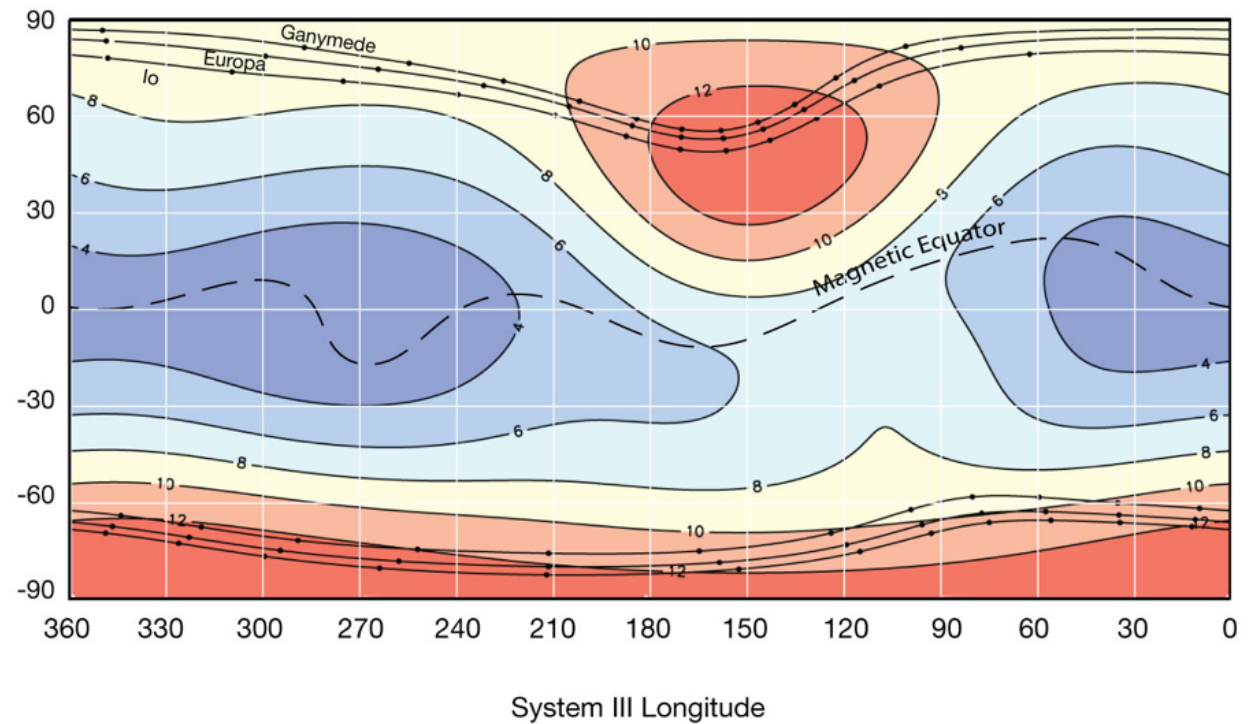
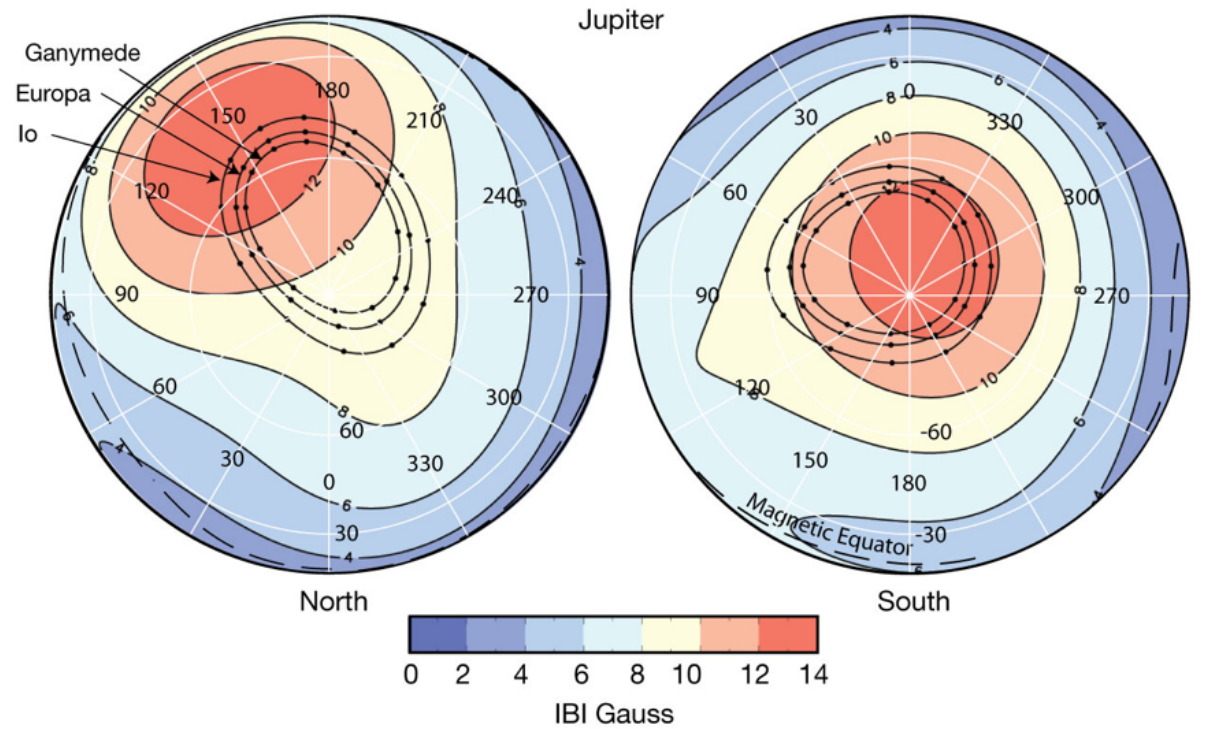


Fig. 1. The mapping of the polar coordinates R and λ on to the B, L plane according to the transformation

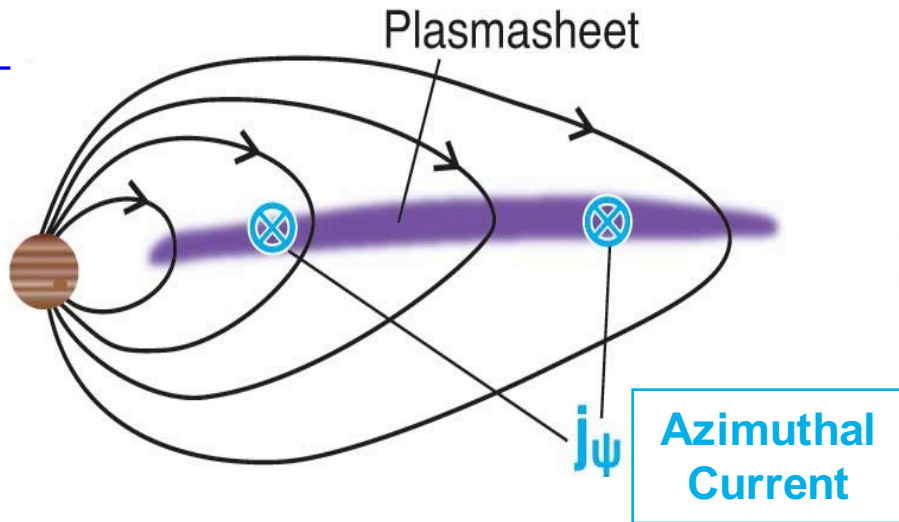
$$B = \frac{M}{R^3} \left(4 - \frac{3R}{L} \right)^{1/2} \quad R = L \cos^2 \lambda$$

Internal Field – VIP4 Connerney

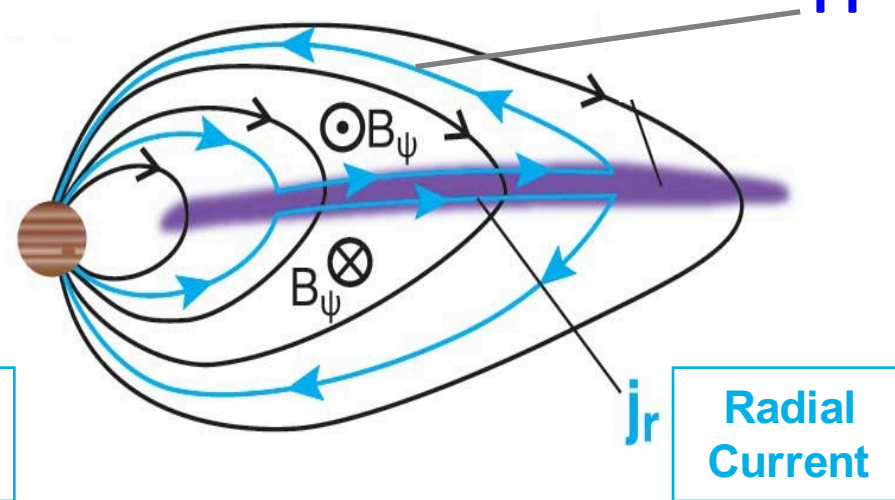


External Currents

$$\nabla \times \mathbf{B}_{\text{observed}} \rightarrow \mathbf{J}_{\perp}$$



$$\nabla \cdot \mathbf{J} = 0 \rightarrow \mathbf{J}_{\parallel}$$



Jack Connerney's slide – March Juno meeting Connerney, Acuna, Ness 1981 – Voyager

Jovian Magnetodisc

CONNERNEY ET AL.: JOVIAN CURRENT SHEET AND MAGNETOSPHERE (1981)

8379

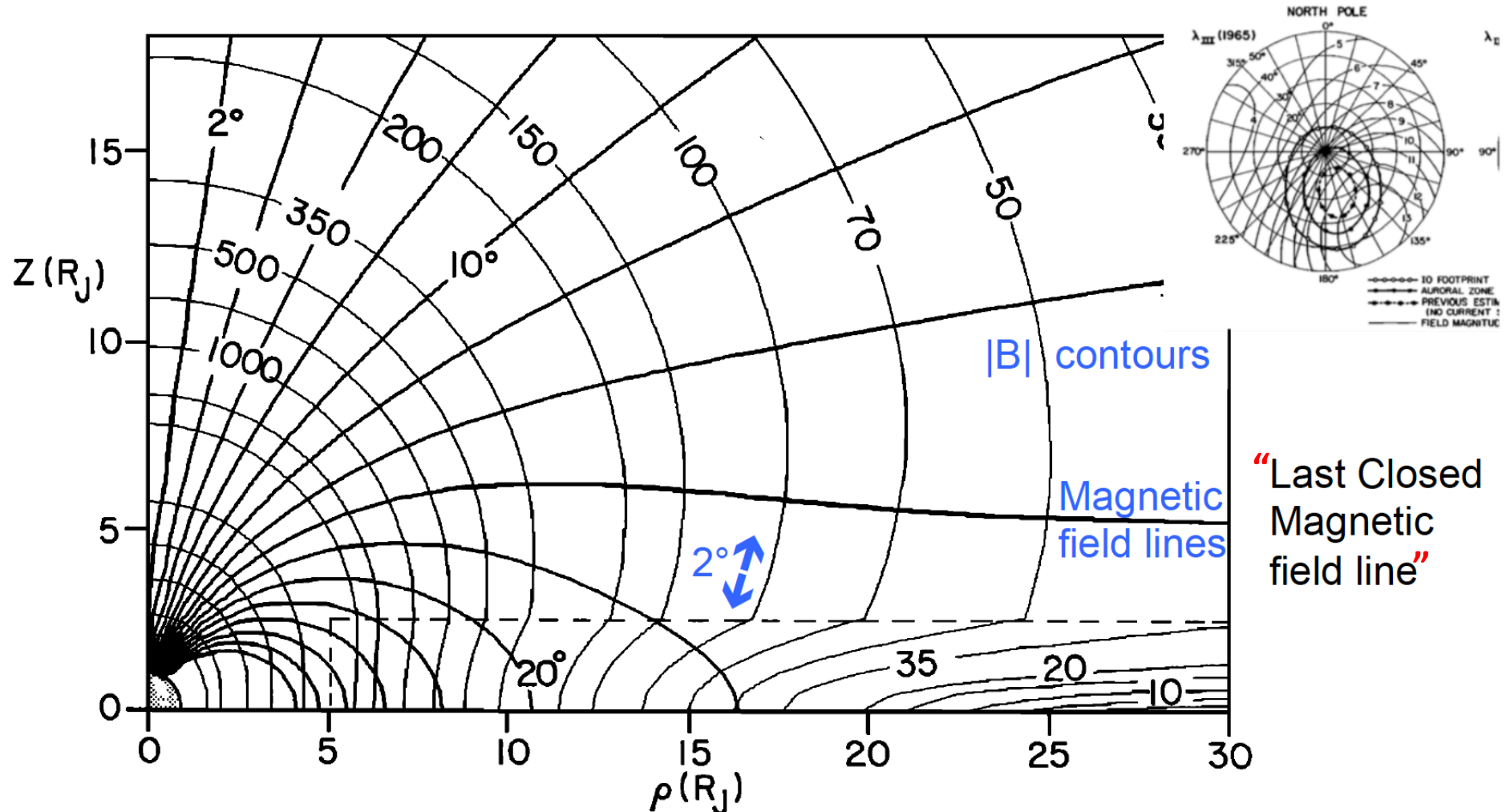
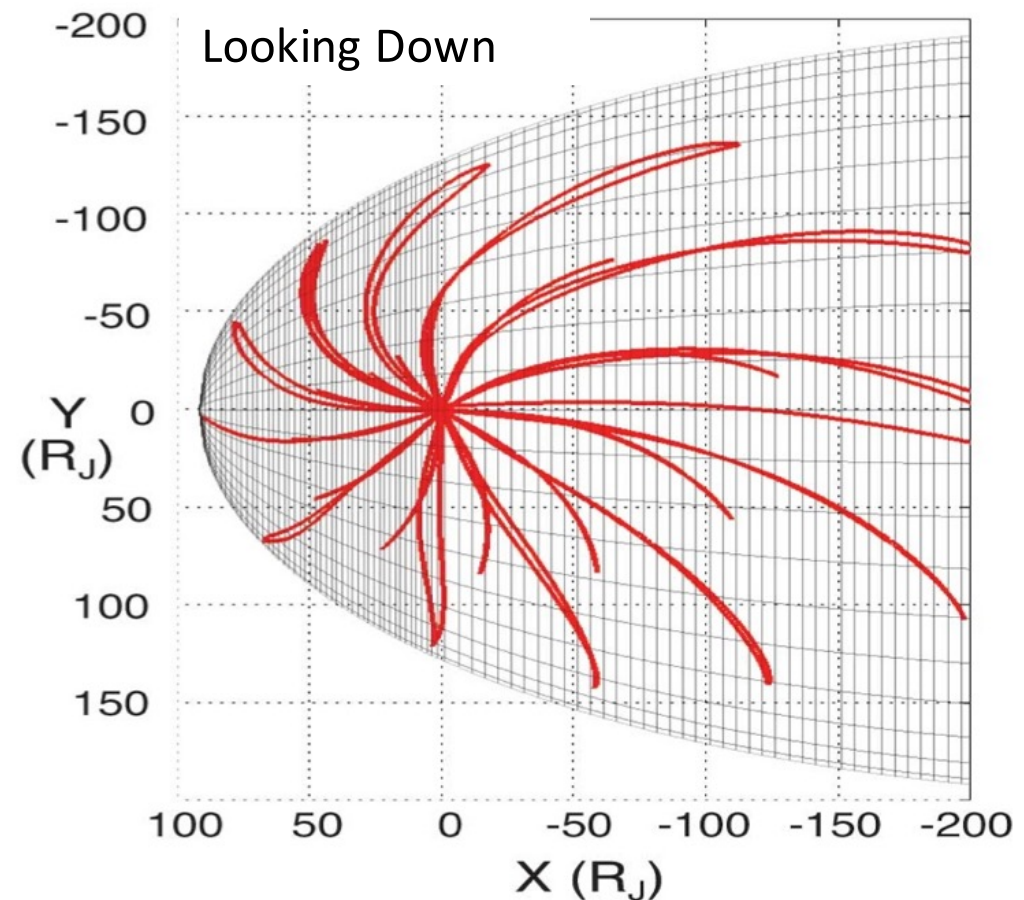
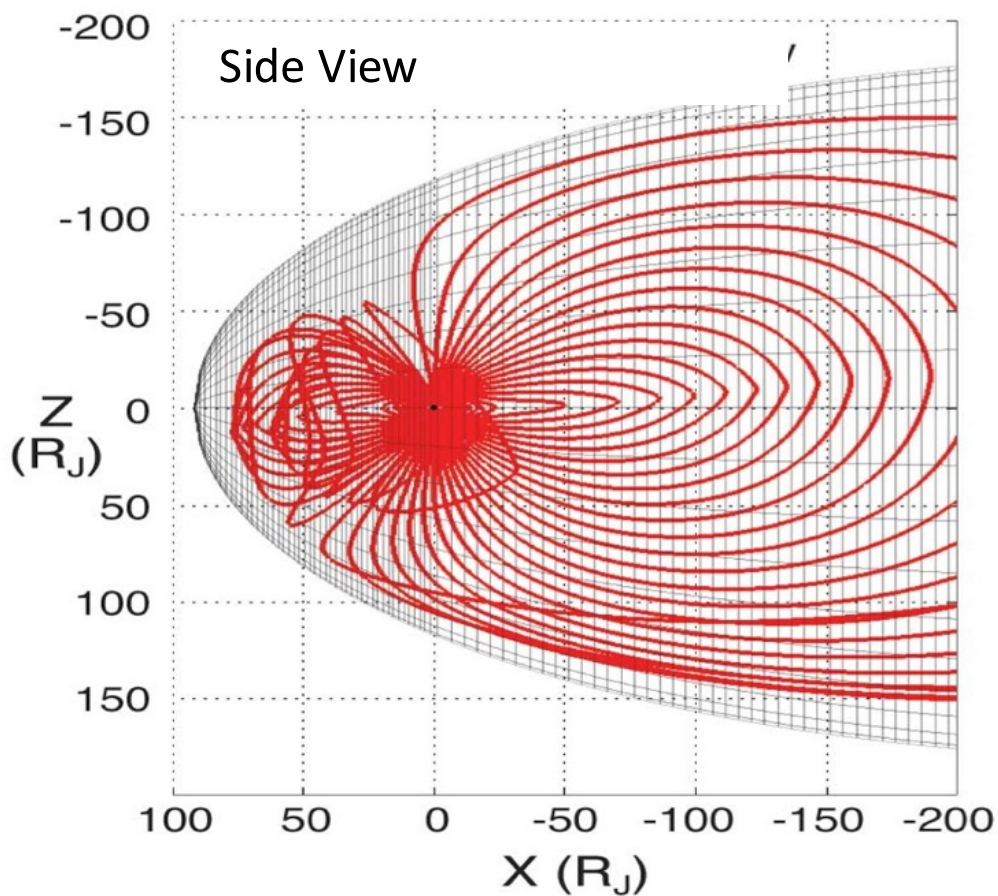


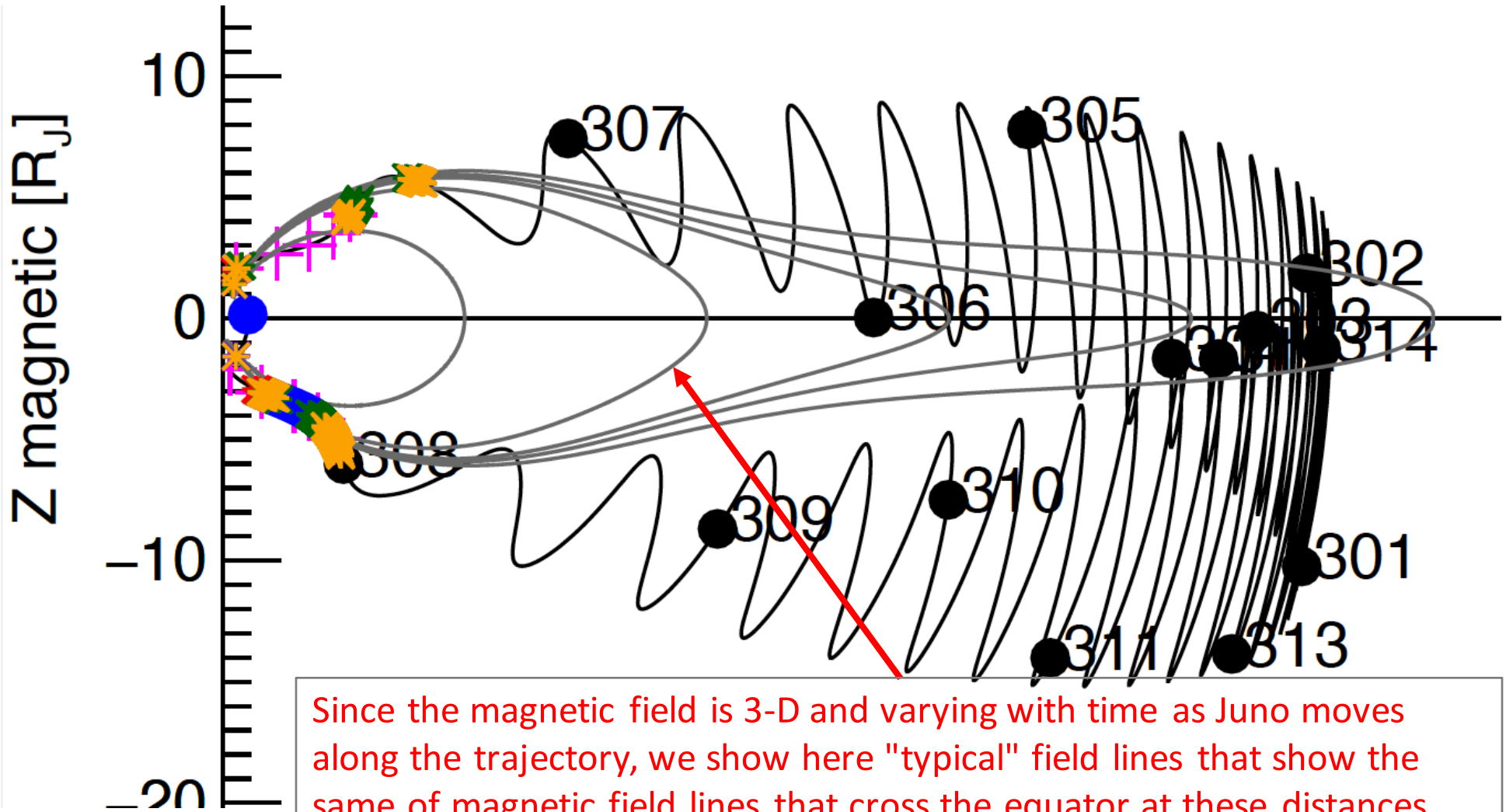
Fig. 9. Meridian plane projection of magnetosphere field lines (heavy) and isointensity contours (light) for Voyager 1 (and Pioneer 10) model. Values on field lines indicate colatitude of field line; field magnitude contours are expressed in gammas.

Jupiter magnetic field model of Khurana based on MAG data from 33 Galileo orbits – VIP4 internal + variable current sheet + magnetopause currents



The Wiggle Plot

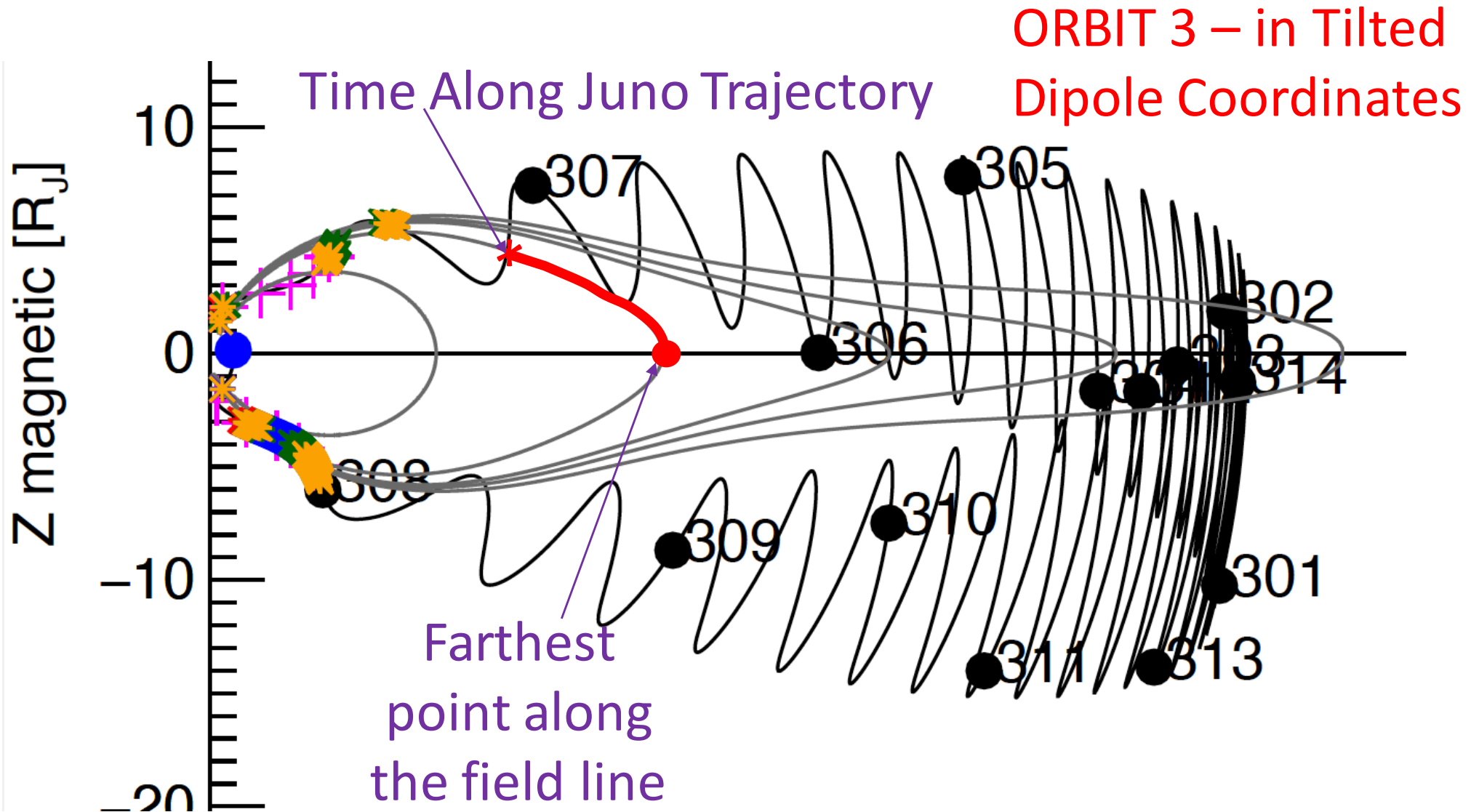
Juno Trajectory – in Tilted Dipole Coordinates



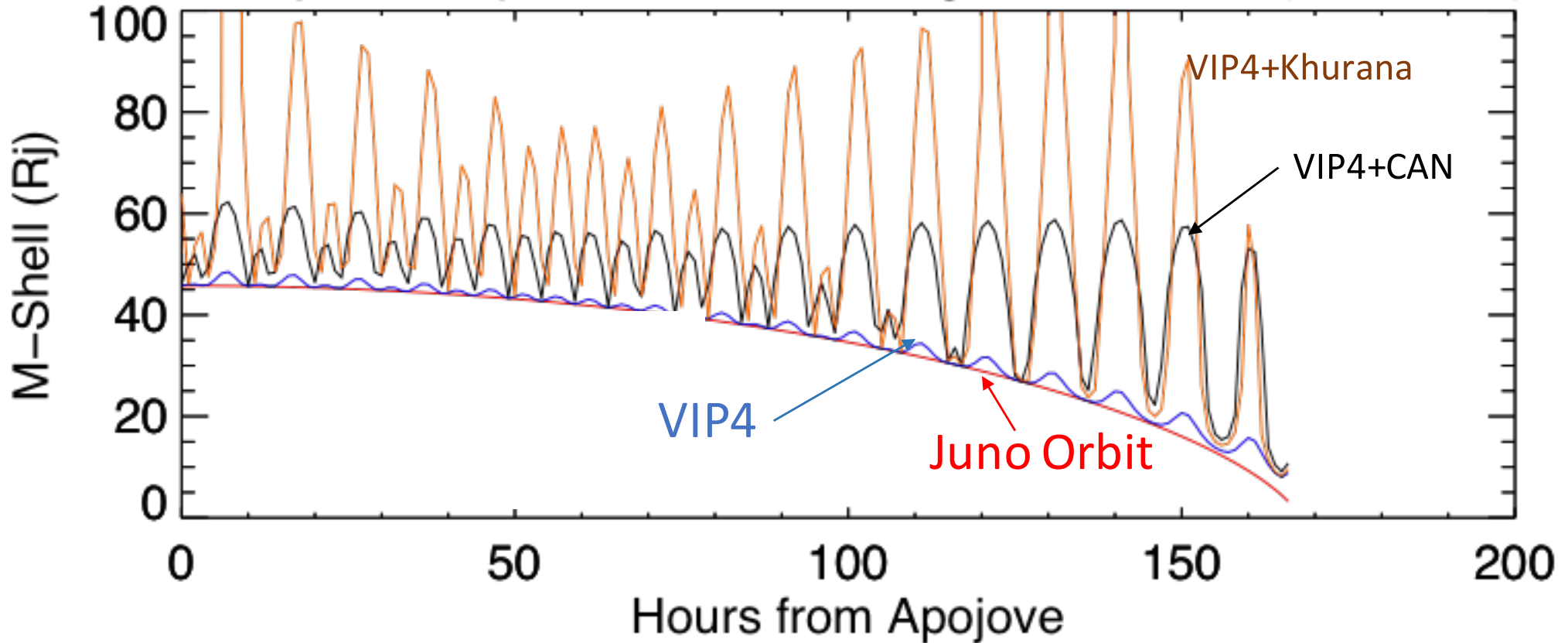
Since the magnetic field is 3-D and varying with time as Juno moves along the trajectory, we show here "typical" field lines that show the same of magnetic field lines that cross the equator at these distances of 10, 20, 30, 40, and 50 R_J – using the VIP4 + Khurana magnetic field.

Magnetic Field Line:

Farthest point = Magnetic Equator & B_r changes sign



Compare Equatorial Crossing Distances (Orbit 03)



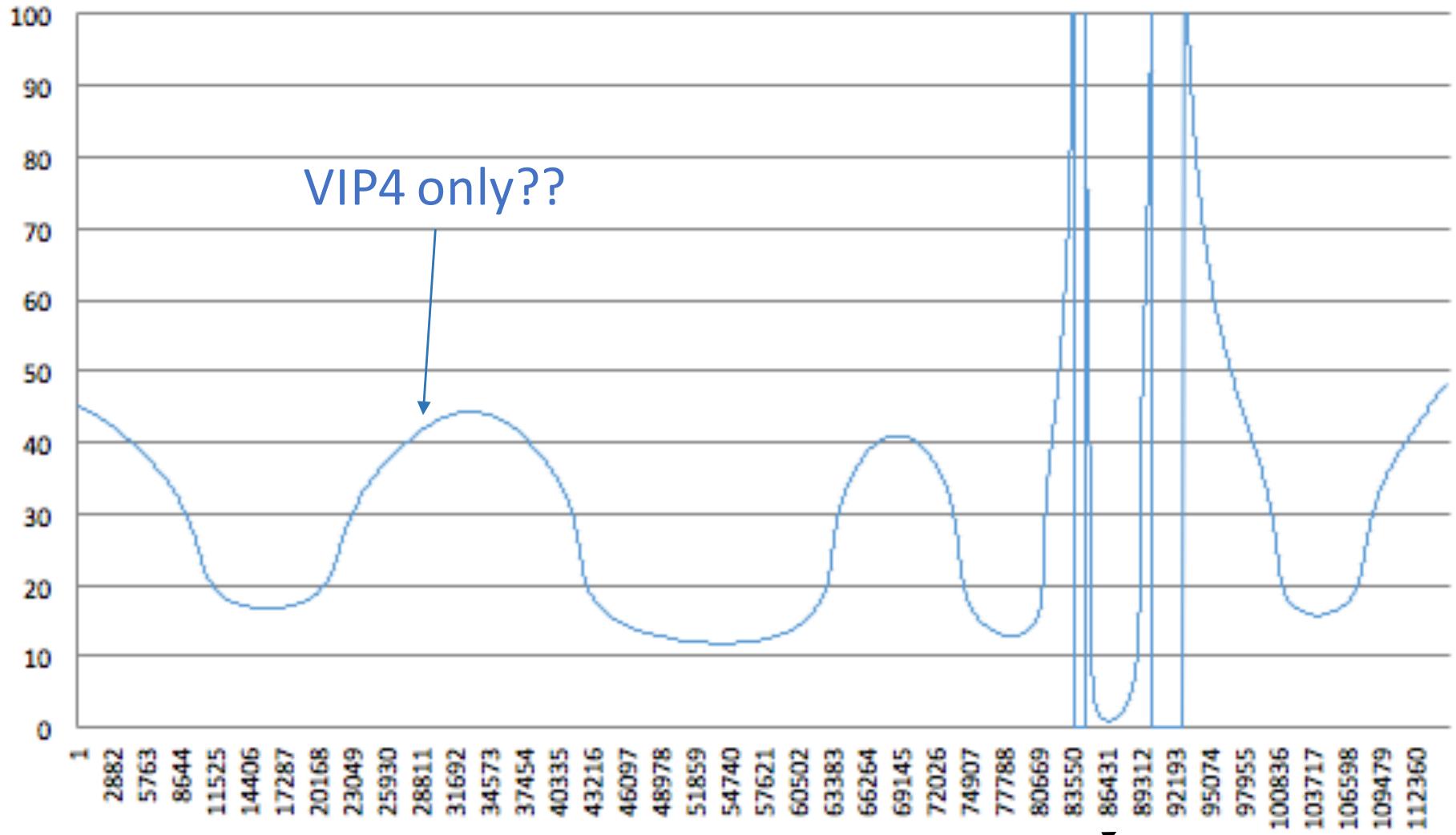
What to call this distance? R_{meq} ?

L-Shell = Dipole M-Shell - ???

J-Shell - ??? V-shell - ???

Barry uses VIP-L

PJ04 - L-Shell from JSOC



VIP4 only??

Nov 15 (DOY 320) 17:00
R~20 RJ

PJ4
Nov 16 (DOY 321) 17:00

Nov 17 (DOY 322) 1:00
R~10 RJ

	Pros	Cons
VIP4	Simplest	Does not work > "L~10"
VIP4 + CAN	Simple Aximuthally symmetric Quick calculation	Only valid when Rmeq<30
VIP4 + Khurana	Based on more data Varies with longitude Varies with local time Varies with absolute time	Not simple Varies with longitude Varies with local time Needs absolute time Computationally heavy
	<i>Is it necessarily more accurate?</i>	

Bill's Proposal:

- Use Dipole based on VIP4
 - call this Dipole L-shell
 - Buyer-beware: this has increasing error >10
- Use VIP4
 - call this VIP4-L
 - Buyer-beware: this has increasing error >10
- Use VIP4 + CAN
 - call this Rmeq
 - Buyer-beware: this has increasing error >30

BOTTOM LINE = LABEL, LABEL, LABEL!