MAGNETIC PPO PHASES

There are two PPO perturbation system, one in the Northern hemisphere and one in the Southern. Both phases are present in the equatorial region.

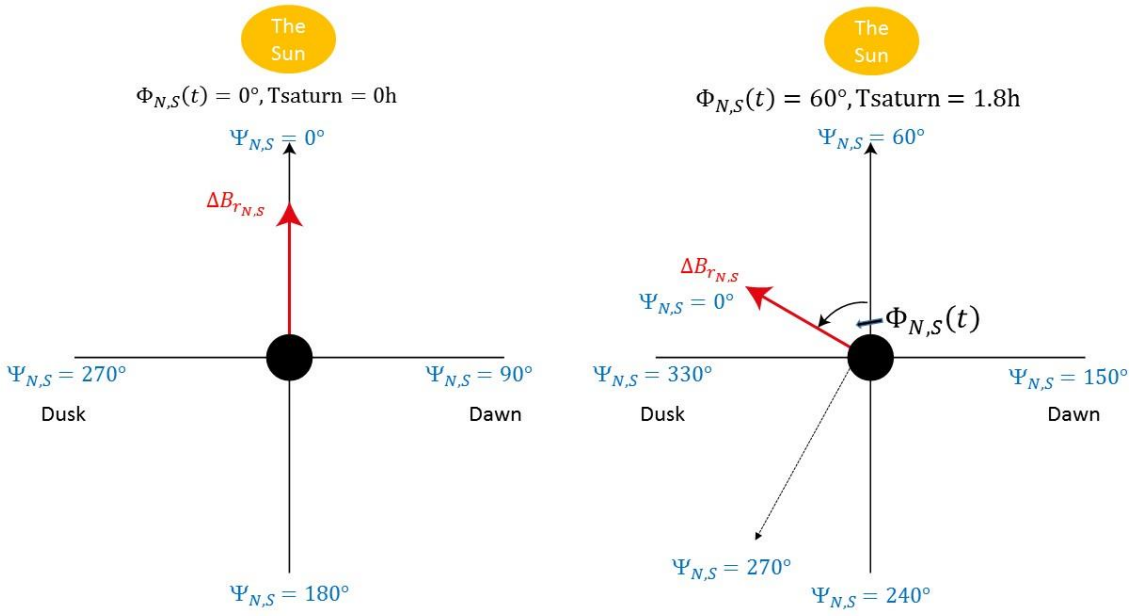
We have defined two PPO perturbation system, where we have defined the radial component of the quasi-uniform equatorial field for either the Northern (N) or Southern(S) system to vary as:

$$\Delta B_{r_{N,S}}=\Delta B_{r_{N,S0}} \cos(\Phi_{N,S}(t)-\varphi) = \Delta B_{r_{N,S0}} \cos(\Psi_{N,S}(t,\varphi))$$

In this system φ is the azimuth relative to local noon $\varphi = (LT-12)*15$

Where $\Psi_{N,S} = 0°$ the radial component of the quasi-uniform equatorial field is pointing radially away from the planet. When $\Phi_{N,S} = 0°$, $\Psi_{N,S} = 0°$ at the sub-solar pointt.

Below is a schematic showing the pointing direction of the Northern or Southern equatorial field at two different PPO phases. The diagram on the left depicts the PPO system at $\Phi_{N,S} = 0°$, the one on the right at $\Phi_{N,S} = 60°$. If we assume that the PPO period at this time was 10.8 h, then the two systems would be separated by 10.8*(60./360) h =1.8 h in time



The phase model that Leicester provides are the N and S phase values at local noon, $\Phi_{N,S}(t)$. When calculating the PPO phases you will generally want either the northern or the southern phase at the spacecraft, which is $\Psi_{N,S}$, so you need to subtract the azimuthal position of Cassini.

Contents of mag_phase.sav file

In the file are the northern and southern PPO periods and phases ($\Phi_{N,S}(t)$) at one minute resolution.

We define the time in doy2004 system where doy2004=0 is 00:00:00 on 1 January 2004, and we have counted days at one min resolution since then. I have included two time arrays in the .sav file, south_model_time and north_model_time. The times in these files correspond to the Southern and Northern periods (south_period_int and north_period_int) and to the Southern and Northern phases (south_mag_phase and north_mag_phase). Please note that there is also an array titled north_mag_skr_phase. In this array I have substituted N SKR phases (from Meudon) at the times early on in the mission when I could not determine the Northern oscillatory periods. In reality it makes little difference to the results and so it is up to you which array you use.

ANALOGY

If we were to make an analogy with how the longitude system is calculated at Earth, then for either system Φ is equivalent to UT (i.e the time at Greenwich), Ψ is the Earth's longitude system but increasing (positive) in a westward/clockwise direction, and Ψ=0 is the Greenwich meridian where the longitude is zero. At Earth the Greenwich meridian is pointing towards the Sun at noon. Here Ψ=0 (where the magnetic perturbation field points radially away from the planet) is at the subsolar point when $\Phi_{N,S} = 0°$.

However, please note, we do not use the term magnetic longitude because we don't feel that we can determine a longitude system without knowing Saturn's true rotation rate.