

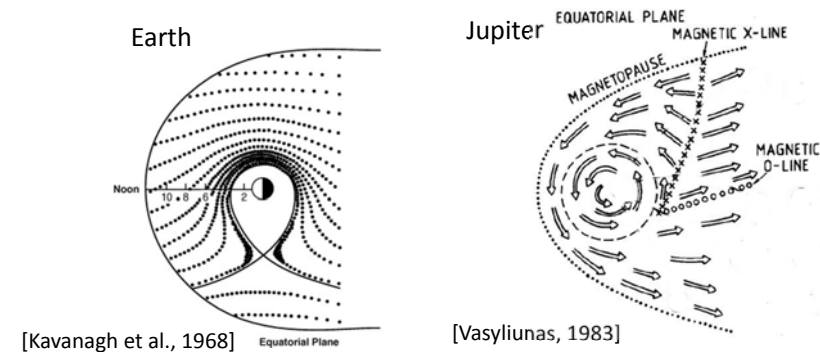
Statistical Study on Jovian Magnetospheric Response to Solar Wind Dynamic Pressure

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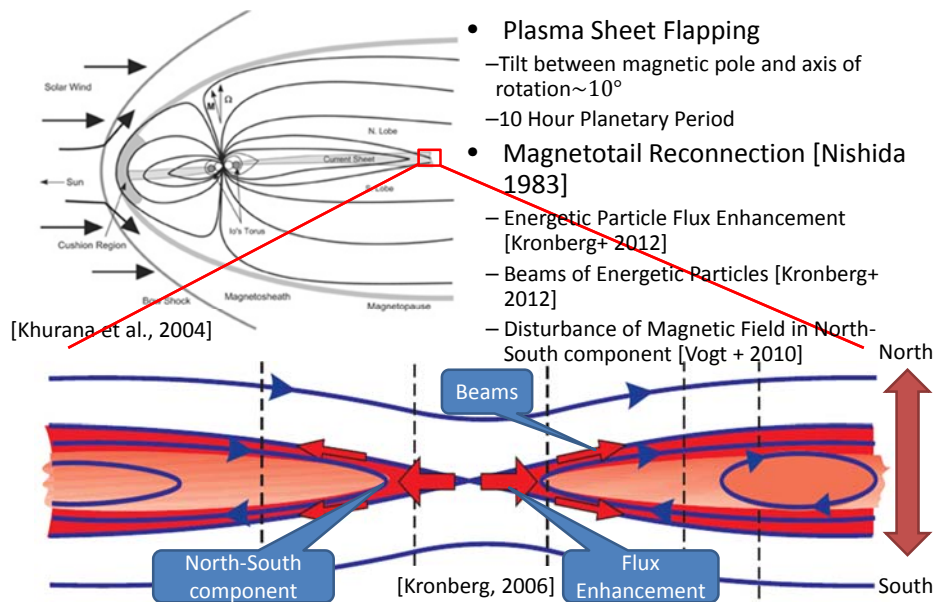
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Plasma Flows in Magnetosphere



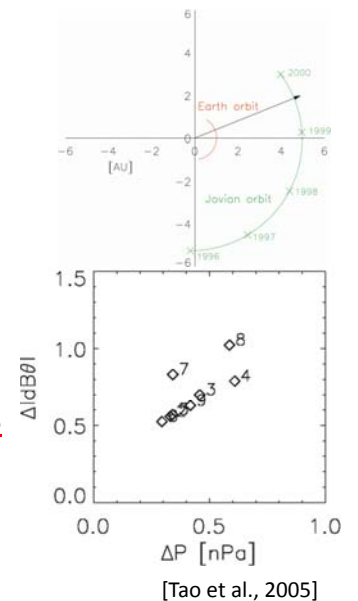
- Solar wind drives the plasma flow at the Earth
- Flow in the Jovian Magnetosphere is corotational

Characteristics of Jovian Plasma Sheet

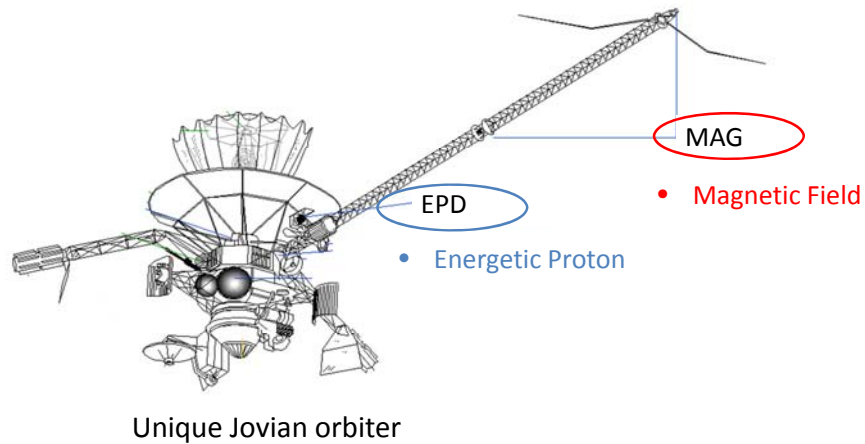


Does the Solar wind affect Jovian Tail ?

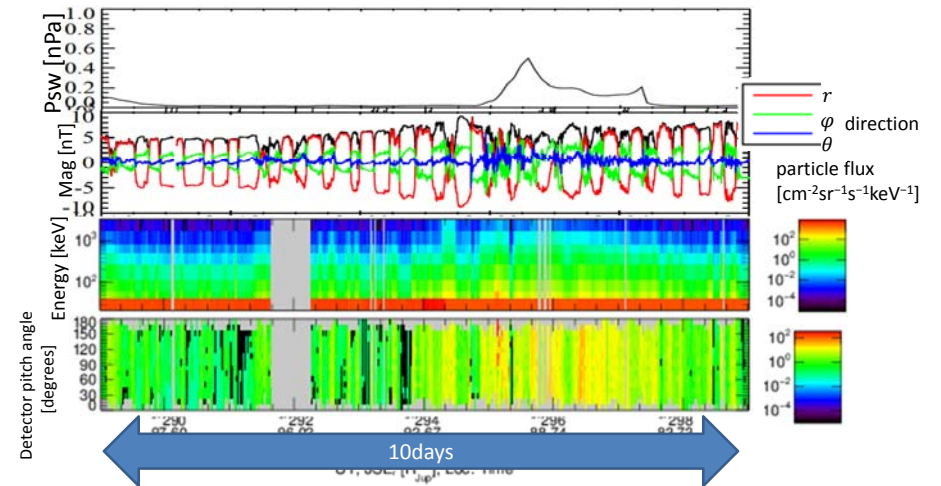
- In-situ SW monitor in Jovian Orbit is absent
 - only several observations are available
- Tao et al. [2005] calculated the solar wind at Jupiter via 1-D MHD simulation and analyzed Galileo magnetic field data
 - Only High Psw Event are examined
 - The number of events is small (9cases)
- Using the same SW propagation model, we investigate the magnetospheric response more statistically
 - Comparing Low Psw Event with High Psw Event
 - Also on Energetic Particles



GALILEO

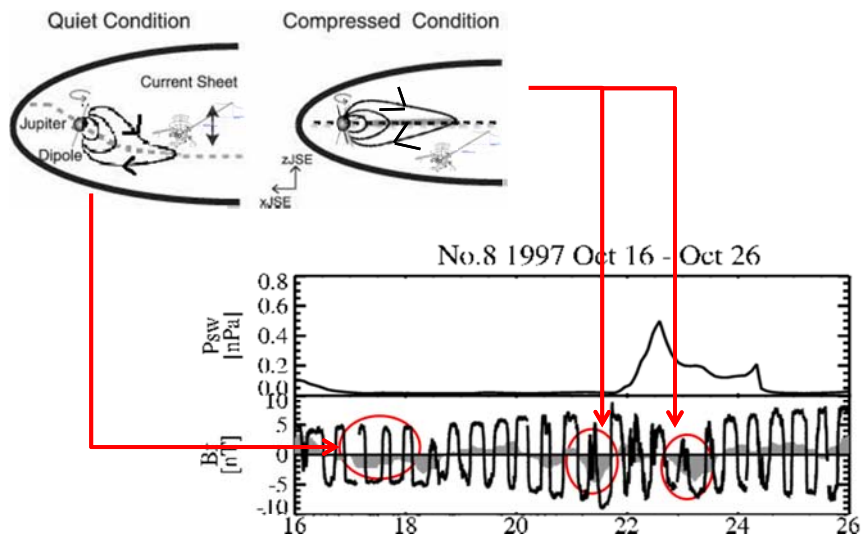


Example of an Observation

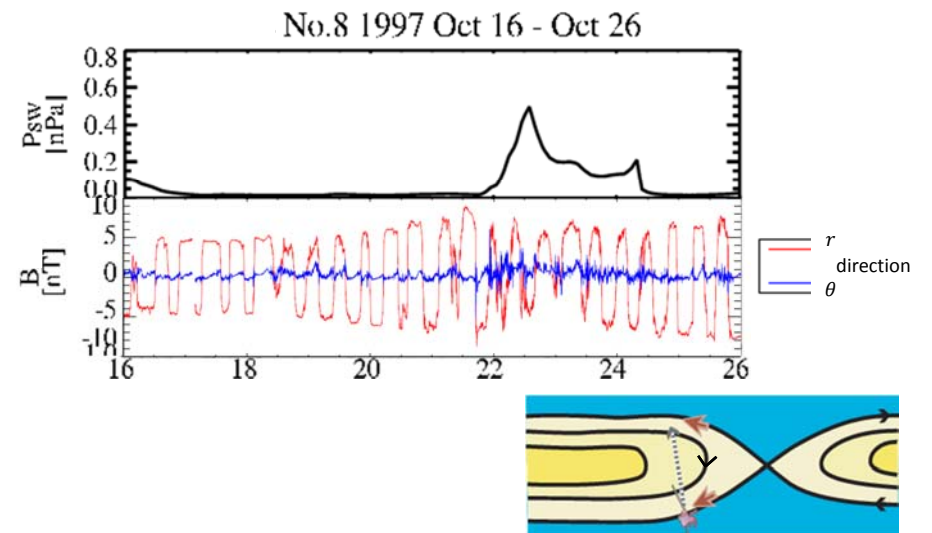


Changes in Magnetic Field Radial Component

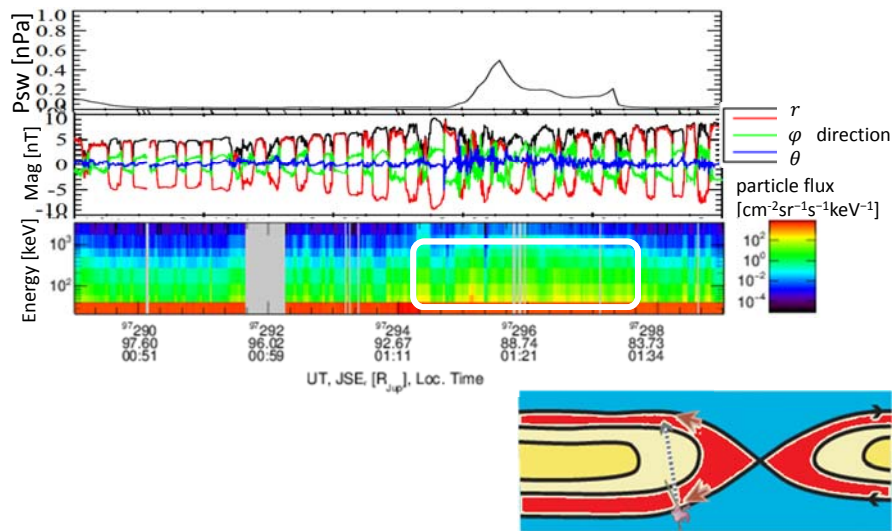
[Tao et al., 2005]



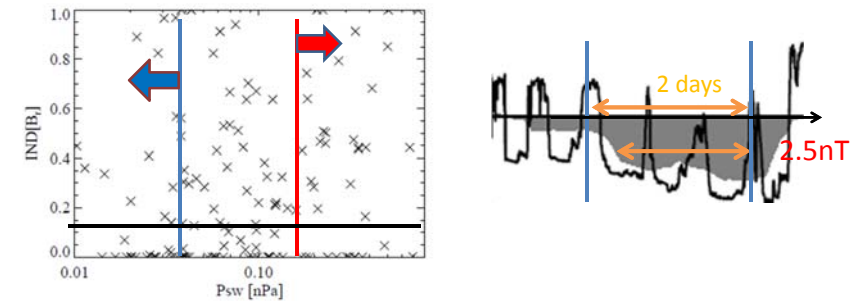
Disturbance in Magnetic Field North-South Component



Enhancement of Energetic Particles

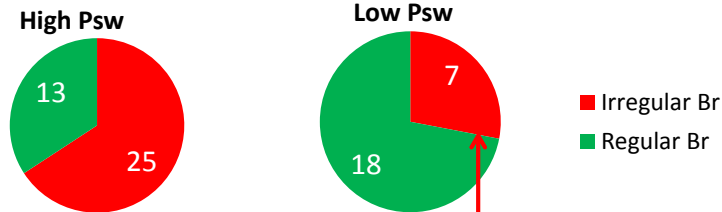


Do Br Have No Correlation with Psw ?

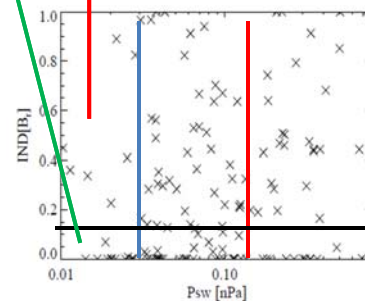


- Definition: 2 days as 1 event
- Index is ratio of time (smoothed Br > 2.5nT) in each event
- No Correlation with Psw?

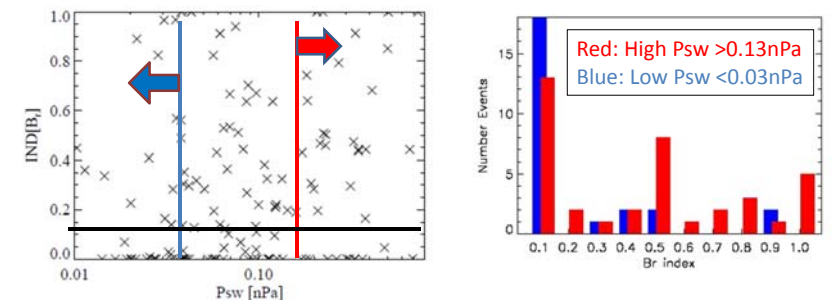
Analysis of Br



- Classifying all events depending on
 - High pressure or not ($P_{sw} > 0.13\text{nPa}$ or not)
 - Smoothed Br increases or not
- Condition of Magnetosphere seems to be different in high and low Psw
 - → We tested this results to confirm statistical significance (in next slide)

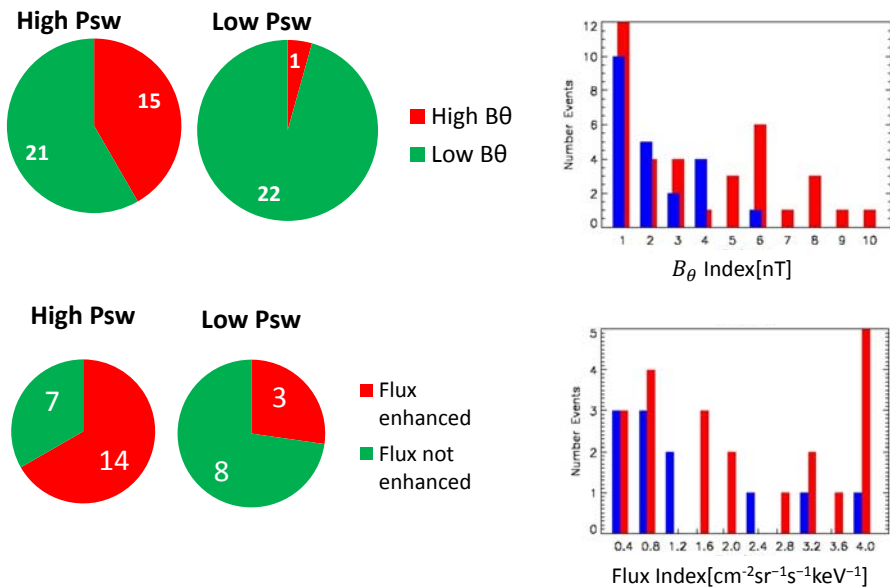


Statistical Analysis of Br



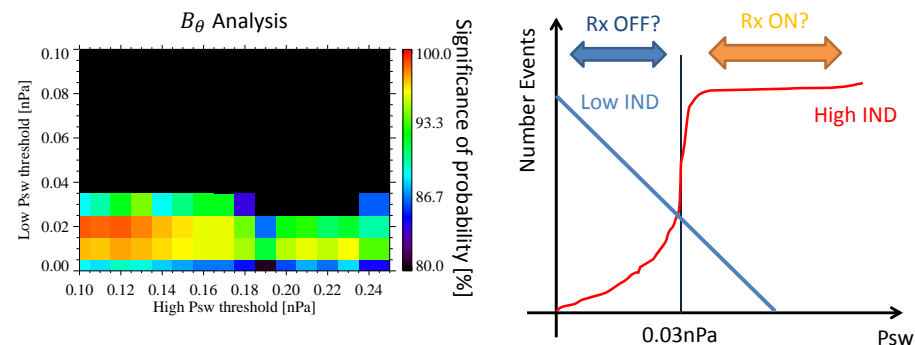
- Histogram of Br index distribution for High and Low Psw
- KS test is a hypothesis test rejecting the null hypothesis that populations of 2 samples are the same
- Confirmed that populations of high(>0.13nPa) and low(<0.03nPa) Psw is not the same by using KS test (99.3%)

Results of Statistical Analysis for B_θ and Flux

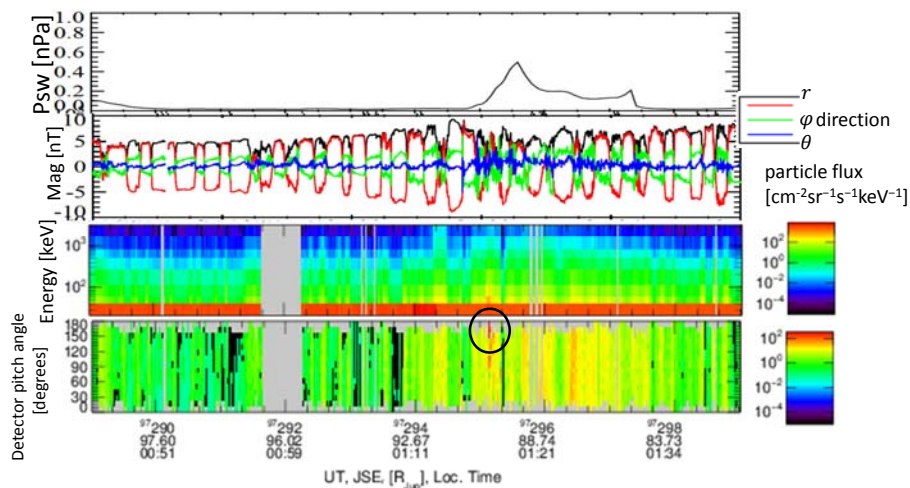


Thresholds of Statistical Analysis

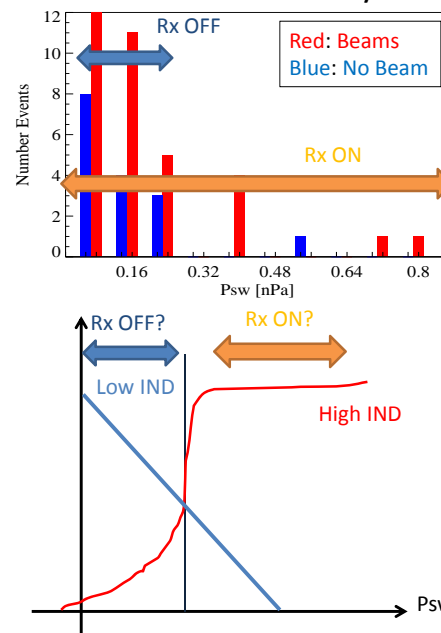
- Response of B_r, B_θ and Flux to Psw
 - Significant correspondence if thresholds of low and high Psw are 0.03nPa and 0.13nPa
 - Significance probability is low if threshold of low Psw is higher than 0.03nPa



Beams of Energetic Particles Response to Psw?



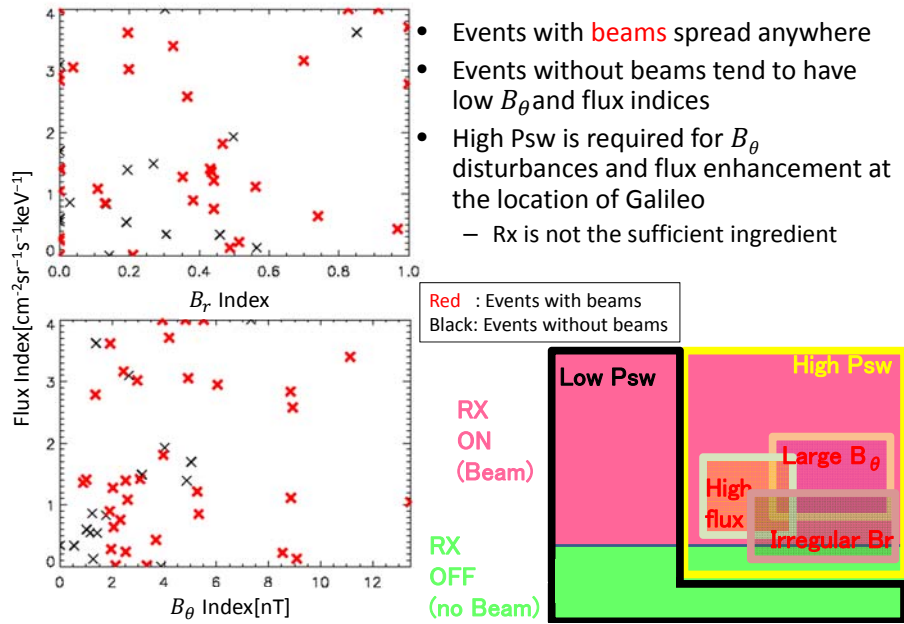
Analysis of Beam Events



- It is statistically insignificant that beams responds to Psw
 - KS test significance probability is 78%
- Beams are frequently observed in the low Psw condition
- Inconsistent with the results for B_r, B_θ and Flux ?

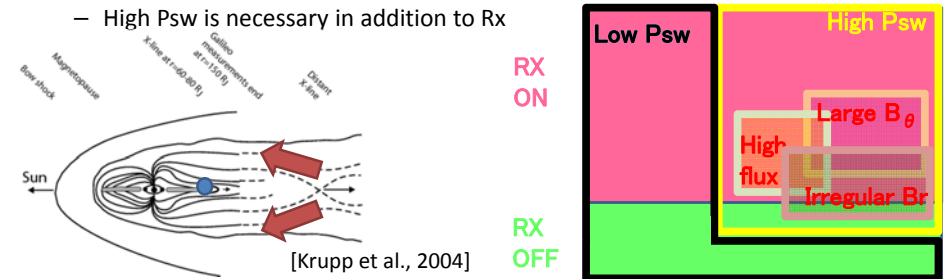
How can they be consistent ?

Relation between 3 Indices and Beams



Discussion

- It is statistically significant that Br , B_θ and flux tend to respond to P_{sw}
 - Events with high indices are seen under the condition $P_{sw} > 0.03nPa$
 - Consistent with high P_{sw} analysis by Tao et al., [2005] (Br and B_θ)
 - The first statistical analysis on the relation between flux and P_{sw} in Jovian magnetosphere
- Reconnection have weak relation with P_{sw}
 - Observationally consistent with conceptual model of reconnection driven by corotation
- Distant tail reconnection (Beam) is insufficient to observe B_θ disturbance and flux enhancement at the location of Galileo
 - High P_{sw} is necessary in addition to Rx



Summary

- We conducted statistical study on the response of night side Jovian tail to the solar wind pressure
 - Analysis has been difficult due to the absence of in-situ solar wind monitor
 - We used MHD calculation instead
 - Galileo magnetospheric observations are examined with propagated solar wind data
- We confirmed that Br , B_θ and flux respond to P_{sw}
 - $0.03nPa$ is the threshold
- Reconnection have weak relation with P_{sw}
- Distant tail reconnection (Beam) is insufficient to observe B_θ disturbance and flux enhancement at the location of Galileo
 - High P_{sw} is necessary in addition to Rx

