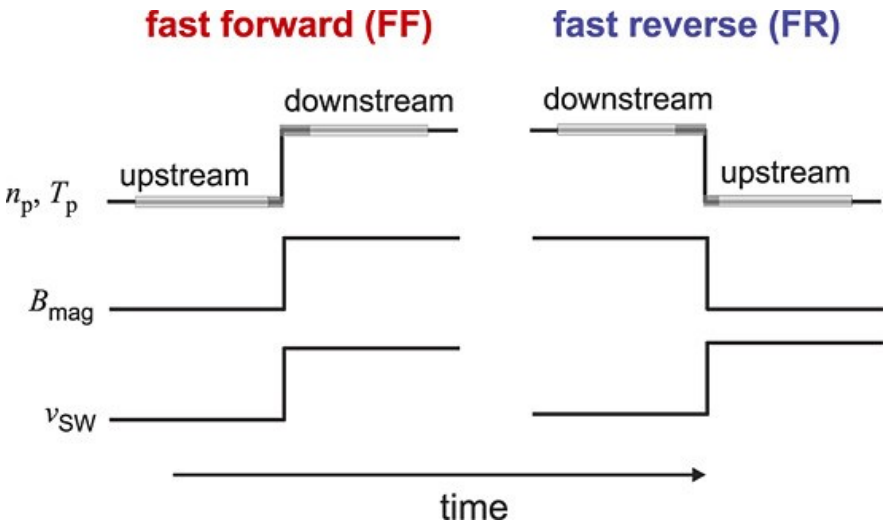
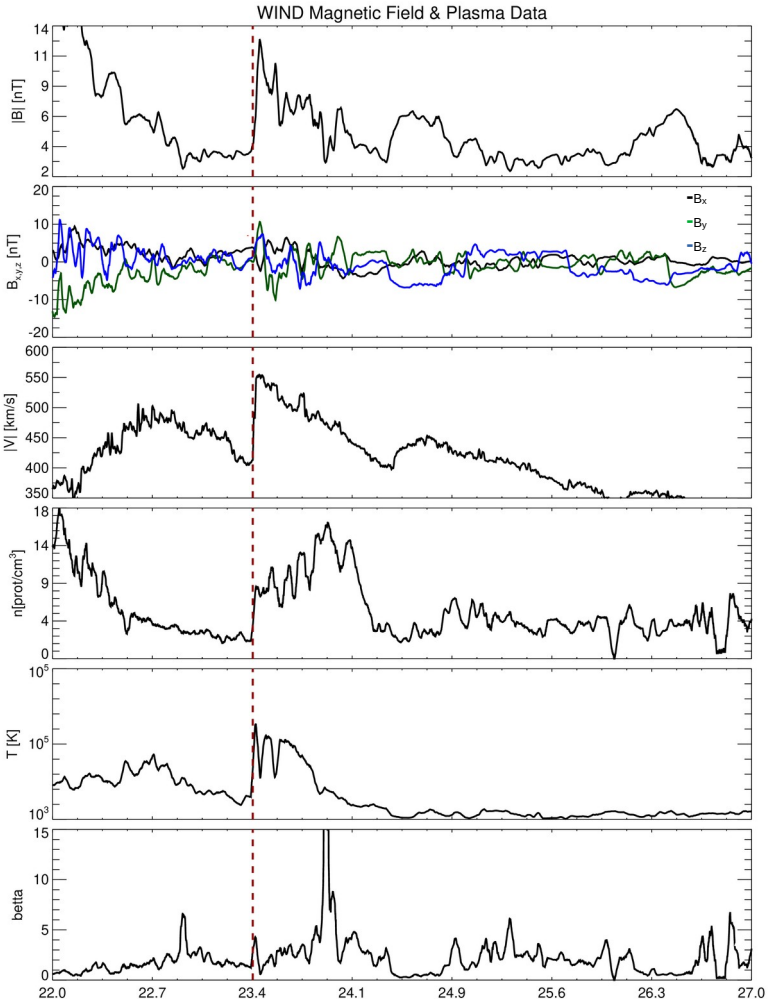
Interplanetary shocks

Characterized by an abrupt change in pressure, temperature, density and magnetic field intensity.





DOY time
Jan 23, 2001

Kilpua, E., et al., 2015

Coronal mass ejections

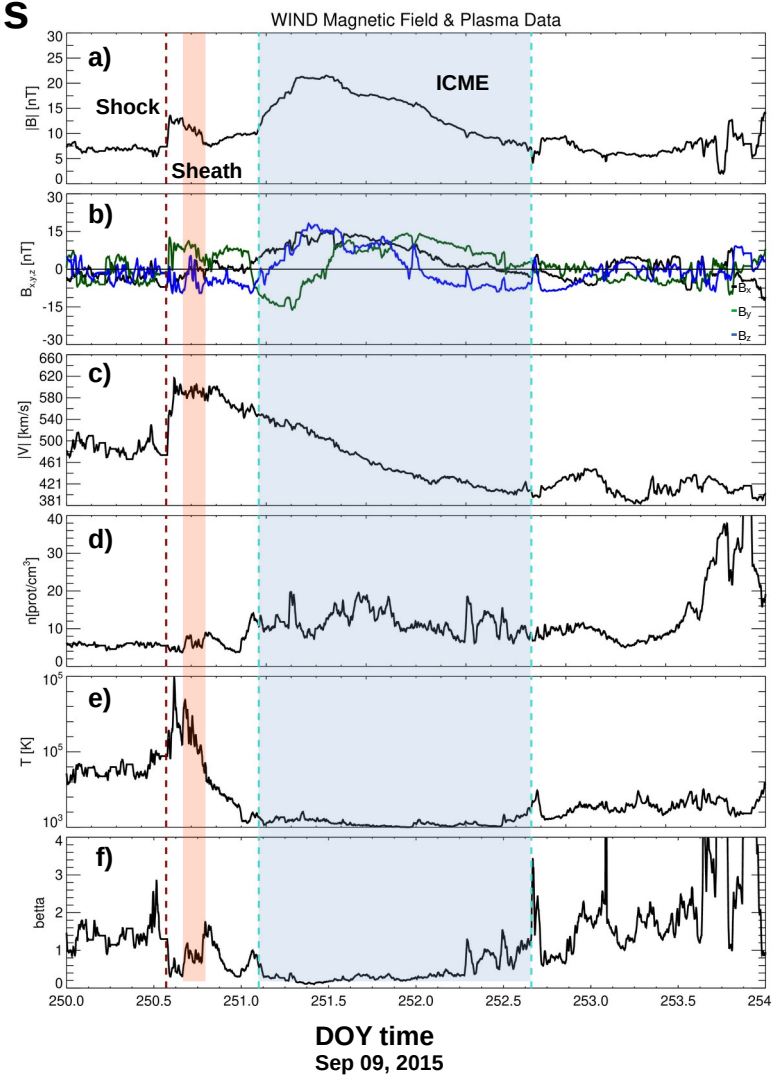
a) Increase of magnetic field strength B, characterized by a stronger than ambient magnetic field.

b) Smooth rotations in the magnetic-field components (presence of a flux-rope).

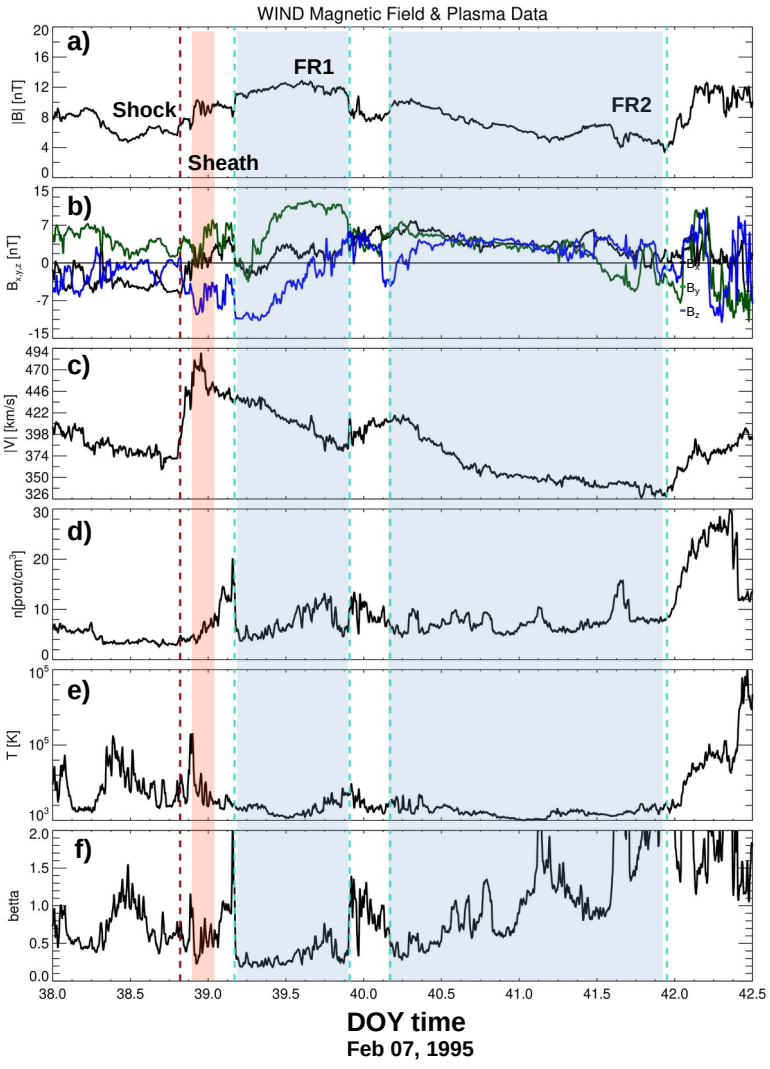
c) Declining velocity.

e) Low proton temperature.

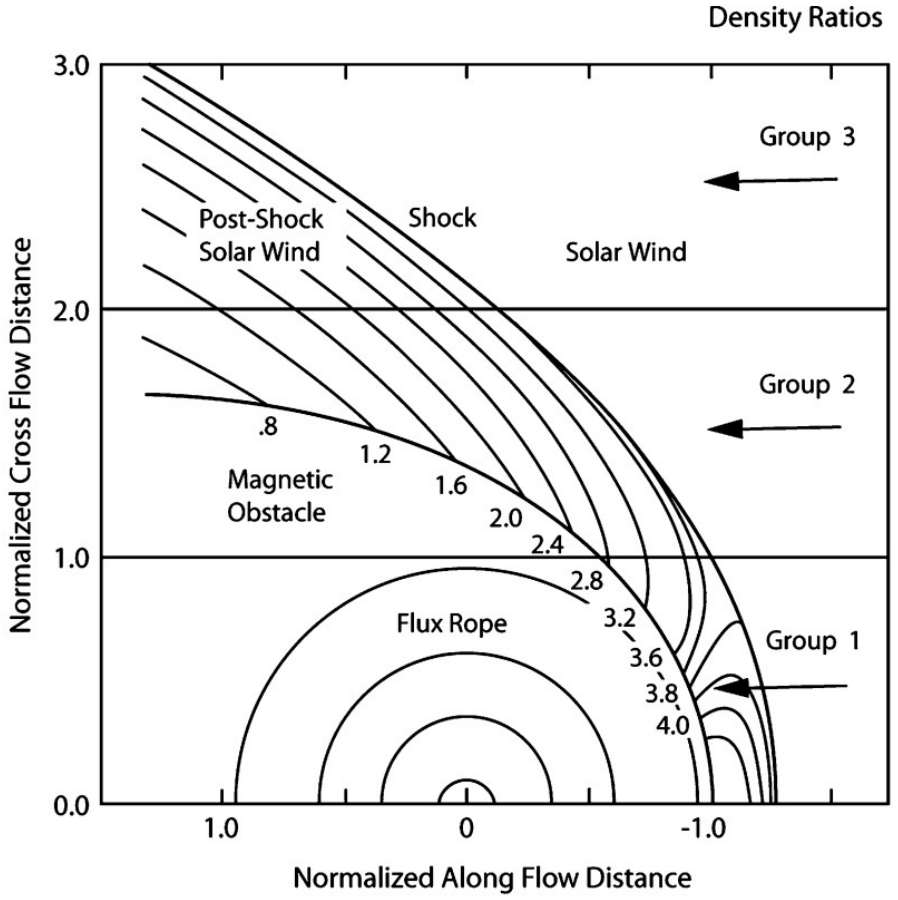
f) Low βp <1 (presence of a flux-rope).

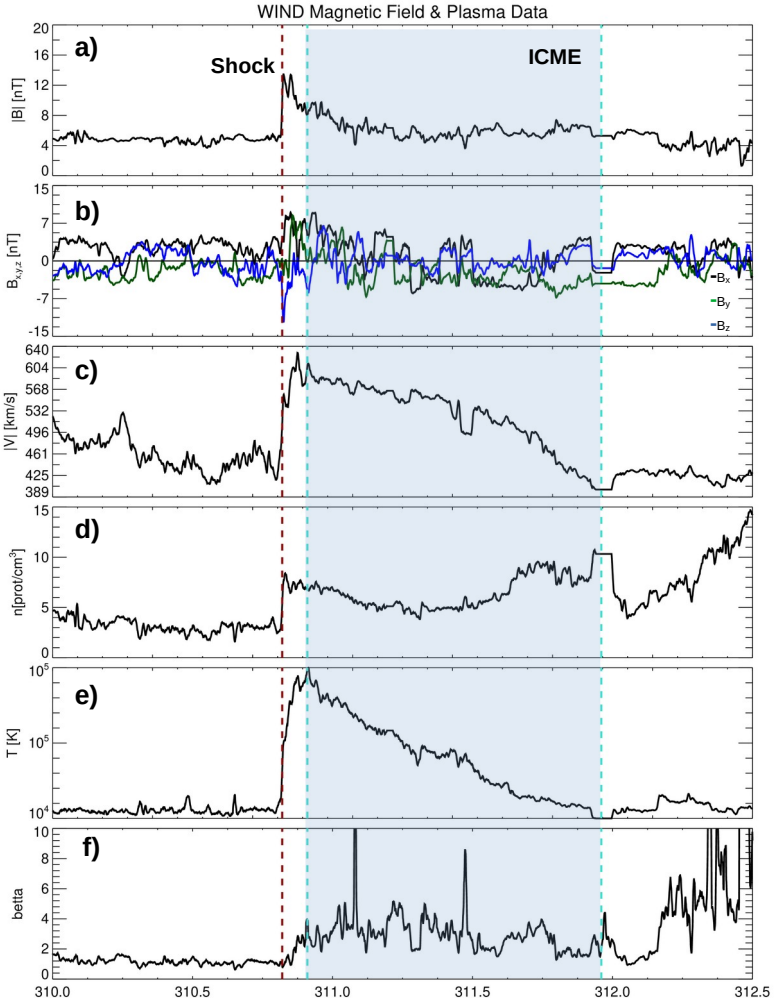


DOY time
Sep 09, 2015



DOY time
Feb 07, 1995





Group 1 events encounter the magnetic obstacle.
Group 2 events encounter the ICME near the obstacle.
Group 3 events the shock detected away the obstacle.
[L. Jian, 2006]

Stream interaction regions

a) Compression of magnetic field strength **B.**

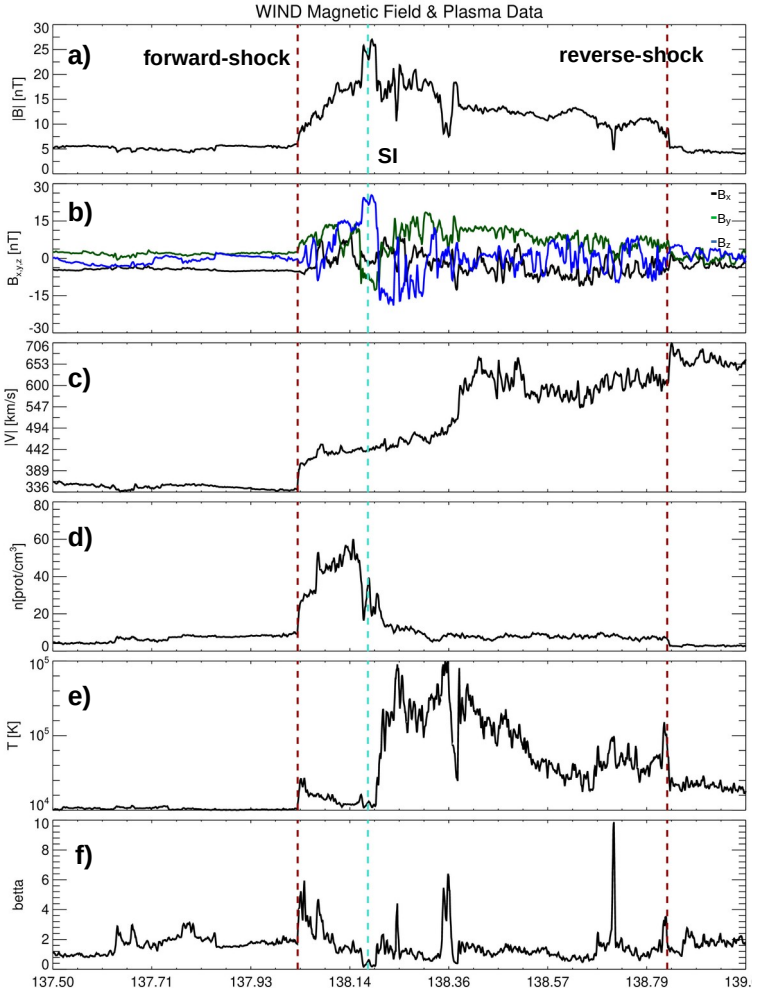
c) Continuosly increased solar wind speed **Vp**.

d) Increase of proton number density **Np.**

e) An enhancement of proton temperature **Tp**.

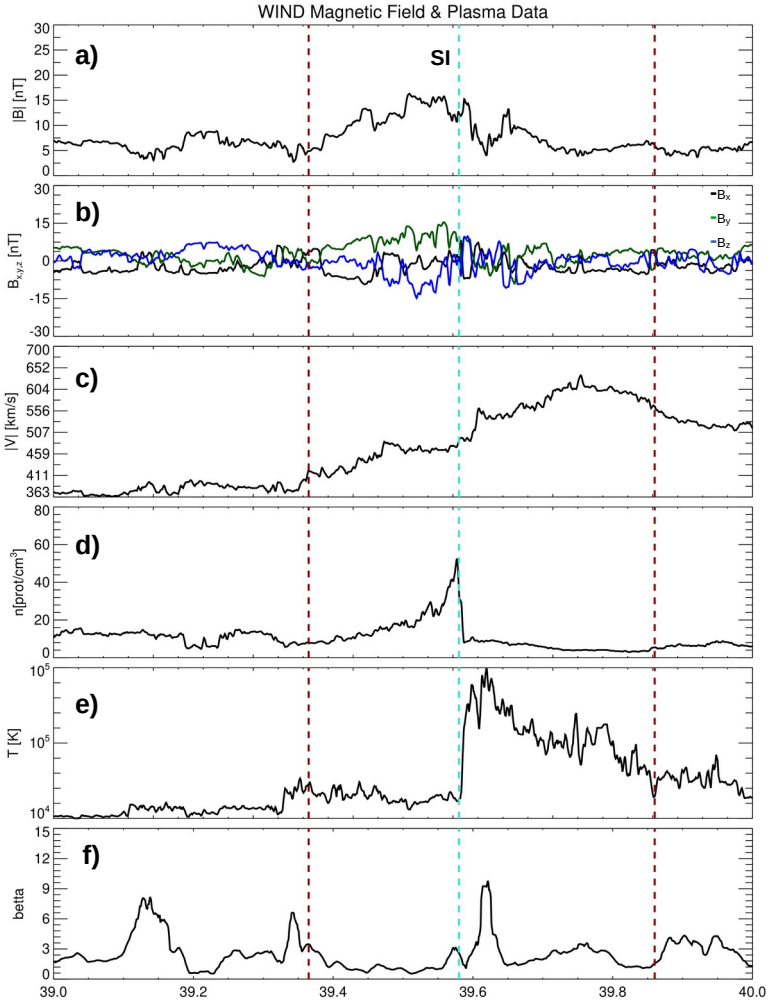
f) Slight increases in entropy.

SIR event with a pair of forward-reverse shocks



DOY time
May 18, 1999

SIR event without shocks



DOY time
February 8, 1997