Characteristics of the flank magnetopause: Cluster results

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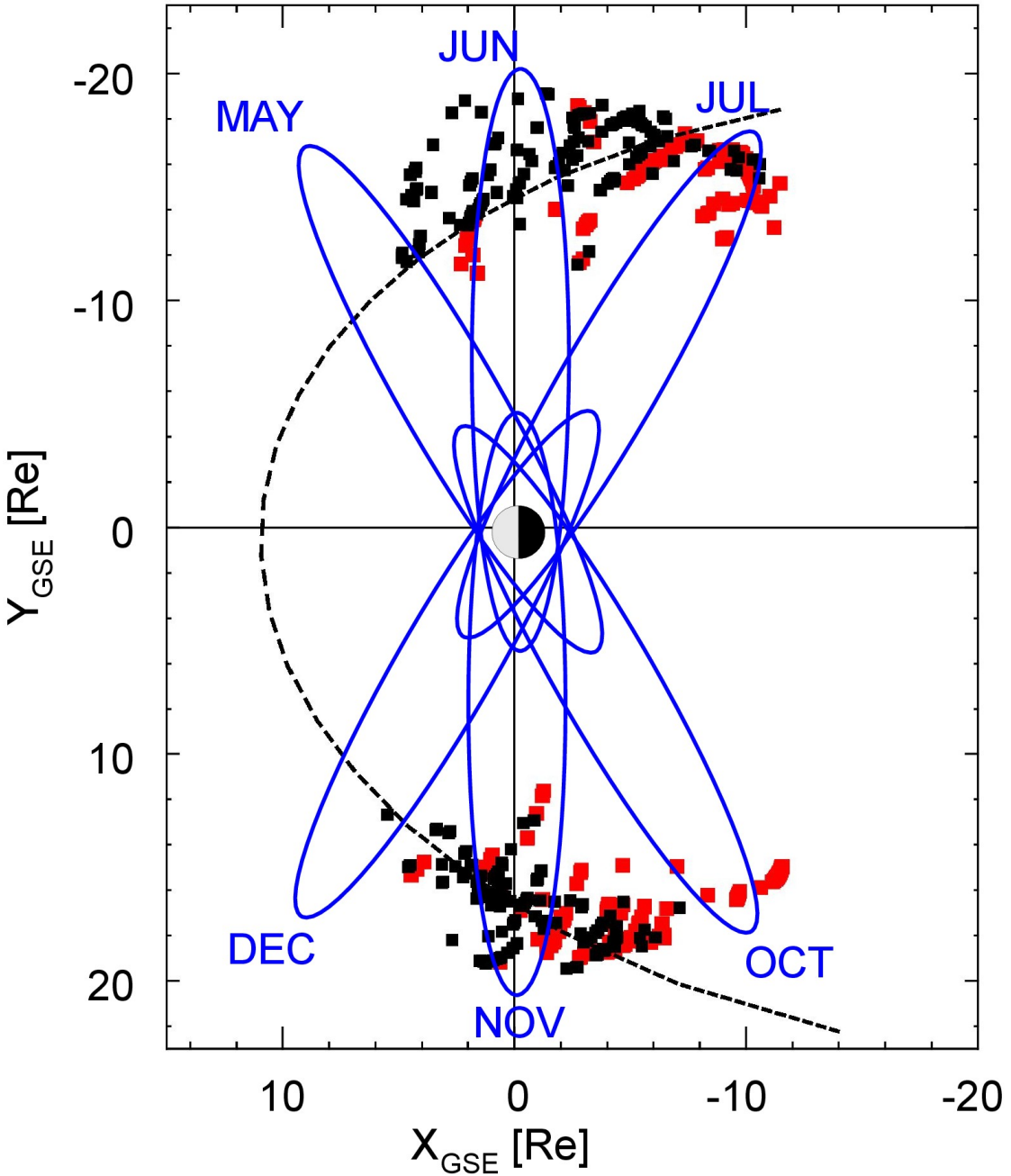
With significant contributions from the CAA team[7]



Cluster

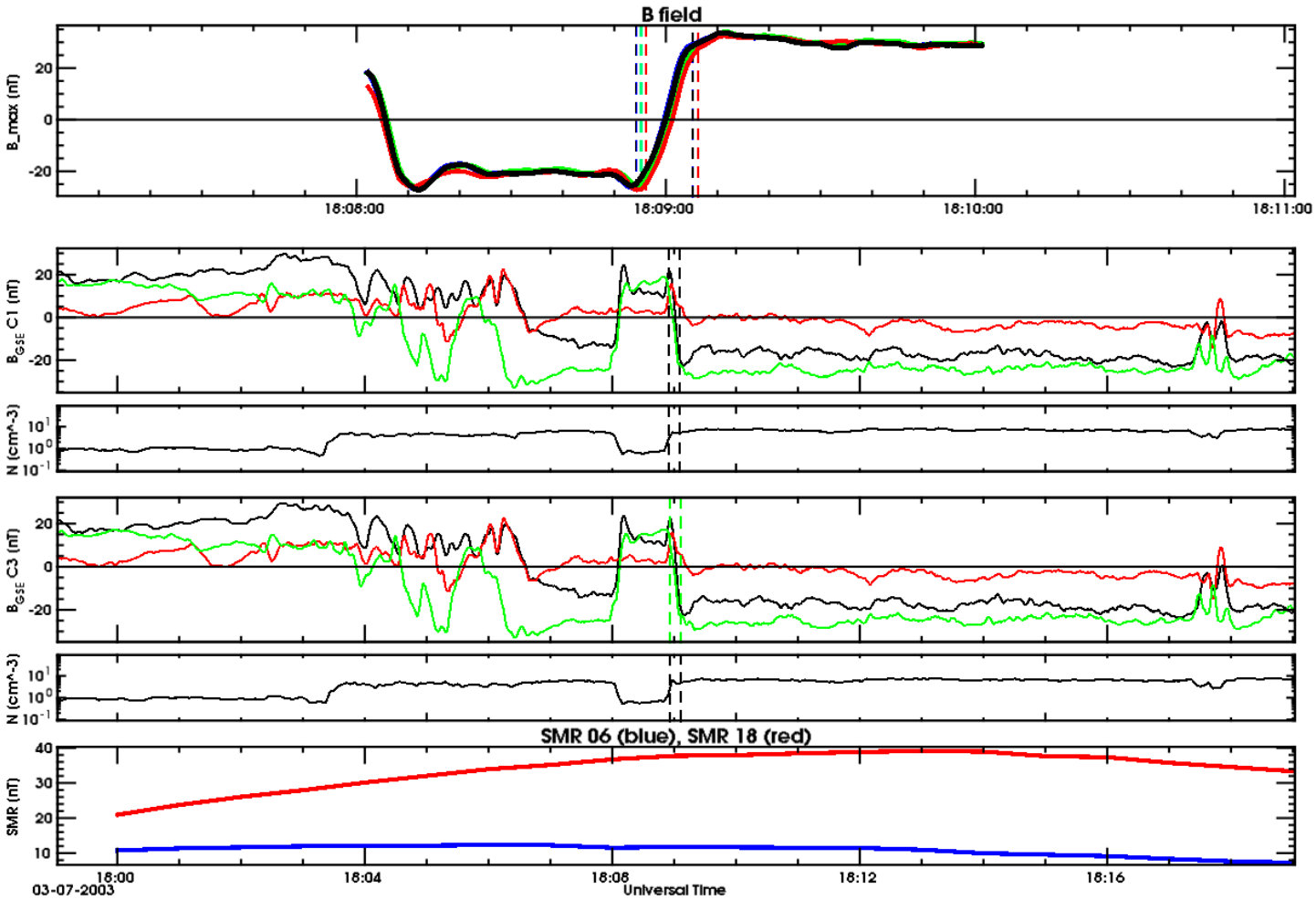
- 4 SC in formation
- 4 x 19 Re polar orbit

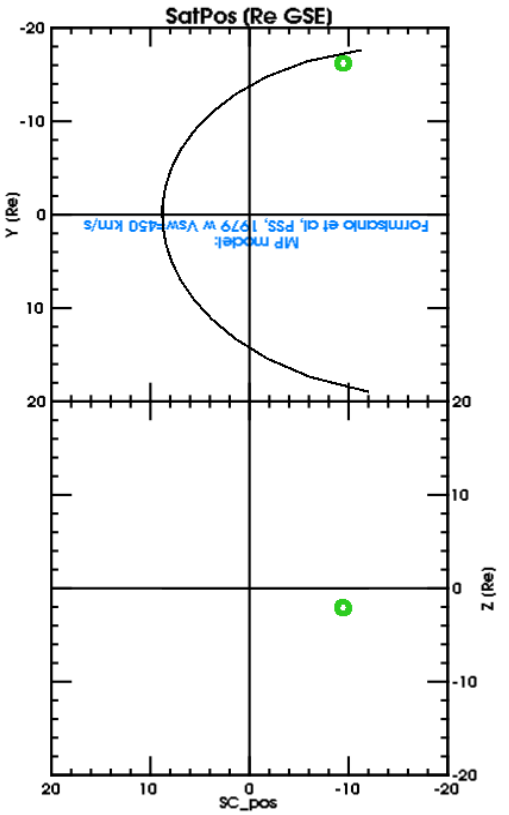
MP traversals 2001-2010:

- May – early July :dawn
- Late Oct – Dec : dusk
- ca 5'800 crossings
  (~16'000 individual xings)

Purpose

- Determine macroscopic properties of flank MP
  - Thickness
  - Current density
  - Motion
    - What controls the above parameters
- Classification (RD vs TD)
- Dawn – dusk asymmetries





Common parameters
V_HT = (-373.87 -96.00 45.07) km/s
HTcc = 0.983
Wsl = 0.153

Statistics C1
Bjump = 60.936744 (nT)
Duration = 11.0 (s)
Vn = -92.1167 (km/s)
D = 1013.28 (km)
J = 47.8561 (nA/m2)

Statistics C2
Bjump = 59.753848 (nT)
Duration = 10.0 (s)
Vn = -184.78 (km/s)
D = 1847.8 (km)
J = 25.7336 (nA/m2)

Statistics C3
Bjump = 60.341109 (nT)
Duration = 11.0 (s)
Vn = -117.402 (km/s)
D = 1291.42 (km)
J = 37.1821 (nA/m2)

Statistics C4
Bjump = 60.473389 (nT)
Duration = 11.0 (s)
Vn = -80.5136 (km/s)
D = 885.649 (km)
J = 54.3365 (nA/m2)

Curlometer results
J ave = 32.9993 (nA/m2)
J max = 48.4721 (nA/m2)
Q ave = 11.8281 (%)
Q max = 56.1109 (%)

MVA details (Eval, Evec):
0 (0.226 -0.315 0.922)
7.13 (0.586 -0.712 -0.387)
190 (0.778 0.628 0.024)
T = 18:08:02.100 - 18:10:01.200
(240 pts)

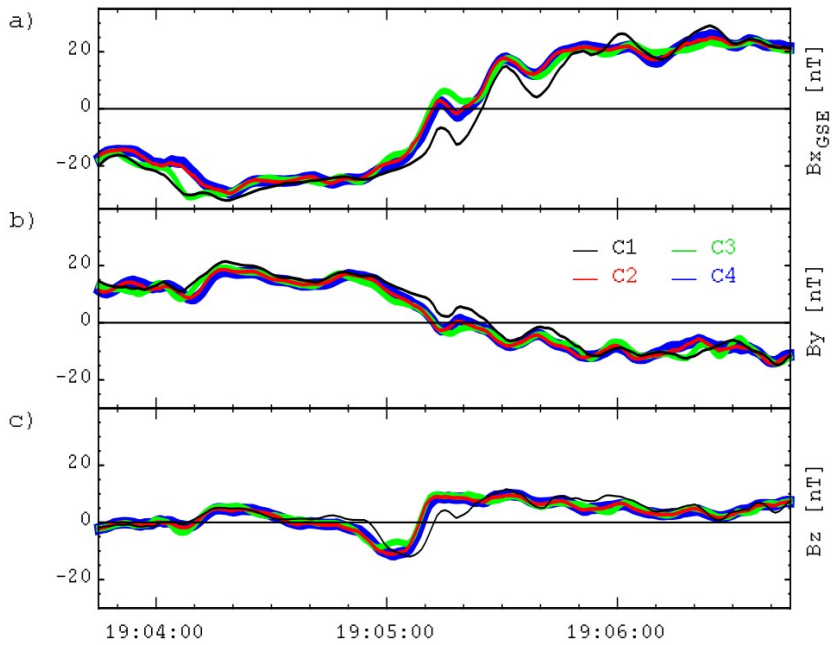
MVA details (Eval, Evec):
6.62 (0.438 -0.864 -0.248)
16.9 (-0.666 -0.498 0.556)
604 (-0.604 -0.078 -0.793)

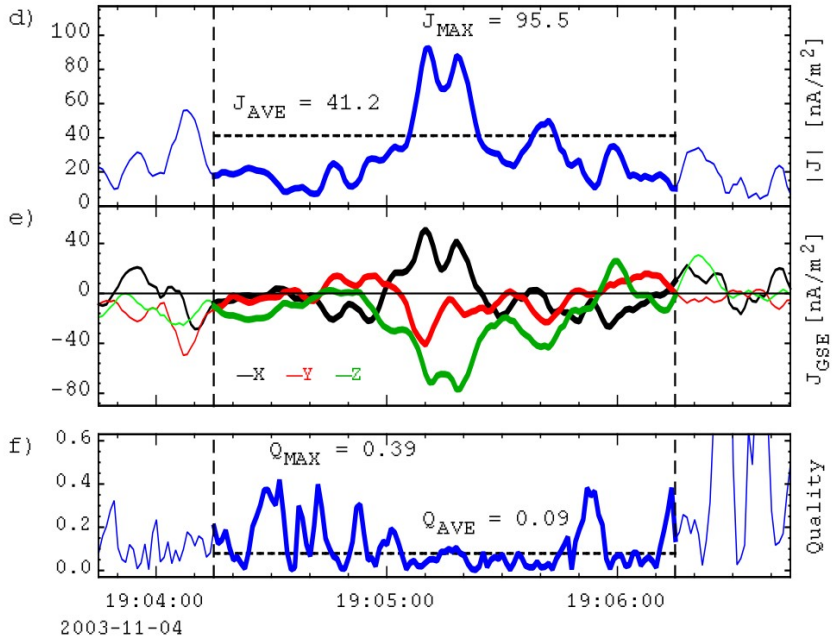
MVA details (Eval, Evec):
6.24 (0.617 -0.672 -0.409)
14.4 (-0.491 -0.736 0.467)
617 (-0.615 -0.088 -0.784)

MVA details (Eval, Evec):
6.64 (0.489 -0.820 -0.297)
15.5 (-0.617 -0.566 0.547)
606 (-0.617 -0.084 -0.783)

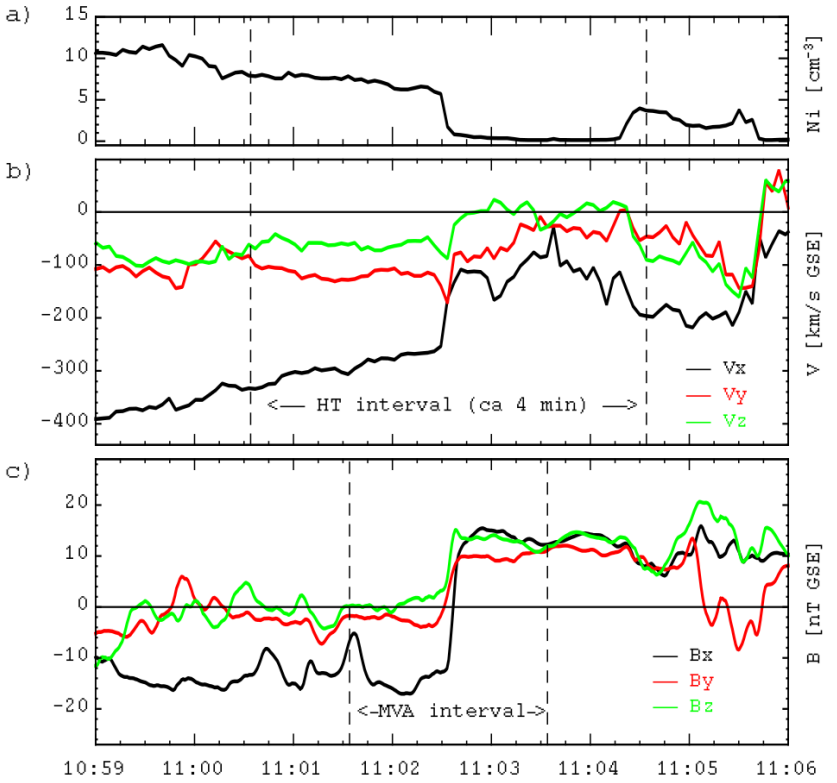
MVA details (Eval, Evec):
6.57 (0.413 -0.880 -0.234)
16.2 (-0.682 -0.469 0.561)
606 (-0.603 -0.072 -0.794)

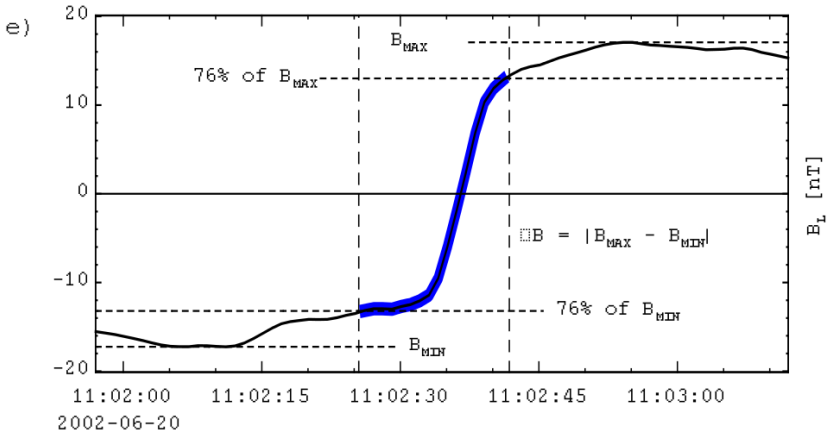
2003-07-03T18:08:59 (calculated; given crossing time = 2003-07-03T18:09:02 - diff = 3.0 s; sumEval = 2433.3 EVALOK)



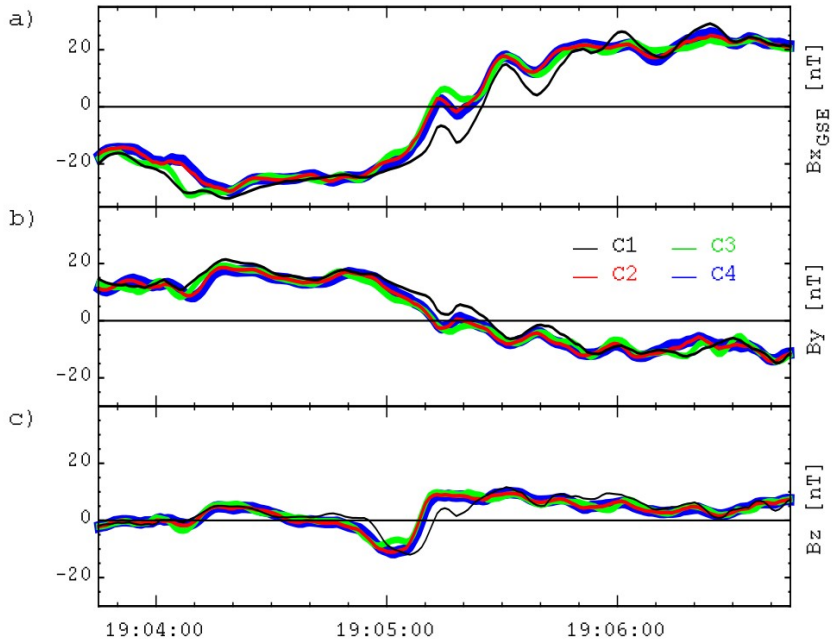


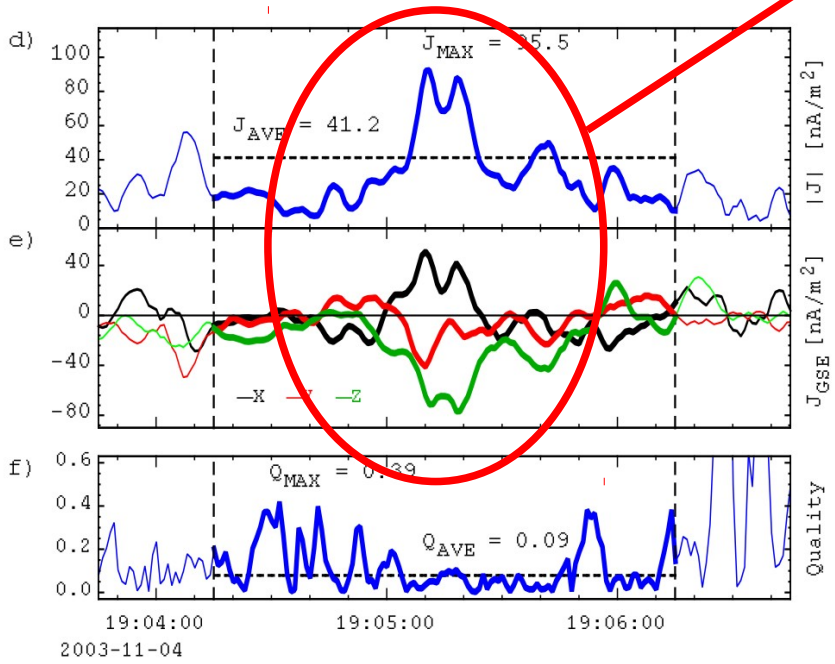
Curlometer (ca 18-20 % of cases)





Single SC (Harris sheet approach)





Curlometer (ca 18-20 % of cases)

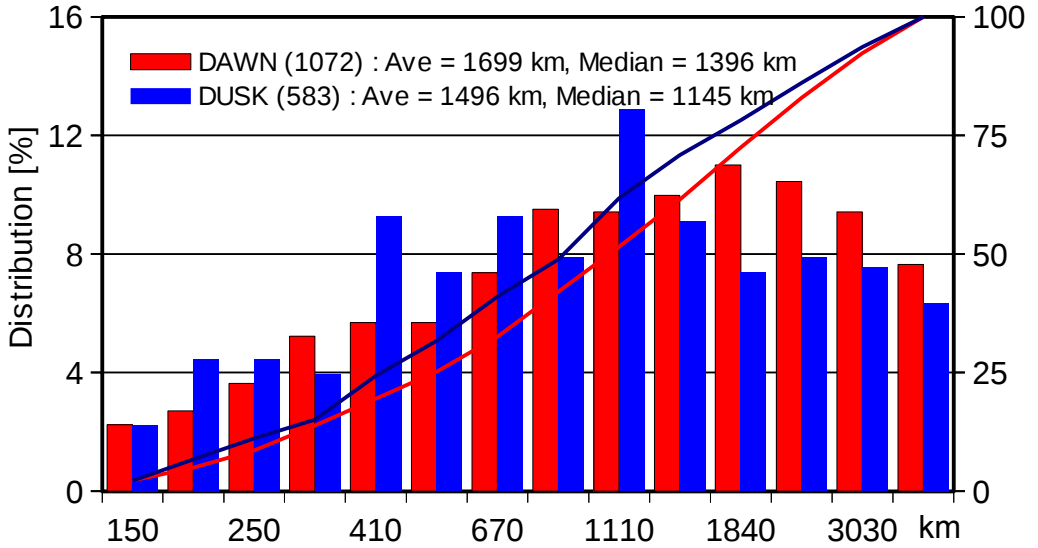
Layered current sheets

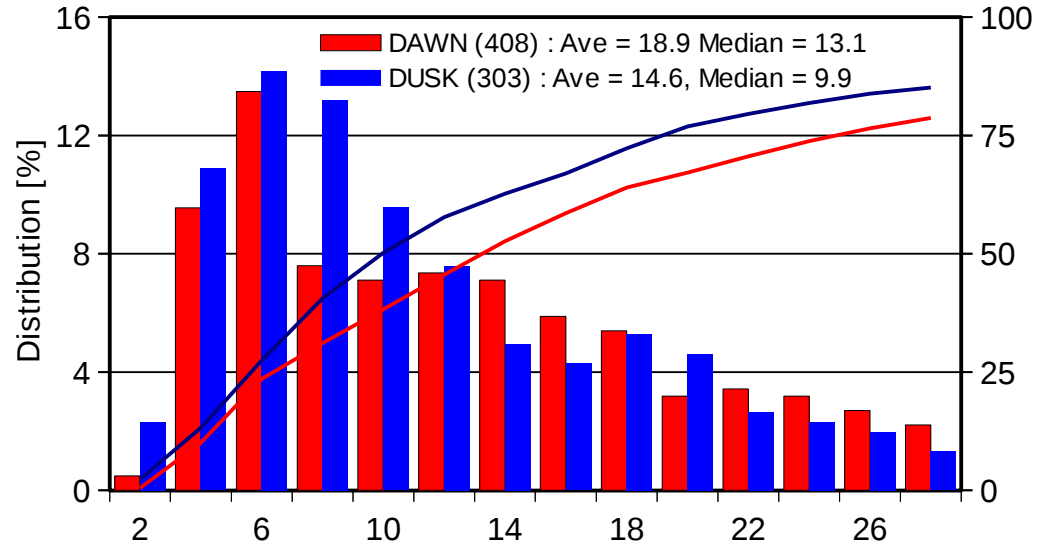
Single SC (Harris sheet approach)

Flank magnetopause characteristics

- **Thickness**
- **Current density**
- **Motion**
- **Classification (RD vs TD)**

Flank magnetopause thickness





Dawn ~1700 (1400) km

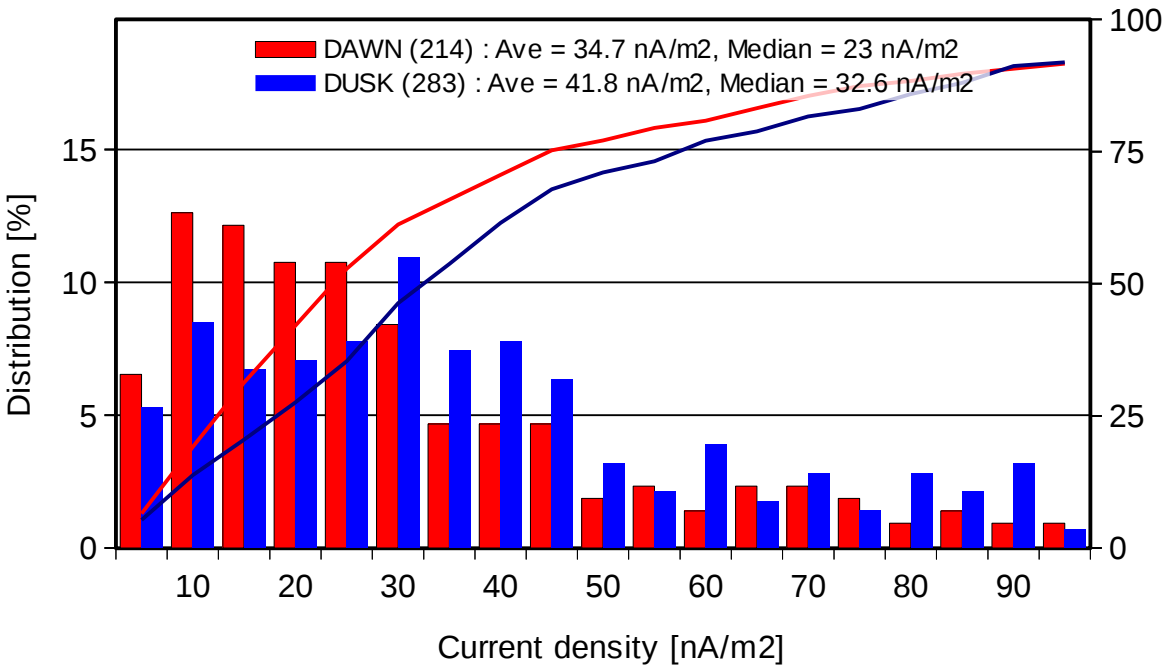
Dusk ~1500 (1100) km

Dawn ~19 (13) Rg_{ion}

Dusk ~15 (10) Rg_{ion}

From [Haaland et al, submitted to JGR]

Flank magnetopause current density



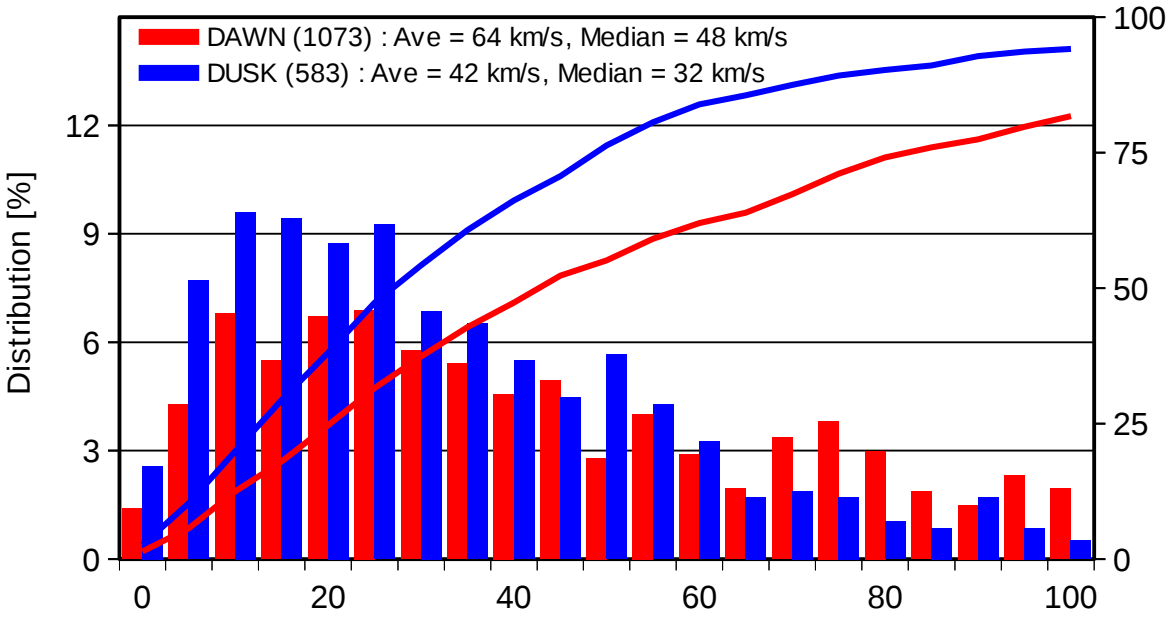
Dawn ~35 (23) nA/m^2

Dusk ~42 (33) nA/m^2

Possibly influenced by both bow shock geometry and ring current intensity

After [Haaland and Gjerloev, 2013]

Flank magnetopause motion



Dawn ~64 (48) km/s

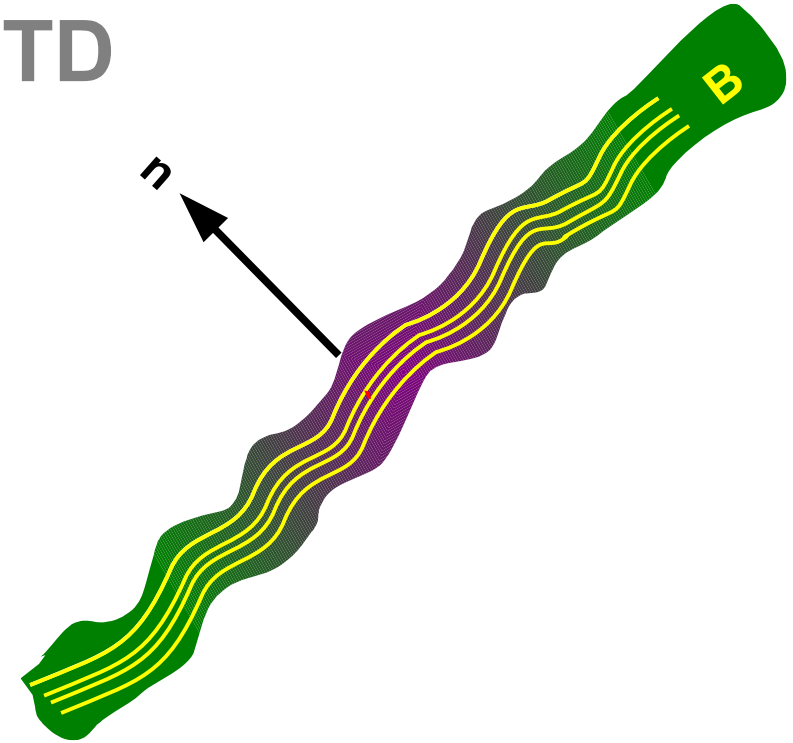
Dusk ~42 (32) km/s

Dawn flank more dynamic. Possibly linked to bow shock geometry

After [Haaland et al, submitted to JGR]

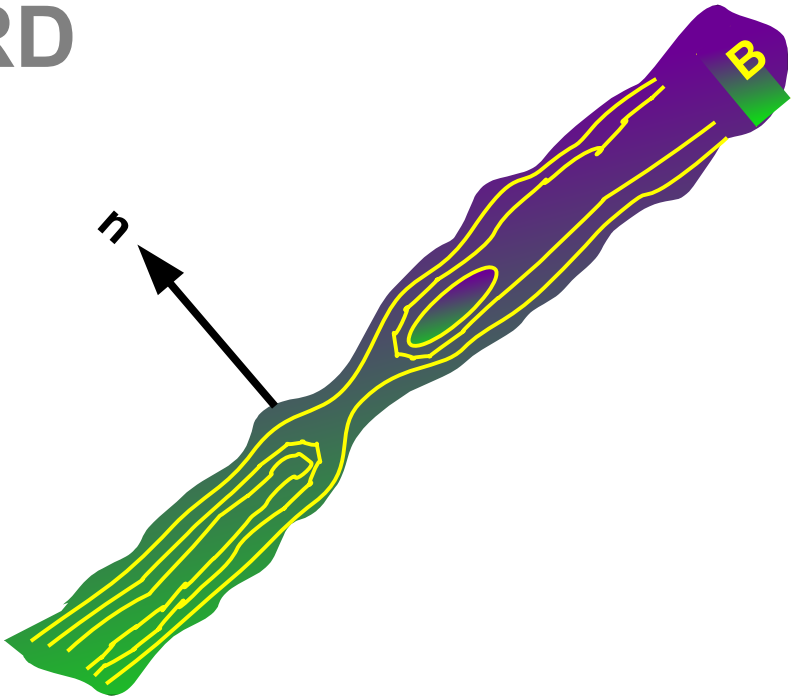
Classification: RD or TD ?

TD



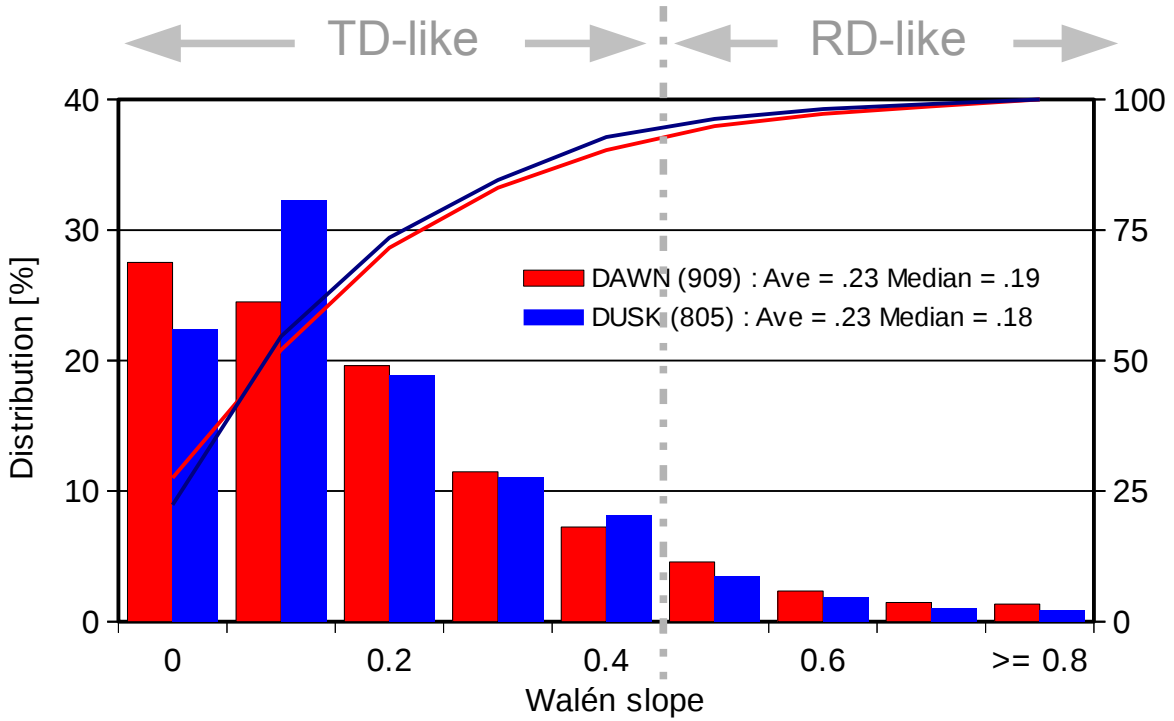
Tangential discontinuity (TD)
- no flow across boundary
- no Bfield along normal

RD



Rotational discontinuity (RD)
- flow across boundary
- Bfield along normal

Classification: RD or TD ?



Walen test indicate Only 7% are RDs (slope > 0.5)

From [Haaland et al, submitted to JGR]

Summary & Conclusion

- Flank MP is thicker than dayside MP
  - 1300 – 1600 km (12-18 Rg)
- Dawn-dusk asymmetry
  - Dusk thinner
  - Dusk higher current density
  - Dawn moves faster (more dynamic ?)
- Most flank crossings are TD type
  - ~ 7% with Walen slope > 0.5 (RD)