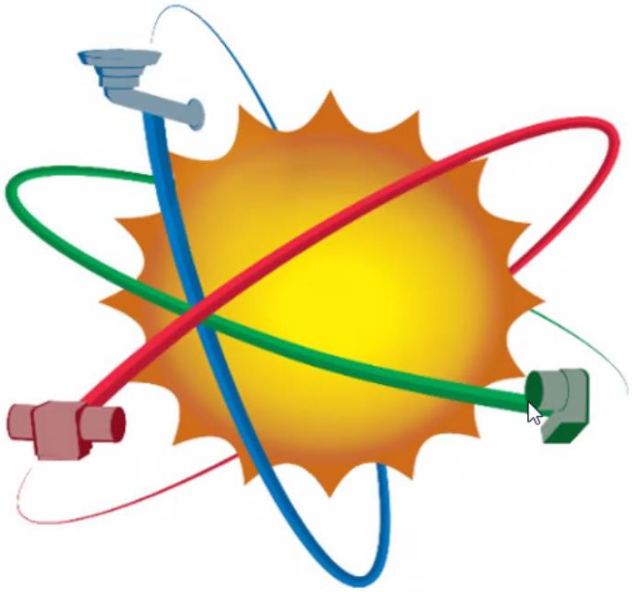


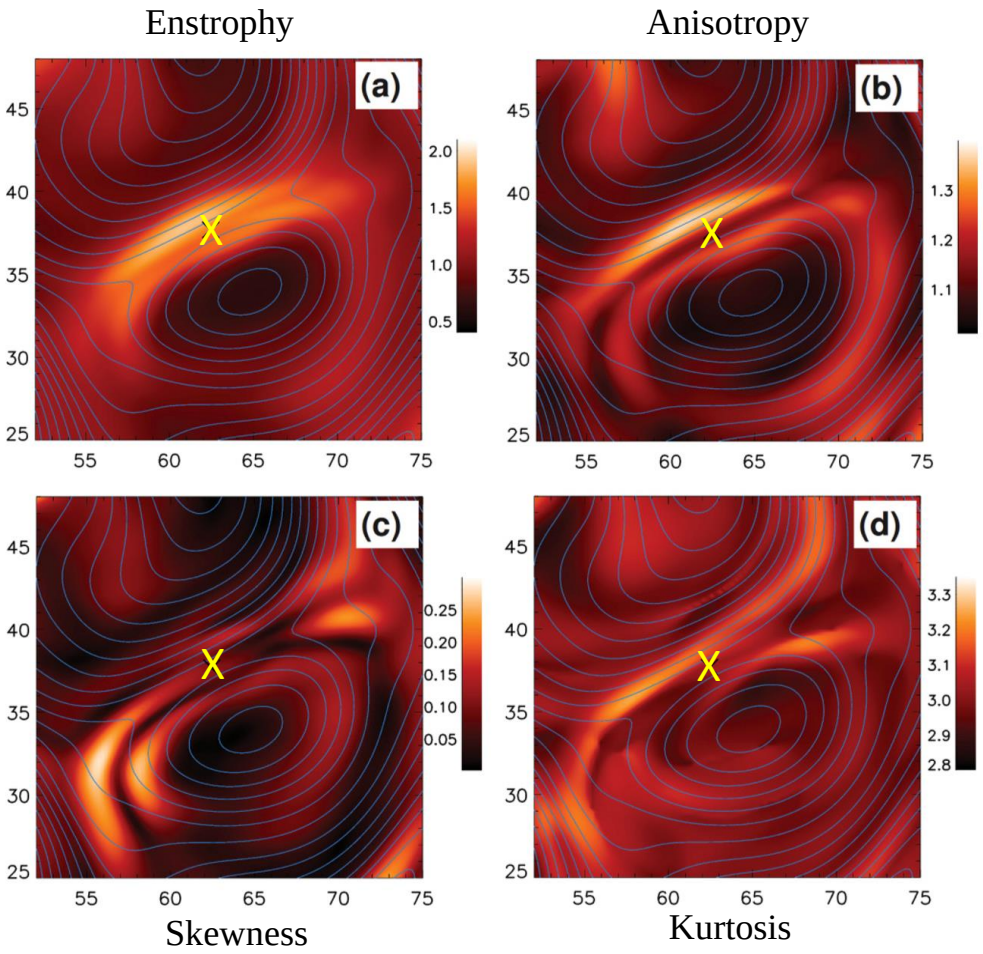
Temperature enhancements coincident with intermittent structures.

UD PSP-fest Team

Data used :

Magnetic Field: psp_fld_l2_mag

Temperature and velocity: spp_swp_spc_l3i (everything in RTN coordinate system)



- Regions with high PVI values implies presence of coherent structures, and is a measure of discontinuity.
- Anisotropy appears in sheet like structure.
- Strong heat flux in upstream regions.

Greco et. Al. (2012)

Partial Variance of Increments (Magnetic):

PVI works as a proxy for current sheet structures.

$$\mathrm{PVI} = \frac{\left|\Delta\vec{B}\right|}{\sigma}, \qquad \sigma = \left\langle \left|\Delta\vec{B}\right|^2 \right\rangle^{1/2}$$

Where,

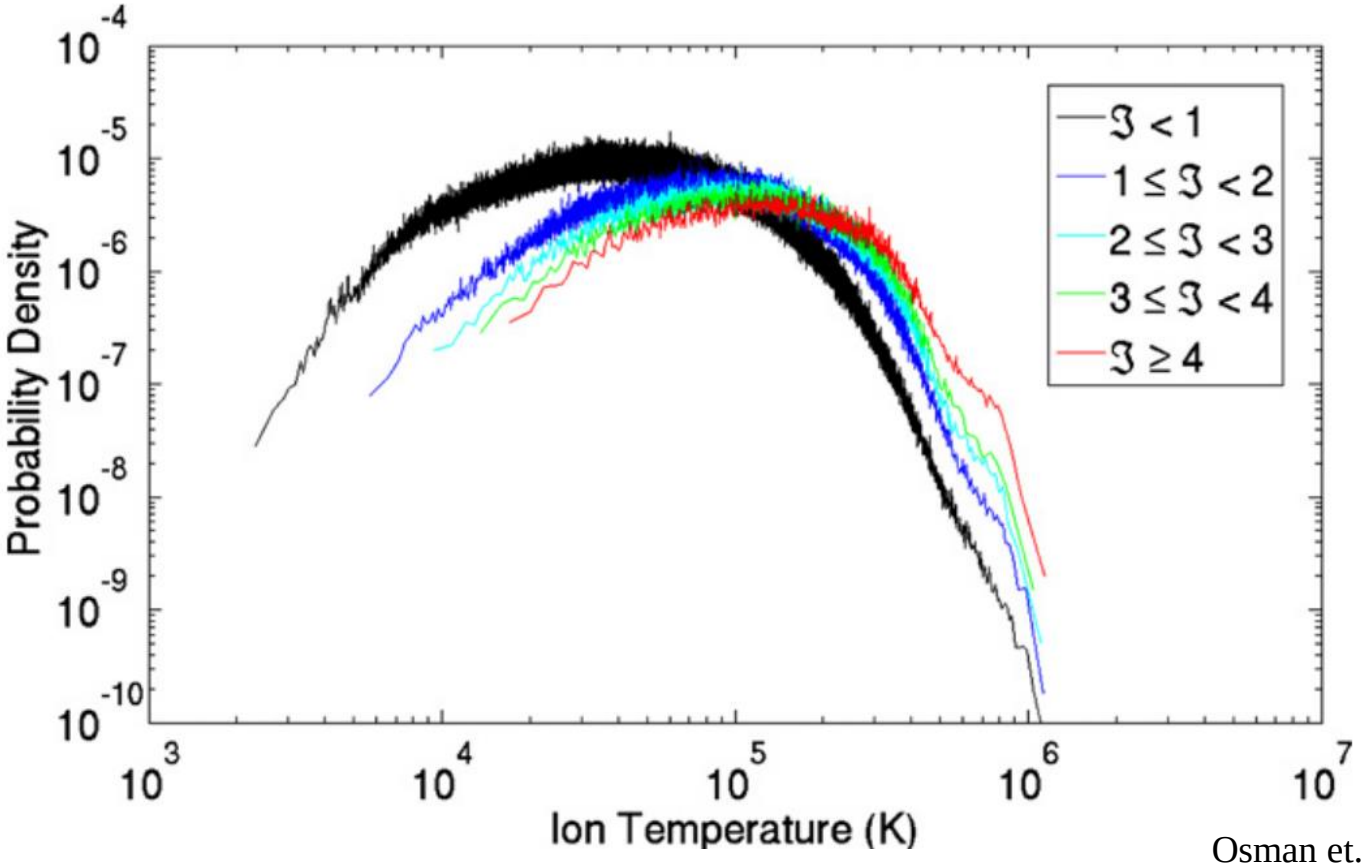
$\left|\Delta\vec{B}\right| = \left|\vec{B}(t+\tau) - \vec{B}(t)\right|$, τ is the lag (generally of the order of inertial length).

Greco et. al. (2008)

Inertial length :

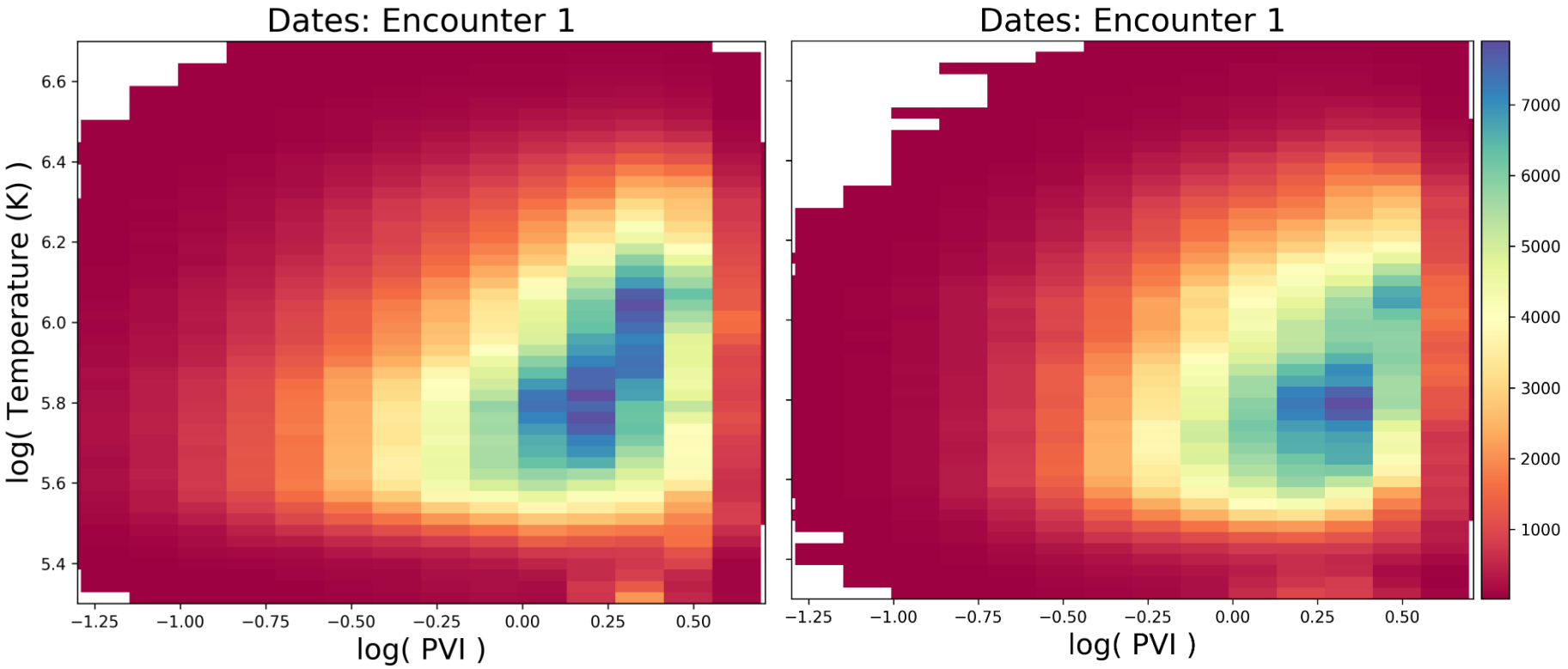
$$\mathrm{d}_i = c/\omega_{p_i}$$

Can also use velocities instead of magnetic fields.



Osman et. al. (2011)

"This plot suggests that higher PVI values, which are related to higher intensity current sheets, are associated with PDFs that have fewer low temperature values, greater high temperature values, and an increased mean ion temperature."

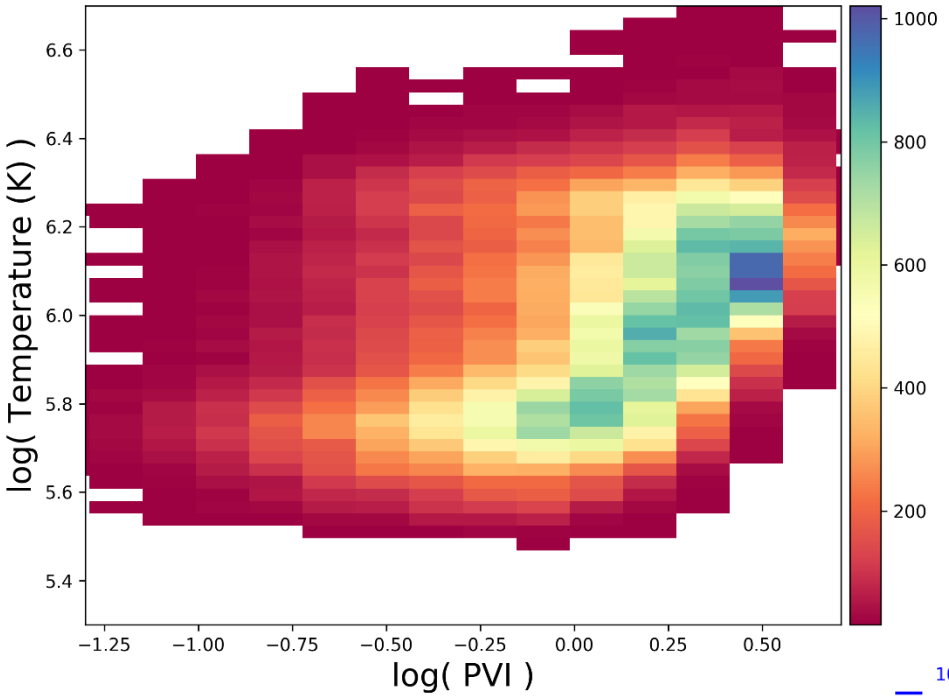


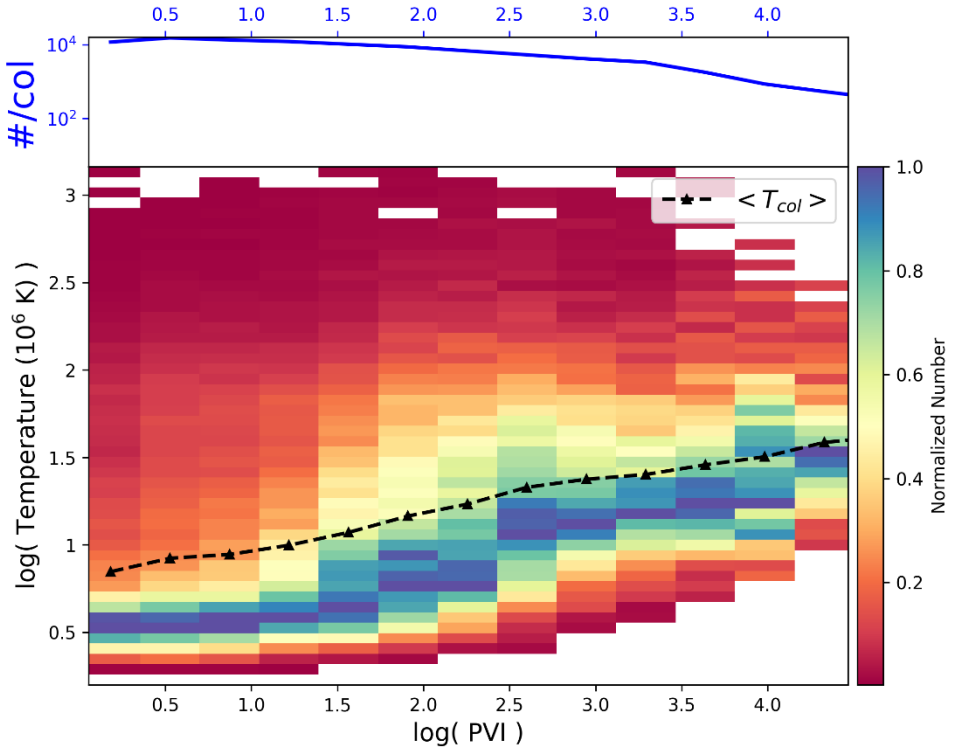
Magnetic PVI

Velocity PVI

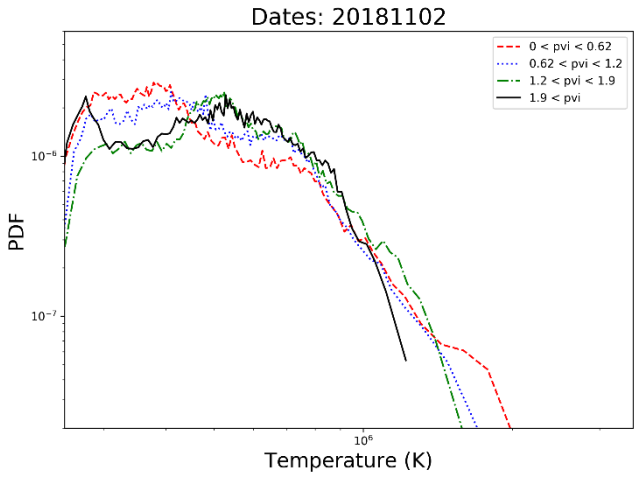
Histogram of data distribution on the log-log plot of PVI and Temperature.

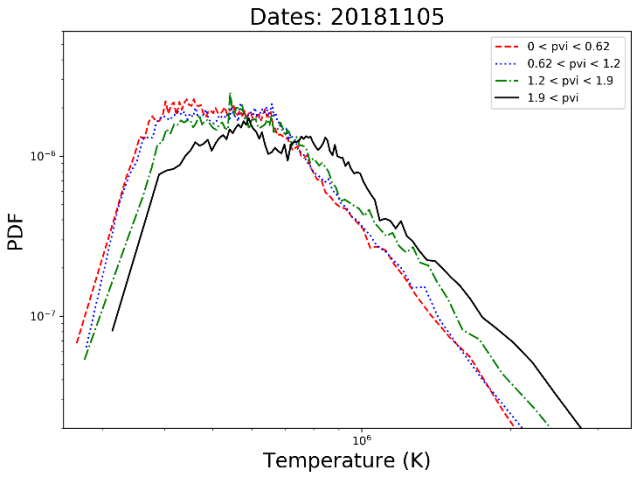
For this study, τ = 1 second, and PVI is normalized by the 8hr standard deviation.

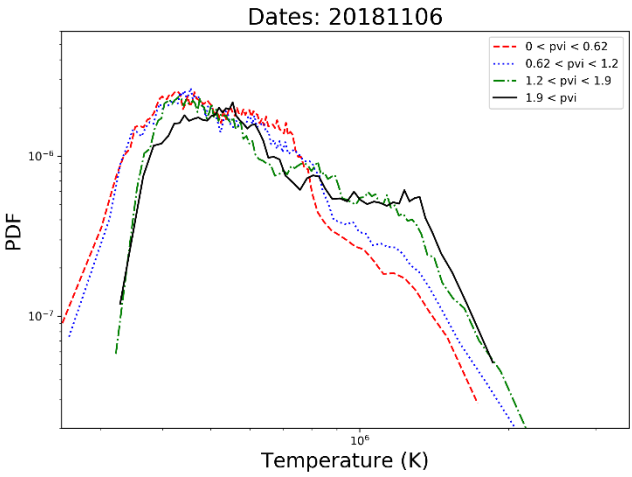

Dates: 20181110
log(Temperature (K))
log(PVI)
6.6
6.4
6.2
6.0
5.8
5.6
5.4
−1.25
−1.00
−0.75
−0.50
−0.25
0.00
0.25
0.50
1000
800
600
400
200

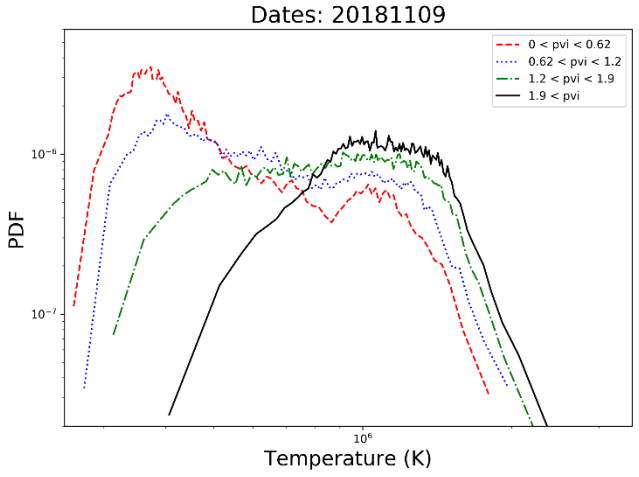

#/col
10^4
10^2
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
$< T_{col} >$
log(Temperature (10^6 K))
log(PVI)
3
2.5
2
1.5
1
0.5
Normalized Number
1.0
0.8
0.6
0.4
0.2

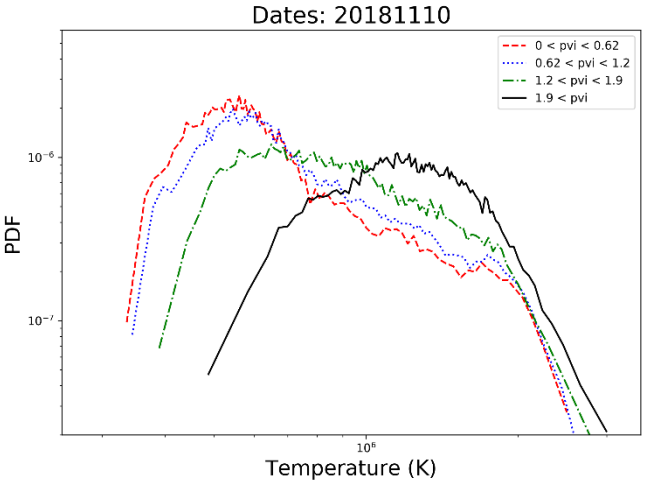
Diurnal Variation of PVI during encounter

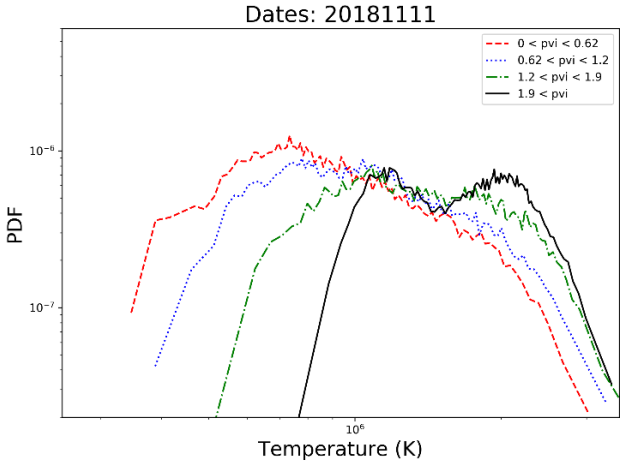


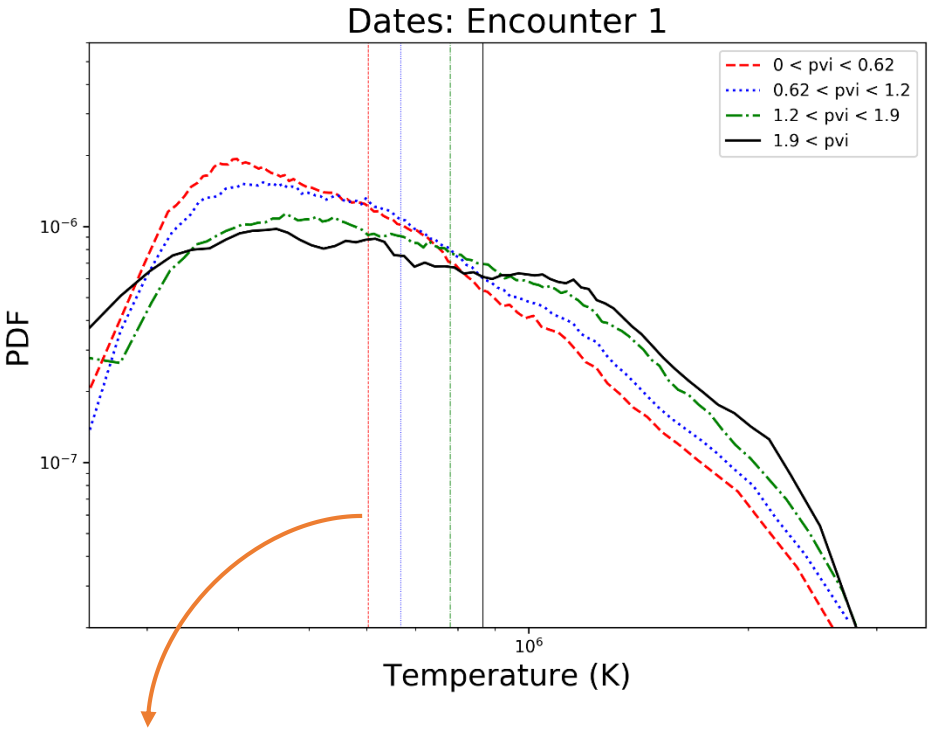






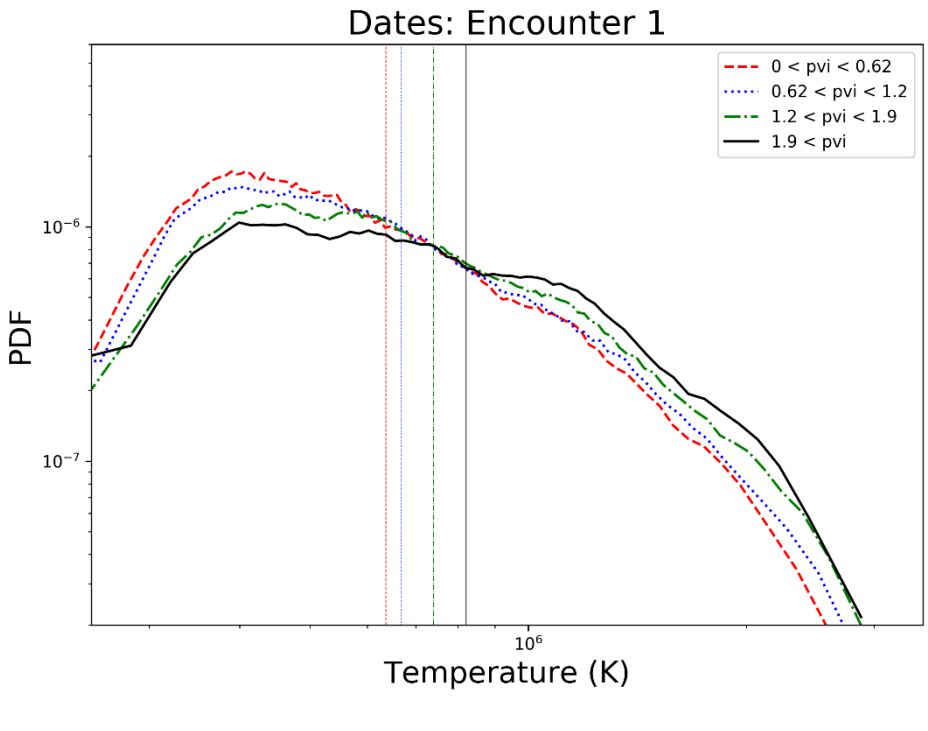






Median Temperatures

Magnetic PVI



Velocity PVI

PDF of data distribution on the log-log plot of PVI and Temperature.

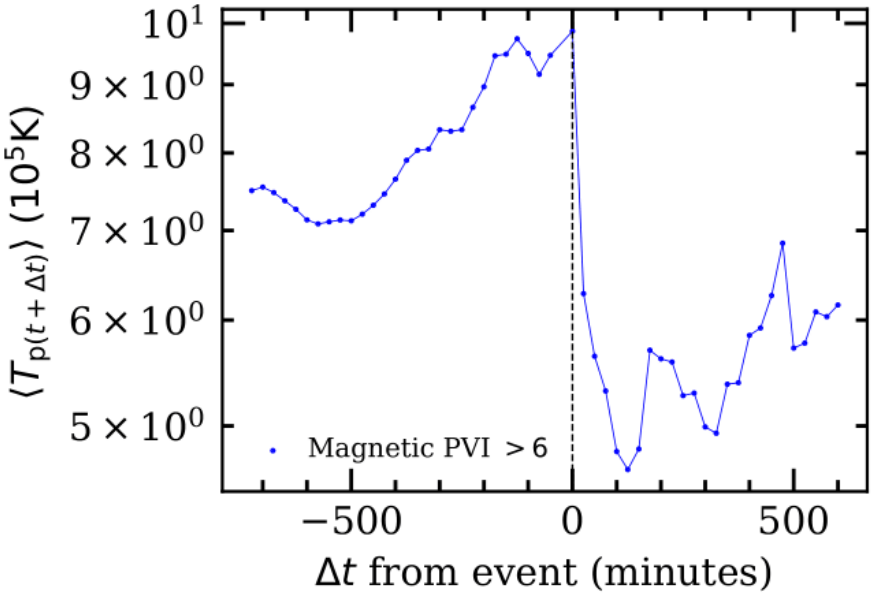
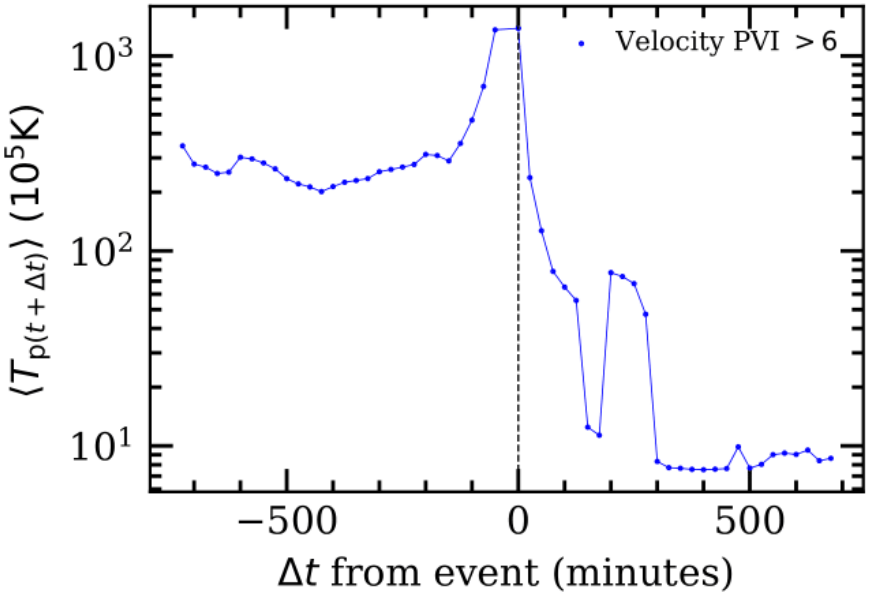
Application using SPC/SPAN-A data:

- We are already using the SPC data to get the radial temperature.
- SPAN-A data could complement the SPC data.
- Anisotropy calculations?

Conclusion:

- There is a correlation between the PVI (both magnetic and velocity) and the regions of enhanced temperature in solar wind close to the sun.

To do:

- Look at the differences between magnetic and velocity PVIs.
- Study the correlation between the lag and the PVI.

Not using this one?