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MAGNETOSHEATH JETS DURING A CME PASSAGE: A CASE STUDY

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Localized enhancements in dynamic pressure observed in the Earth's magnetosheath (EMS) have been studied since 20 years ago. These structures known as jets can propagate through the EMS transporting mass, momentum and energy being able to reach and perturb the Earth's magnetopause.

Large scale solar wind (SW) structures called Coronal Mass Ejections (CMEs) travel through the interplanetary medium and depending on their direction they may impact the Earth. How the different SW conditions triggered by the CMEs (upstream side – shock/sheath – magnetic ejecta) change the production of jets in the EMS is a topic that is just beginning to be explored.

In this case study we characterize jets observed by THEMIS A, E and D during a CME passage. We find clear differences in number and size between the jets associated with the different CME regions arriving at the EMS. Comparing WIND and THEMIS data we discuss how these differences are associated with the SW conditions and with different jet generation mechanisms.

Questions? / Suggestions? / Collaboration? → luis.preisser@oeaw.ac.at

OVERVIEW FOR THEMIS-A

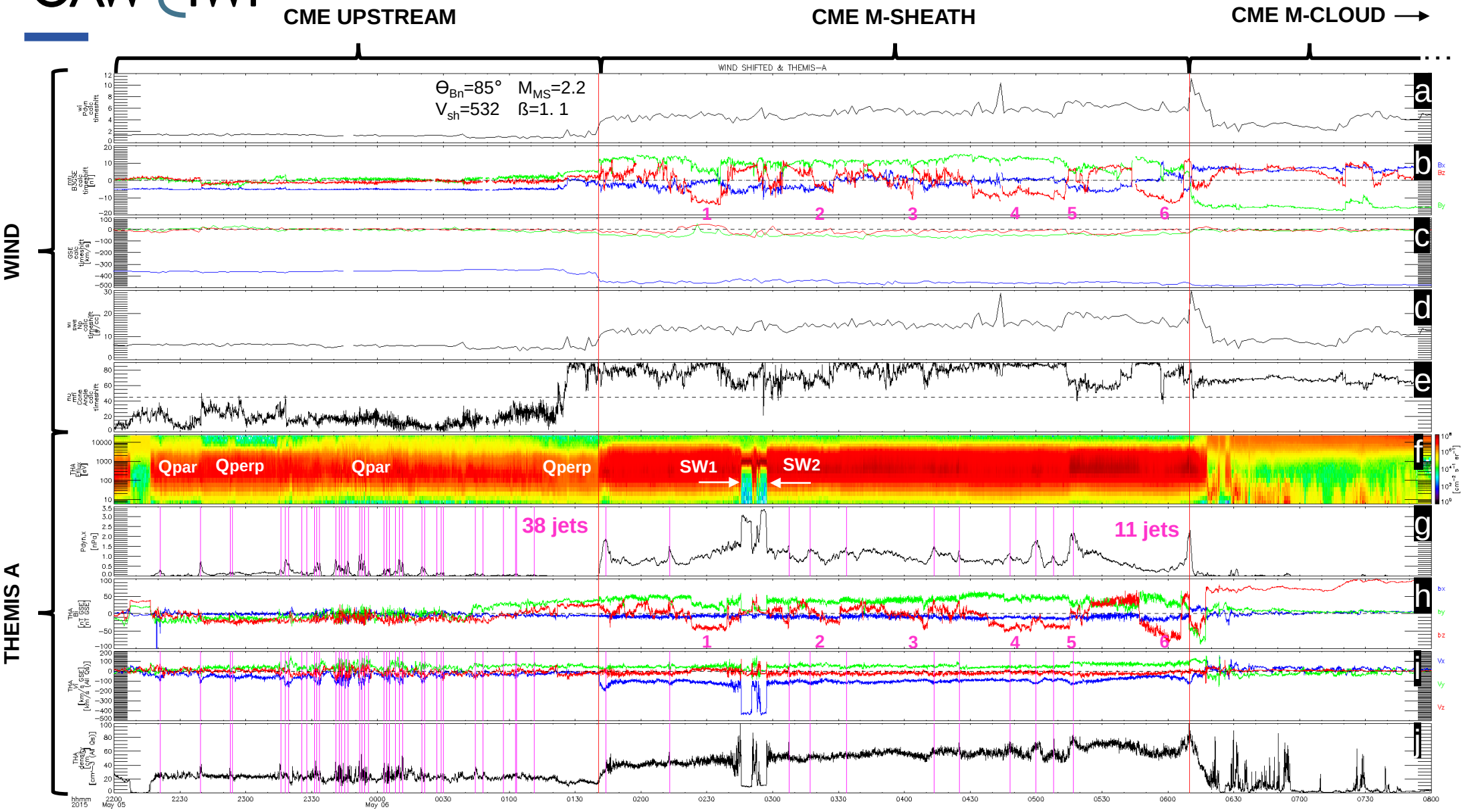

Figure 1: From top to bottom (a-e)WIND, (f-j)THEMIS A: (a) Dynamic Pressure, (b) GSE Magnetic field components, (c) GSE Velocity components, (d) Proton density, (e) Cone angle, (f) Energy flux, (g)Dynamic pressure in x-direction, (h) GSE Magnetic field components, (i) GSE Velocity components, (j) Proton density. The WIND data is shifted 45 min to fit with THEMIS data based in the arriving to the shock and magnetic cloud (red vertical lines) and signatures in magnetic field (magenta numbers in panels b, h). Jets are identified by magenta vertical lines (panels g, i, j). The q-parallel and q-perpendicular typical signature as well as solar wind crossing are identified in white (panel f).

OVERVIEW FOR THEMIS-E

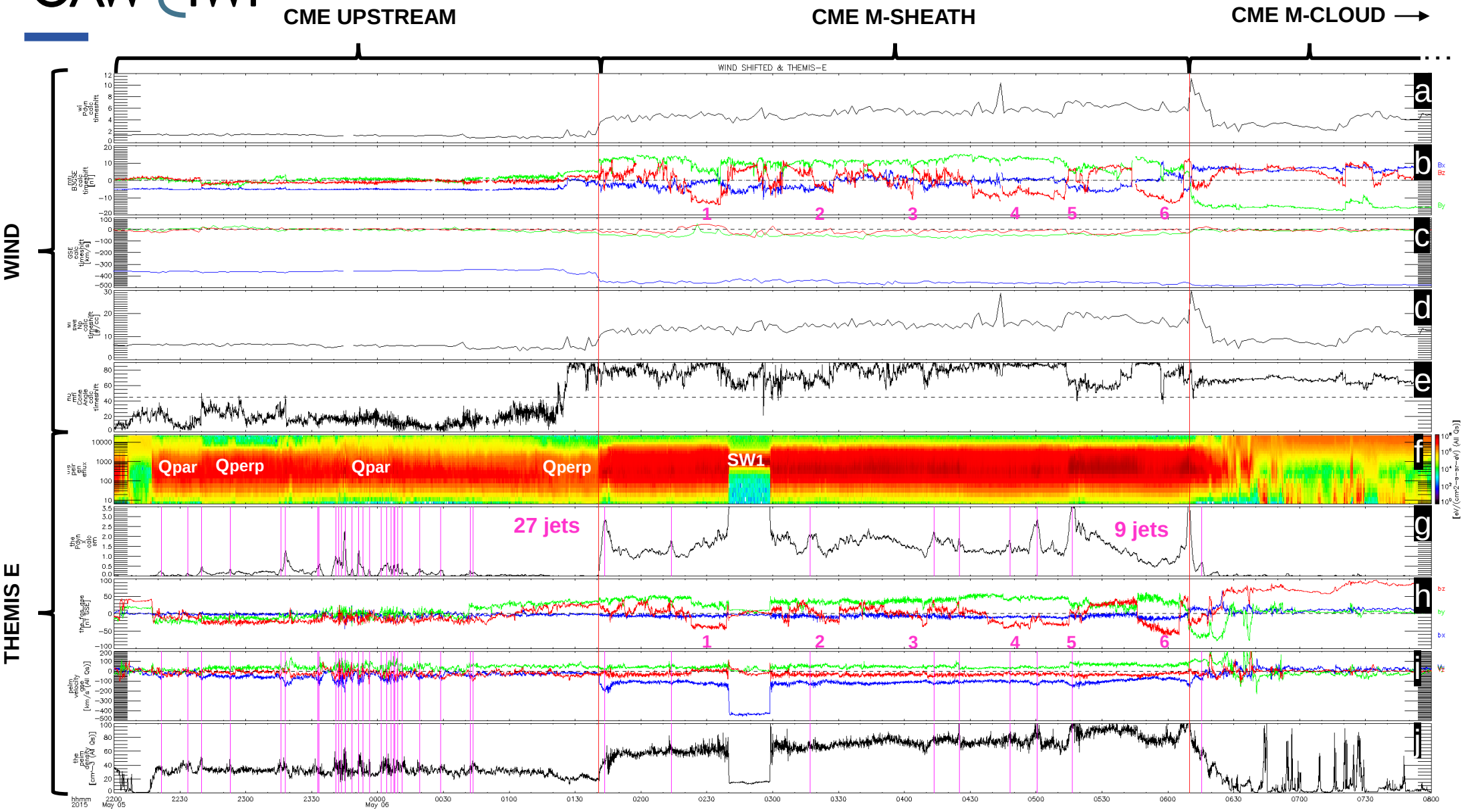

Figure 2: Same as Figure 1 but for THEMIS E

OVERVIEW FOR THEMIS-D

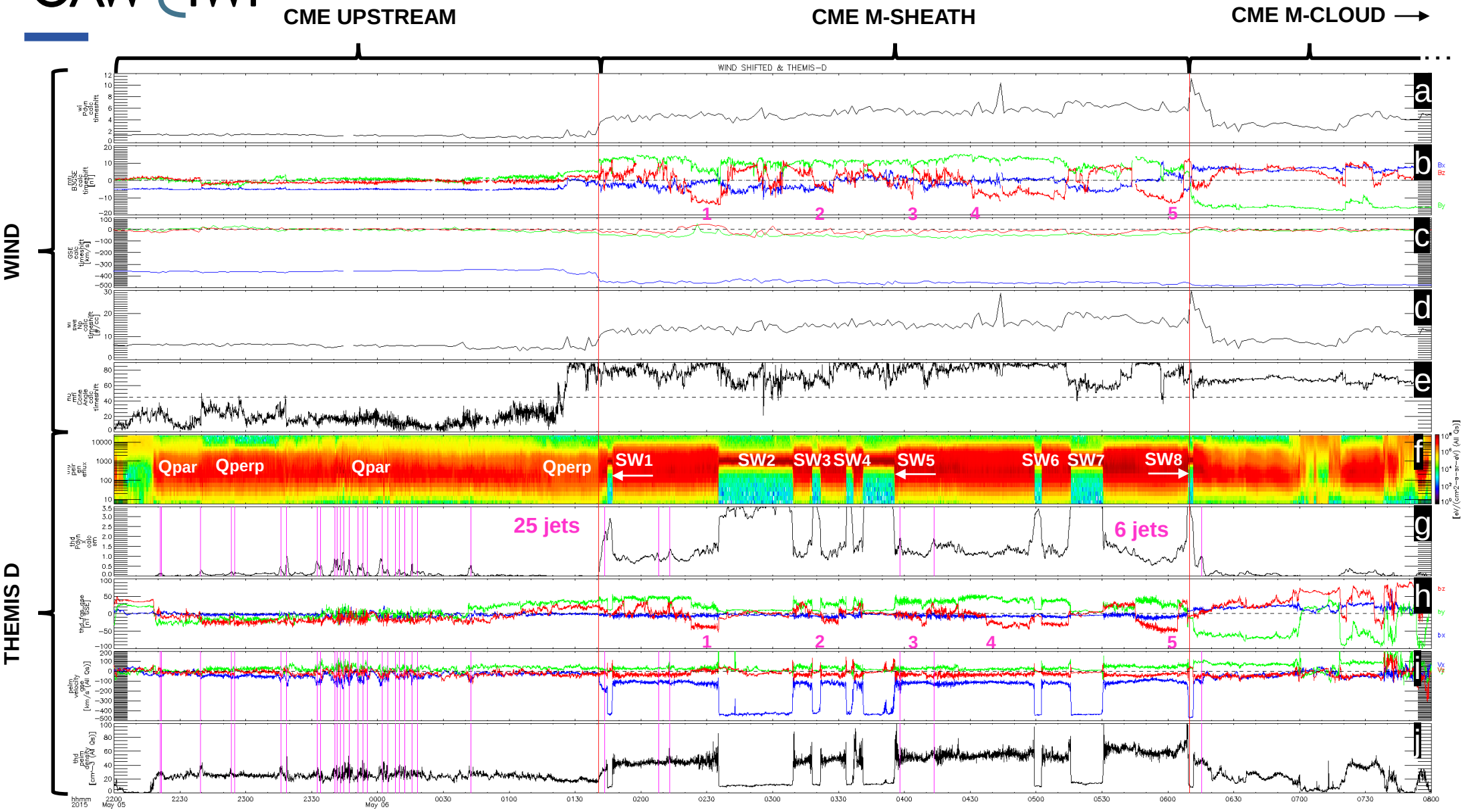

Figure 3: Same as Figure 1 but for THEMIS D

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MULTISPACECRAFT COMPARISON UPSTREAM / DOWNSTREAM

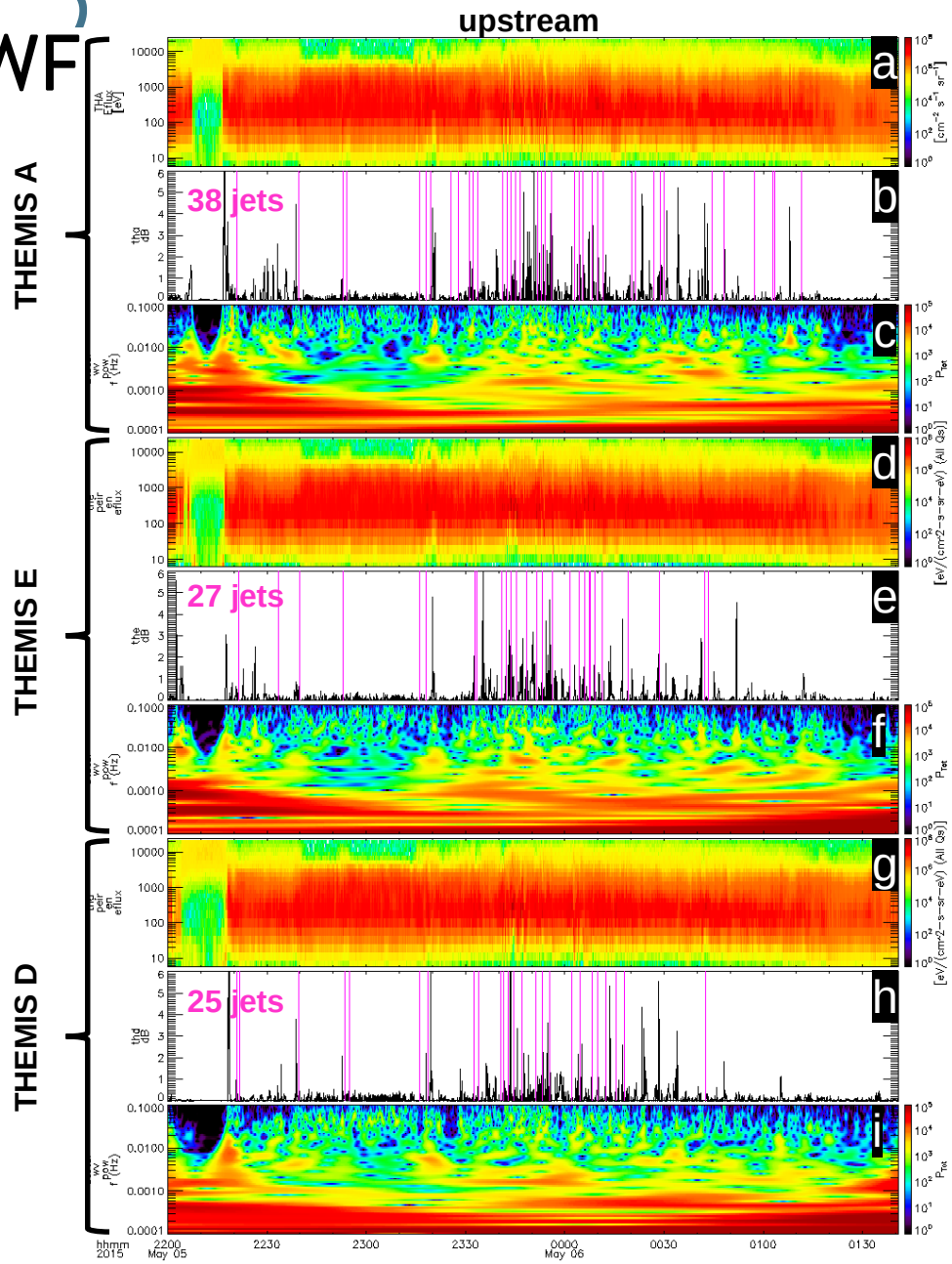


Figure 4

Figure 4: From top to bottom for THEMIS (A, E, D) (a, d, g): Energy flux, (b, e, h) Fluctuation parameter dB, (c, f, i) Wavelet spectrum of |B|. The number of jets and the time for each one is showed in magenta in panels (b, e, h).

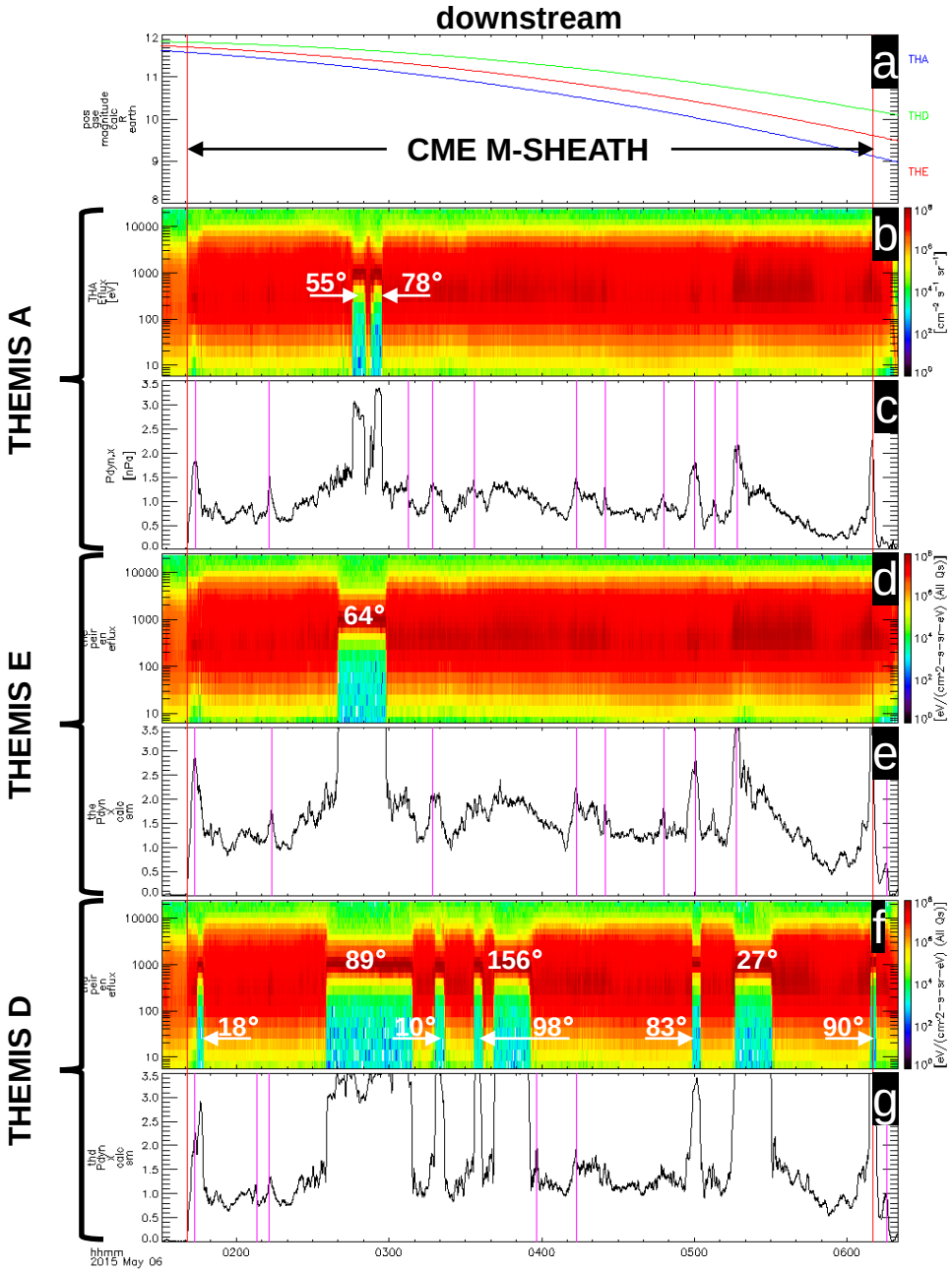
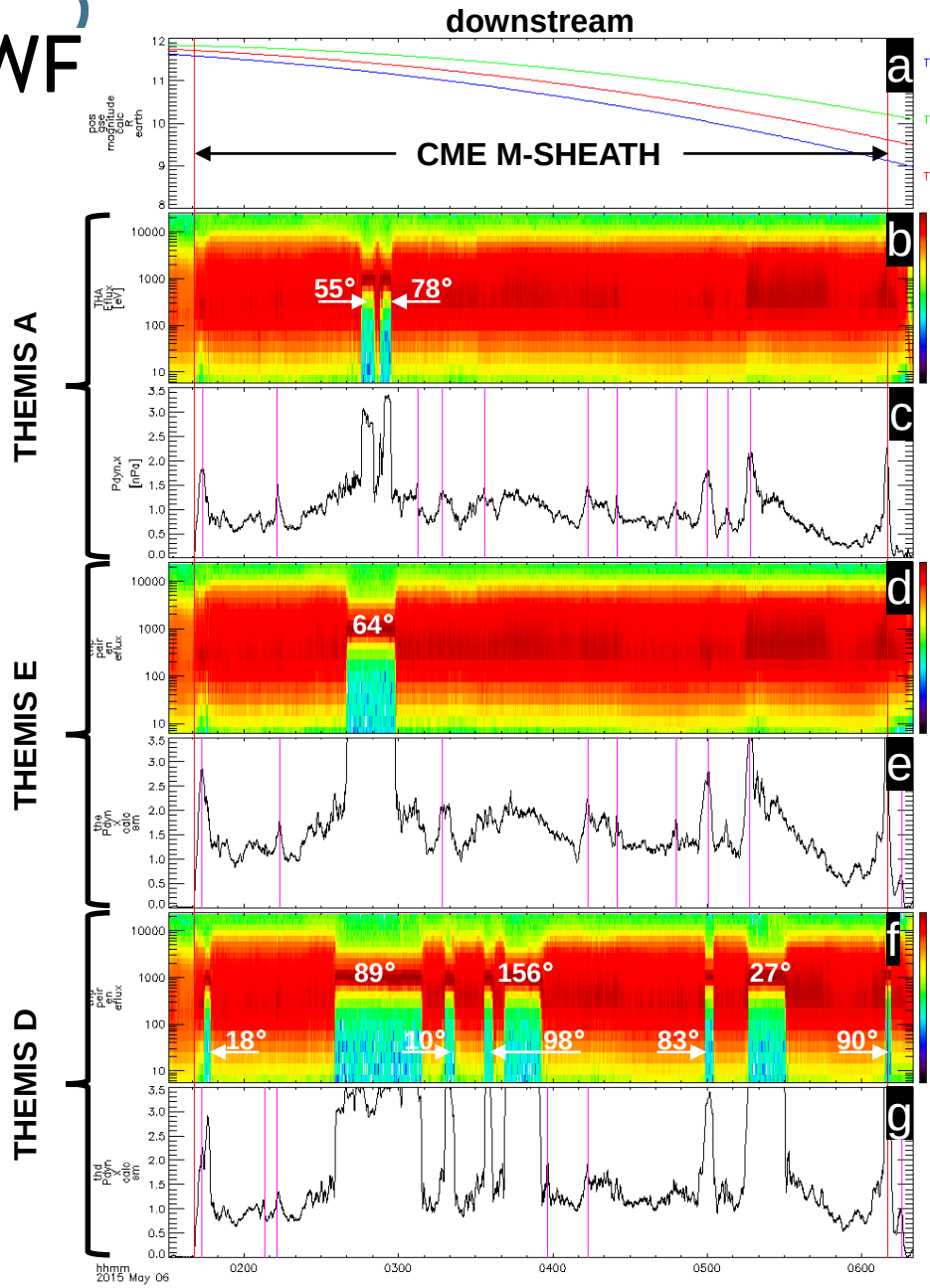


Figure 5

Figure 5: From top to bottom (a) Distance to the Earth for each THEMIS, for THEMIS (A, E, D) (b, d, f): Energy flux and angle between normal vectors for SW crossings using MVA in white, (c, e, g) Dynamic pressure in x direction. Jets are shown in magenta in panels (c, e, g).

MULTISPACECRAFT COMPARISON UPSTREAM / DOWNSTREAM



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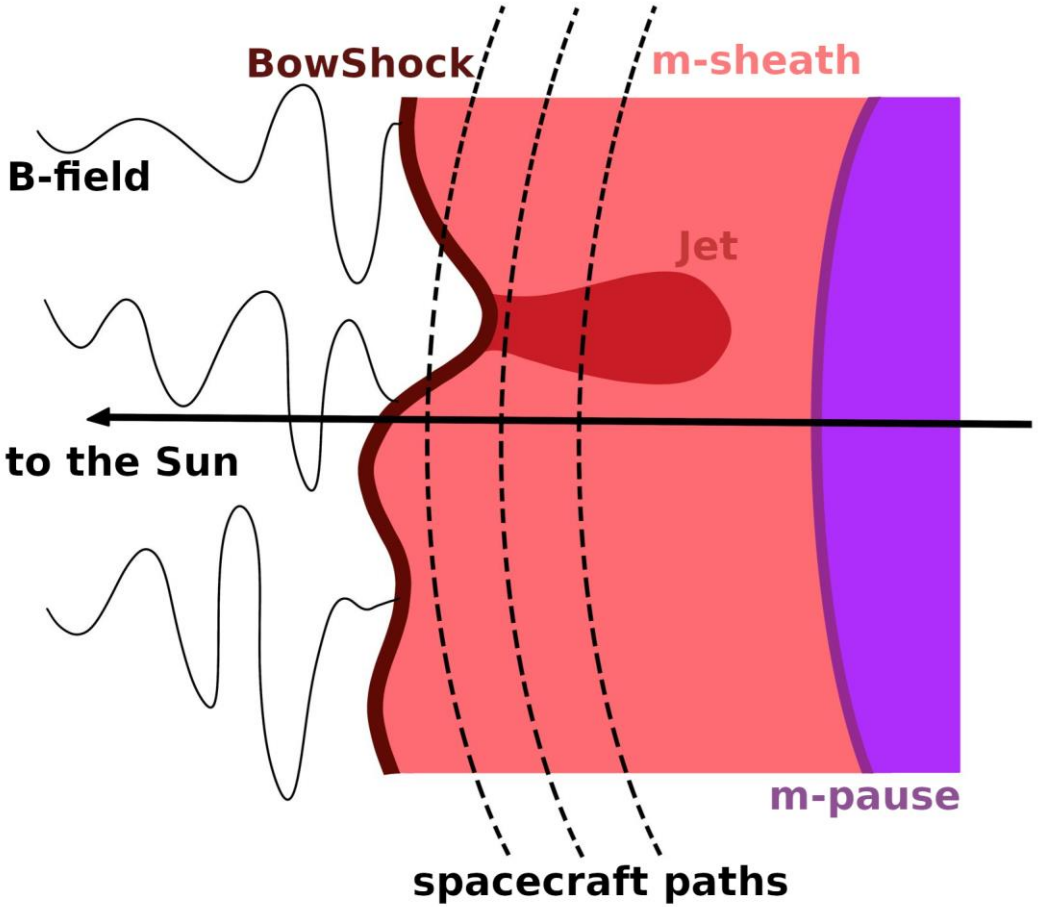

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CONCLUSIONS

- Clear differences can be observed on jet production when a CME structure (upstream/downstream side) arrives to the Earth magnetosheath.
- Jets produced before the arriving of the CME shock are more numerous and smaller than those produced between the CME shock CME magnetic cloud arrival.
- Multispacecraft observations show that the closer the spacecraft is to the Earth, the less jets it will observe, in accordance with previous works and models.
- Also multispacecraft analysis show that the closer the spacecraft is to the Earth, the less SW encounters it will observe between the CME shock CME magnetic cloud arrival.
- Using MVA and coplanarity theorem we calculate the difference between the normal angles for each SW encounter. The discrepancies between these values suggest shock rippling as generation mechanism for the jets observe between the CME shock CME magnetic cloud arrival.
- Using dB fluctuation parameter and Wavelet analysis we found that the location of the jets before the arriving of the CME shock is correlated with high amplitude and frequency of magnetic field fluctuations.
- A statistical study regarding this topic can be consulted in next talk **EGU22-6521: Solar wind conditions suppressing the production of magnetosheath jets during CME occurrence.**

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