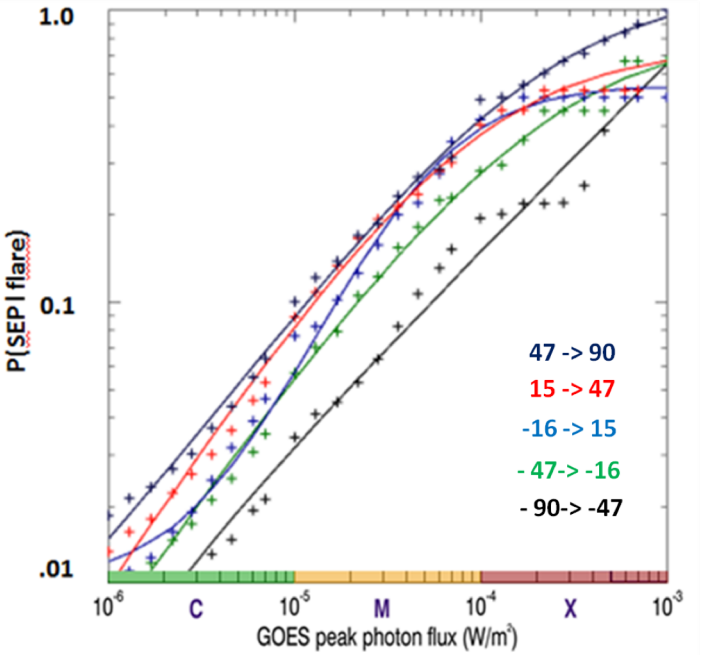
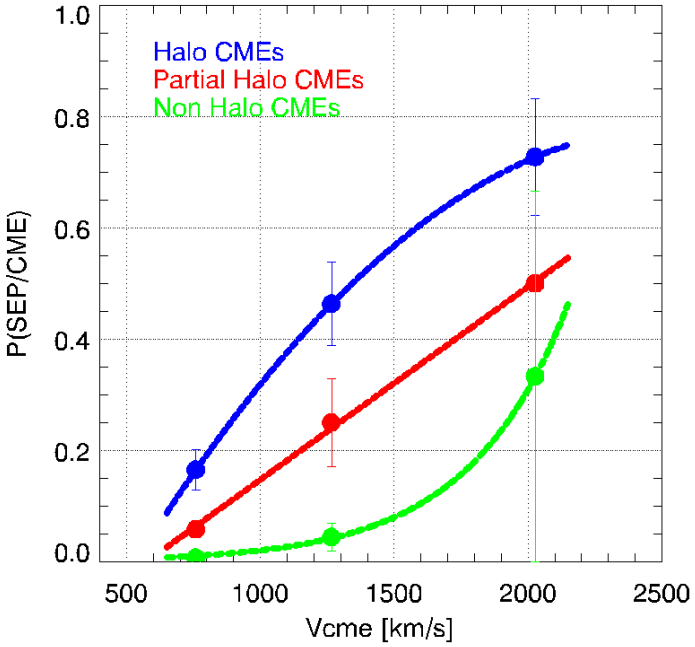
Brief Description of the Model

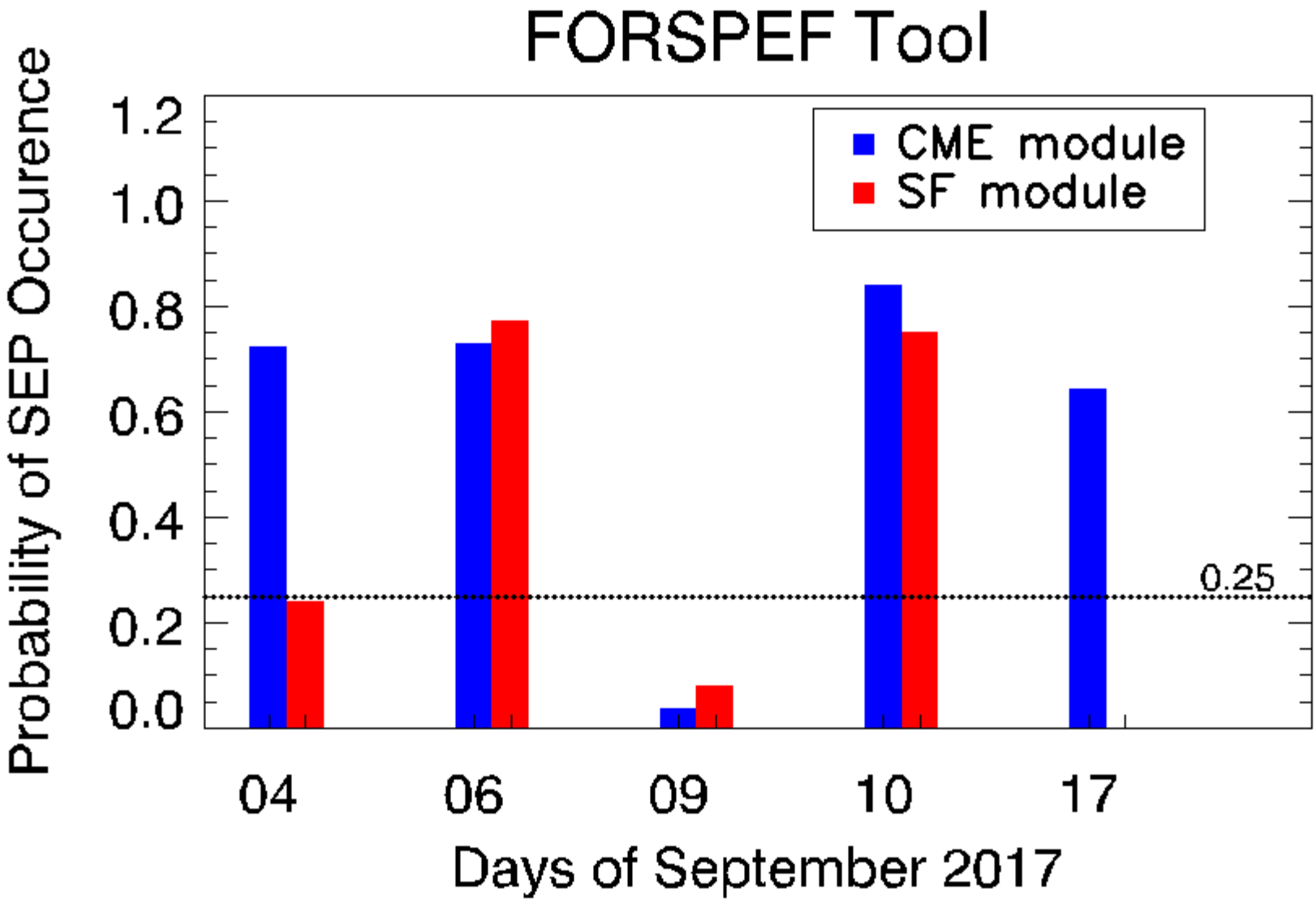
Solar Flare (SF) Module: We use five longitudinal bins that cover the whole visible disk of the Sun. For each longitudinal bin, 4000 historical flares from our databse are used in order to derive a probability of SEP occurrence per solar flare magnitude defined as *P(SEPflare)i = (NSEP)i/(Nall)i with i = [1, 28] covering all 28 GOES bins (C-X10)*. These *P(SEPflare)i values are used to implement a local SEP statistical* model *via distribution functions (DFs). The values are further fitted with a sigmoidal fit.* These probabilities depend on the FORSPEF database alone (Anastasiadis et al., Solar Physics, DOI: 10.1007/s11207-017-1163-7, 2017)



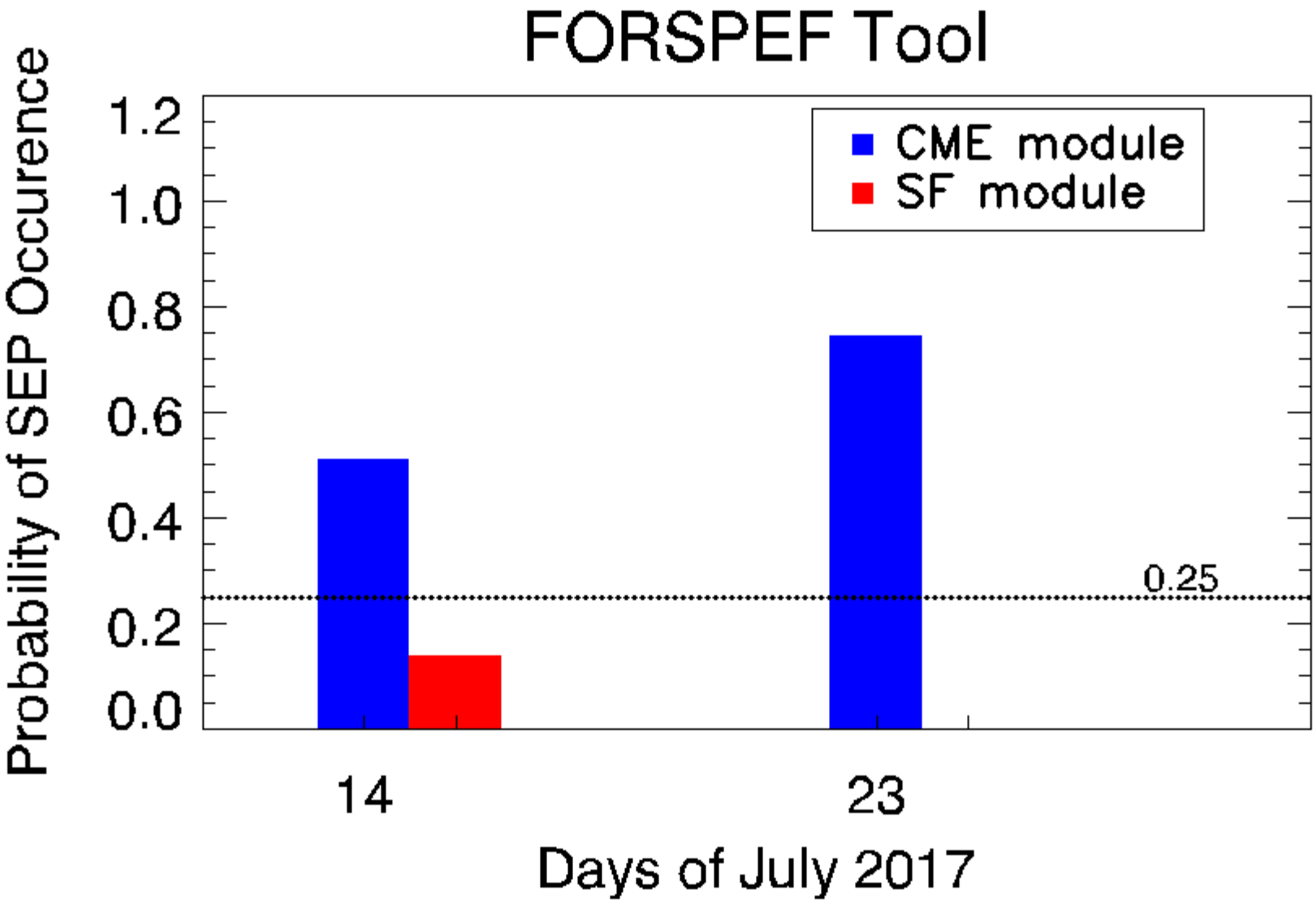
Coronal Mass Ejections (CMEs) Module: We consider 2-dimensional SEP occurrence probabilities depending on CME speed and angular width. We divided the CMEs into nine (9) subgroups according to their characteristics. There are three CME speed ranges: slow (400 ≤ V < 1000), moderate (1000 ≤ V < 1500), and fast (V ≥1500) and three angular width ranges: full halo (AW = 360), partial halo (120≤ AW ≤ 359) and non-halo (AW < 120). The derived SEP probabilities are defined as: *P(CME)i = NSEPi/Ni* where Ni is the total number of CMEs in the subset i and Ni SEP is the number of those events that resulted in an observed SEP event (Papaioannou et al., J. Space Weather Space Clim., DOI: 10.1051/swsc/2018024, 2018)



Model results: September 2017



Model results: July 2017



Discussion questions

- How did your optimized run results differ from the initial run?

N/A

- What aspects of the event does your model capture well, and what aspects were more difficult to capture?
  - The CME module seems to identify all 5 events plus the non-SEP on the 9/10 but provides a false alarm for 27/7
  - The SF module seems to identify correctly 2 events plus the non-SEP event on the 9/10

- What are the next steps for your modeling technique?
  - Apply a probabilistic approach across the modules
  - Provide the expected SEP time profile in real-time
  - Make a dynamic system with interacting modules