Assignment Answers
DAY 2 Wednesday 6/8

Assignment - CME lower coronal signatures

1. What does a solar magnetogram show?
It shows the line-of-sight magnetic field at the photosphere distribution of the solar magnetic field, 2d cut of the 3d magnetic field at the photospheric level.

2. What is the difference between the magnetic field structure of an active region and a filament?
Magnetic field lines connect mostly perpendicular to the polarity inversion line in an AR, and mostly parallel to the PIL in a filament.

3. What are the signatures of a solar flare and which AIA filters are the best to find the location of the source?
Enhanced EM radiation in X-Ray, EUV and UV, AIA 131

4. What are the coronal signatures of a CME and which AIA filters are the best to use?
post-eruptive loop system after lift-off of CME (171, 193), bright foodpoints of post-eruptive loops (304, 193, 171), darkings (dimmings and waves, 193, cool filament material erupting, 304), opening of coronal loops off limb (193, 171), cool filament material in emission off limb (304)

Assignment - coronal holes and high speed streams

1. Why is there solar wind?
The upper atmosphere of the Sun is continuously releasing charged particles into interplanetary space. Within interplanetary space are magnetic field lines along which these charged particles propagate. The solar wind can be described as the stream of charged particles following these magnetic field lines and exists because the Sun is continuously emitting these charged particles

2. Does slow solar wind generally originate from high or low latitudes on the Sun?
Low latitudes on the Sun. The slow solar wind appears to originate from a region around the Sun's equatorial belt that is known as the "streamer belt"

3. What is the typical speed for the slow solar wind?
Typically at 1 AU, solar wind velocities are <450 km/s.

4. What is the typical density for the slow solar wind?
Typically at 1 AU, proton and electron densities are between 7-10 cm^-3.

5. Does fast solar wind generally originate from high or low latitudes on the Sun?

High latitudes. The fast solar wind is thought to originate from coronal holes, which are funnel-like regions of open field lines in the Sun's magnetic field. Such open lines are particularly prevalent around the Sun's magnetic poles.

6. What is the typical speed for fast solar wind?
450-800 km/s

7. What is the typical density for fast solar wind?
3 cm^-3

8. What is a coronal hole? How does the plasma density of a coronal hole compare to the rest of the corona?
Coronal holes correspond to regions of open magnetic fields. The plasma density of a coronal hole is lower when compared to the rest of the corona.

9. Where are the coronal holes typically found during solar minimum, and how does that change at solar maximum?
Coronal holes are typically found near the poles during solar minimum. At solar maximum, they can be found at all latitudes.

11. What is a high speed stream, and how is it related to a coronal hole?
A high speed stream is high speed solar wind originating from a coronal hole.

12. What is a corotating interaction region (CIR) and stream interaction region (SIR)?
A CIR are high speed streams from persistent coronal holes over multiple solar rotations. A SIR is the region formed at the compressed boundary between the fast and slow solar wind in a high speed stream.

13. How does a geomagnetic storm caused by a high speed stream differ from one caused by a CME?
Geomagnetic storms caused by high speed streams are longer in duration but not as strong as geomagnetic storms caused by CMEs.

14. How are high speed streams related to energetic electron fluxes in the magnetosphere?
High speed streams are related to energetic electron fluxes in the magnetosphere because these streams accelerate electrons towards Earth resulting in a potential electron flux enhancement in the radiation belt.

Assignment - iSWA layouts for different applications
1. What can the cygnet ‘magnetic connectivity solarscape viewer’ be used for? What information can it provide? Name at least two features it provides (or more if you like).

It can be used for assessing where a planet/spacecraft is connected to on the surface of the sun and whether its magnetic footprint is in the vicinity of an active region. If so and if the active region is big and ugly, the planet/spacecraft is likely to see enhancement in SEP (solar energetic particle) if the active region erupts with flare/CME.

Since it is a hybrid product by combining magnetic connectivity (using a model of the interplanetary magnetic field -WSA+Enlil) and solar images/background, it provides information regarding active regions, their classification. In addition, it also provide all clear forecasting for flare, CME, SEP occurrence from MAG4 (a model).

2. Name two types of background images that you can use on the cygnet ‘magnetic connectivity solarscape viewer’.
It has 13 different backgrounds to choose from SDO observations. Any two of the 13 backgrounds will be ok for example SDO AIA 193A, SDO AIA 171, etc.

3. Name two SEP cygnets and write down their use.
a. ISWA custom timeline cygnet that includes integral proton fluxes for different energies from GOES, ACE, STEREO A, B satellites use: realtime monitoring SEP fluxes (also for historic assessment) from different satellites
b. REleASE proton flux forecast at CCMC - The forecast proton flux using the REleASE model that is based on the electron measurements of SOHO - use: when the data is available, it is capable of an hour lead-time forecasting of SEPs
c. SOHO/Costep proton flux - use: monitoring energetic proton flux for different energy channels at SOHO"

4. Name one CME cygnet and write down its use.
Coronagraph images from SOHO LASCO C2/C3 or STEREO A, B - use: to monitor CMEs and their propagation
WSA-Enlil-Cone model cygnet - use: model product for examining CME evloution/propagation

5. Name one flare cygnet and write down its use.
a. SDO AIA 193 - monitoring flares - appearing as sudden brightening
b. SDO AIA 131 - monitoring flares - appearing as sudden brightening
c. GOES x-ray flux in the long wavelength (1-8 angstrom) — the black trace in the interactive timeline - use: for monitoring and classification of flares