Topical Discussion Meeting report

A Topical Discussion Meeting aims at active participation or interaction between the participants. The participants work and discuss on a predefined theme or problem heading towards an outcome or target. A working meeting is a 1h 15min informal afternoon meeting with NO abstract submission form and therefore NO poster contributions.

Name of the meeting*:*

3D Structure and extraction of coronal holes, and the consequences for space weather

Conveners:

Stephan G. Heinemann, Jon Linker, Stefan J. Hofmeister, Tadhg Garton, Manuela Temmer

Data – Time – Room:

Monday 18.11.19 - 17:15-18:30 – Room Monzane 789

Nr of participants:

40-50

Important discussion participants:

N. Nitta, L. Krista, J. Magdalenic, A. Veronig, J. Linker, S.J. Hofmeister, S.G. Heinemann, T. Garton, M. Temmer

Objective of the TDM

The aim of this TDM is to discuss a roadmap towards a consistent definition of CHs, how this can be applied for CH detection, and in turn improve forecasting and modeling results

Some discussion highlights

Part I: Observational aspects of coronal holes and associated high speed streams (HSS)
Speakers: T. Garton and S.J. Hofmeister
Highlights:

- Polar coronal holes (CHs):
  - Very unreliable, not well known
  - How do polar CHs contribute to the HSS speed? Do they directly connect to the spacecraft/earth or does the magnetic pressure of the expanding field lines “push” down the open field of low-latitude CHs and as such they are better connected?
  - Are there HSSs without sources on the solar disk (e.g., only polar CHs without an extension to lower latitudes)?

    - Are all low-latitude CHs connected to polar regions via channels that are or aren't visible. Can be investigated by associating polarities of low-latitude CHs with the polar polarities.
- High speed streams (HSS)
    - Where does the HSS actually originate from? This should be determined by checking the in-situ plasma and magnetic field measurements and comparing with parameters of possible source regions. E.g., the polarity of the HSS matches the CH polarity of its origin.
    - HSS do not have to be "fast". Depends on the relative background. The historic bimodal definition of "fast" and "slow" winds should be used with care. There are "fast" winds originating from CHs that can be lower than "slow" winds during an active phase of the sun.
    - The definition of HSS is not clear.
    - Single point measurements of the in-situ data are a problem. Local turbulences can have large effects.
- Obscuration of CHs, stray light and long-range scattered light
    - Significant contribution of counts in CHs is not real but seems to be scattered light which not corrected by the instruments PSF. E.g., microroughness of the mirror.
- Coronal hole formation/evolution
    - Decaying active regions
    - Filament eruptions that "permanently" open the magnetic field configuration (in contrast to "short" term coronal dimmings)

Part II: Open flux and of coronal holes
Speakers: J. Linker
Highlights:

- Closed versus open magnetic field: open magnetic flux and open field regions
    - area powerful constraint on coronal and heliospheric models; this refers to the well-known (but not yet solved) open magnetic flux issue
    - observed open flux is underestimated by factor of 2
    - all dark EUV regions are „open field"? underdetection! most small CHs in central region - obscuration of small CH in high latitudes?
    - underestimation of magnetic flux especially at the poles (see Riley et al., 2019)
    - dynamic component not taken into account! most long lived structured appear dark, we might miss short lived ones!
    - Squashing factor - separatrix and pseudo streamer identification - interchange reconnection.
    - active regions close to CHs and emerging flux; formation of coronal holes? Can we infer from photosphere magnetic field to intensity at coronal heights?

Part III: Modeling the magnetic field of coronal holes using the EUHFORIA WSA relation and comparison with observed Ch boundaries.
Speakers: E. Asvestari
Highlights:

- Modeled open flux often does not correspond with dark areas observed in x-ray and EUV emission.

Main conclusion of the meeting

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- **A specific and general definition of high-speed-streams is important.** The speed alone is not a precise measure
- **DEM analysis** (from EUV, scattered light is an issue - up to 50%) for more physical approach in extracting CHs – observational issues due to LoS integrated intensity images
- **CH development/evolution** over several days (E->W rotation) is important
- **Open magnetic flux issue** (observed open flux is underestimated by factor of 2) => do we catch entire open magnetic field by the simple proxy of „dark regions“ in EUV?
- **Dynamic component not taken into account!** We might miss short lived structures, e.g., by interchange reconnection? „Time-dependent open flux?“
- **How much do we know about the formation of coronal holes?** What are the roles of nearby active regions and magnetic characteristics nearby/below?
- **Modeling coronal magnetic field and especially open magnetic field** – optimizing model input parameters by combining with observations