

Novel validation scheme for quality assessment of coronal models

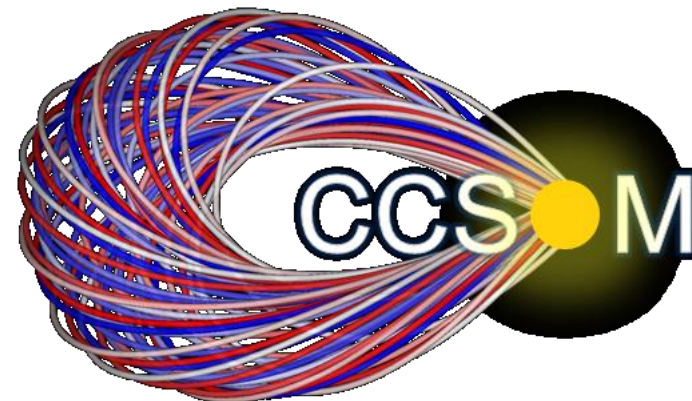
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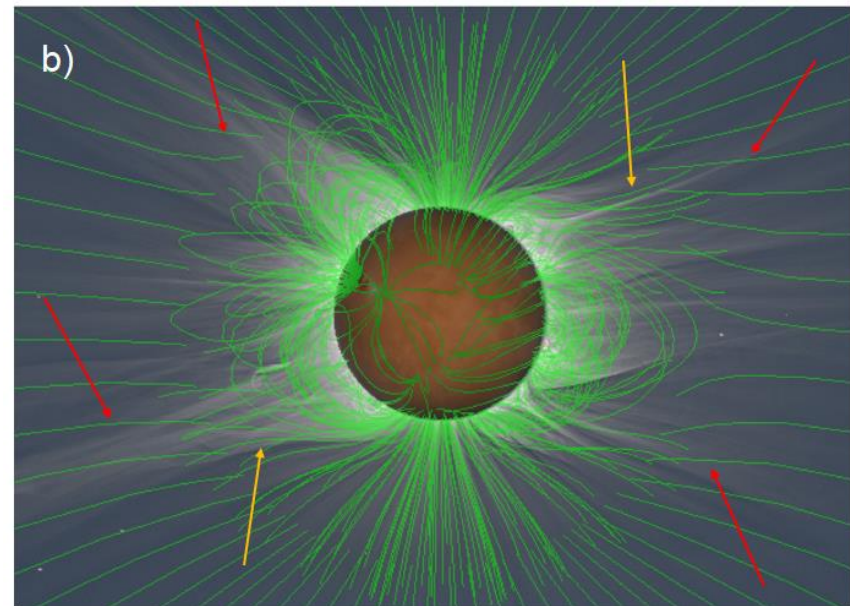
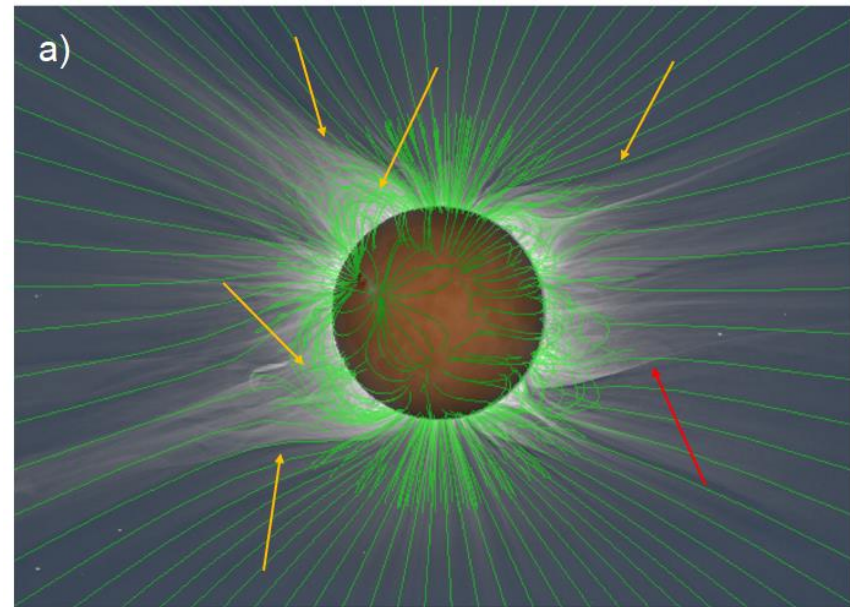


Validation System

- Motivation:
 - Standardize Coronal Magnetic Field Model Validation
- Three Main Steps:
 - Visual Classification
 - Feature Matching
 - Topology Analysis
- Application to EUHFORIA's coronal model (Pomoell & Poedts, 2018)
 - Test 67 parameter configurations
 - 2 Eclipse Dates (01-Aug-2008, 11-Jul-2010)
 - Comparison to SOHO (white light, EUV), STEREO (white-light), SDO (EUV) and Eclipse data

Visual Classification

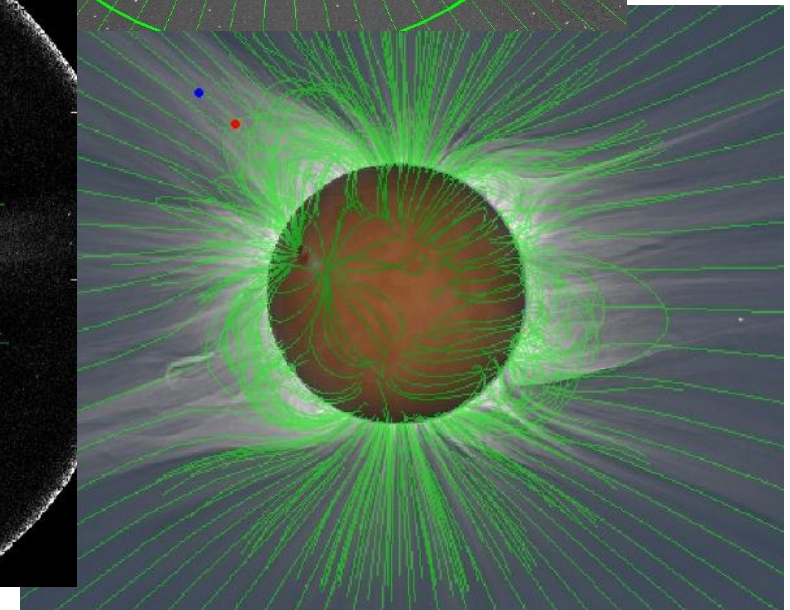
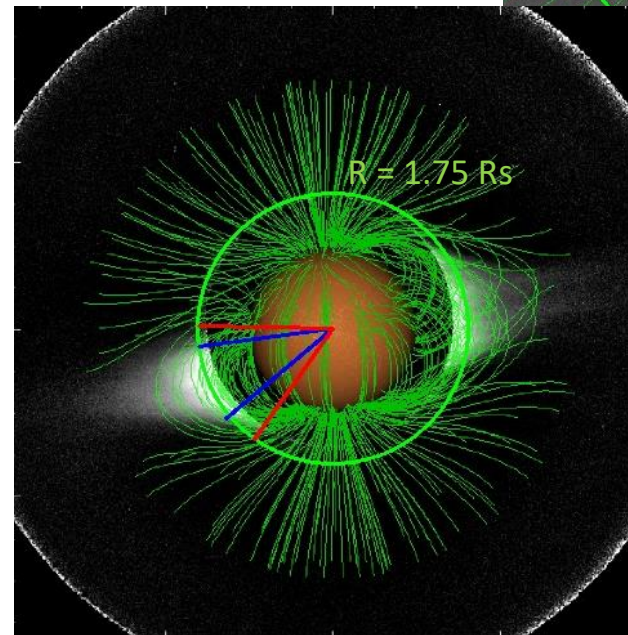
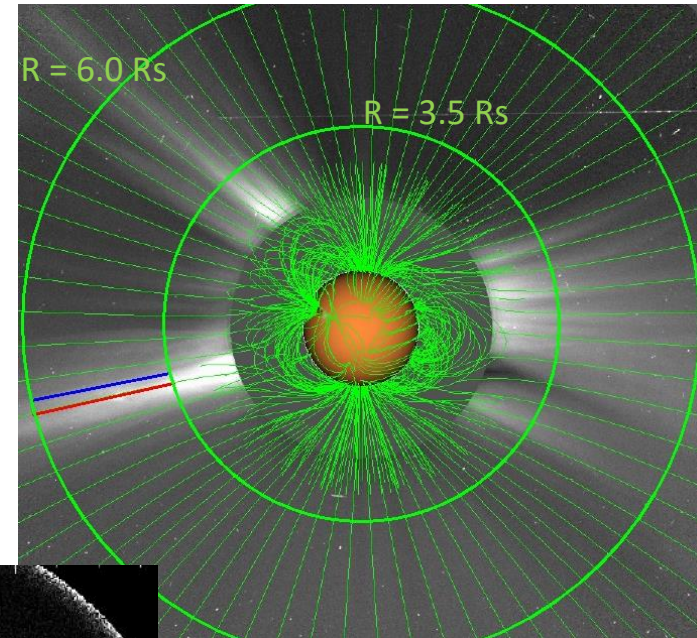
- First step: identifying matching of structures in simulated field lines vs. White-light by eye
- Here:
 - 11-Jul-2010
 - Druckmüller Eclipse Image (<http://www.zam.fme.vutbr.cz/~druck/eclipse/>)
 - 3D: PFSS, 2D: SCS
 - a) $R_{ss} = 1.9 R_{sun}$, $R_{scs} = 1.5 R_{sun}$
 - b) $R_{ss} = 2.8 R_{sun}$, $R_{scs} = 2.4 R_{sun}$
 - a) good match, b) bad match



Wagner et al., 2021 (under review)

Feature Matching

- Streamer Angle vs. Field line Angle (shown: $R_{ss} = 2.9 R_{sun}$, $R_{scs} = 1.9 R_{sun}$, LASCO C2)
- Streamer Width vs. Width of Loop Structures (shown: $R_{ss} = 3.0 R_{sun}$, STEREO A)
- Brute Force Matching of Loop Apex (shown: $R_{ss} = 2.4 R_{sun}$, $R_{scs} = 1.4 R_{sun}$, Druckmüller Eclipse Image)



Topology Analysis

- Magnetic Topology Derivation:
 - EUV: thresholding (coronal holes, here: 11-Jul-2010, SDO/AIA)
 - Model: Field line topology (open vs. Closed, here: $R_{ss} = 3.2 R_{sun}$, $R_{scs} = 2.8 R_{sun}$)

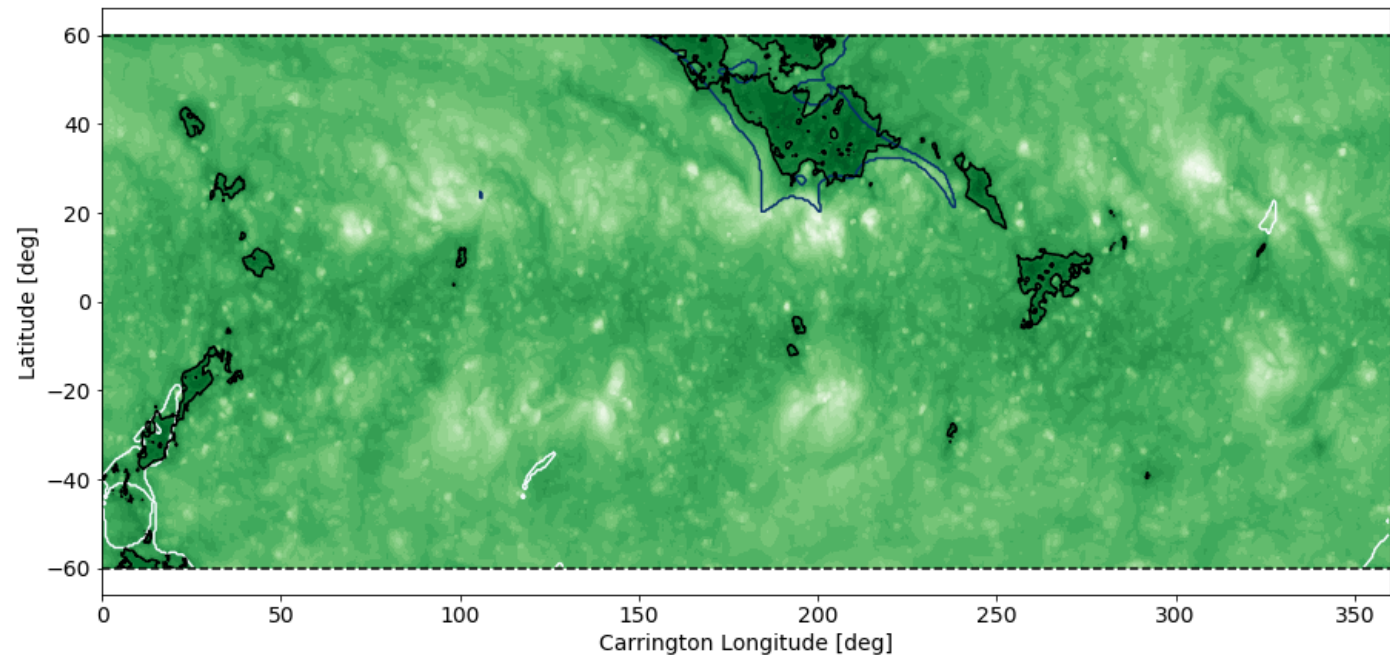
- 3 Metrics:

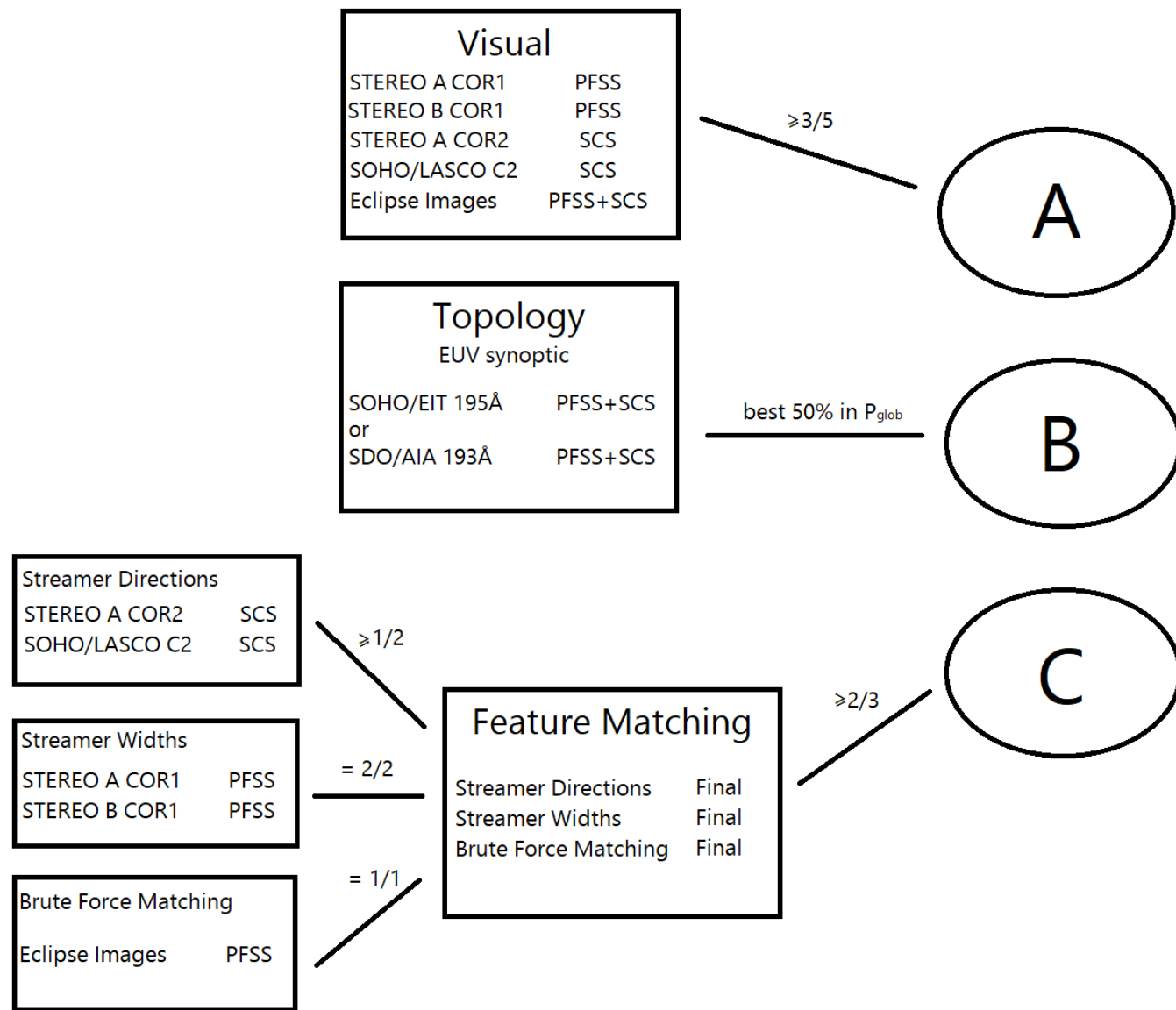
$$P_{cov} = \frac{N_{o,b}}{N_{o,EUV}} * 100\%$$

(Asvestari et al. 2019)

$$P_{Jac} = \frac{N_{o,b}}{N_{o,all}} * 100\%$$

$$P_{glob} = \frac{N_{match}}{N_{tot}} * 100\%$$





Wagner et al., 2021 (under review)

Conclusion

- Possibility to Derive Ideal Parameter Set
 - Exemplary Analysis for EUHFORIA: $R_{ss} = 2.4 R_{sun}$, $R_{scs} = 2.0 R_{sun}$
- Standardization of Quality Assessment
- Flexibility and Customizability
- Applicability to any Coronal Magnetic Field Model