



# 3D CME reconstruction model comparison: GCS vs. StereoCAT

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## Introduction

Coronal mass ejections (CMEs) are large scale eruptions of plasma and magnetic field from the solar corona.

- Forecasting CME eruptions and arrivals is challenging.
- Estimation of the initial parameters needed for CME modelling are one of the sources of the biggest errors.

EUHFORIA (European Heliospheric FOrecasting Information Asset) is a space weather forecast-targeting inner heliospheric model.

Main inputs in EUHFORIA:

- Half Width of the CME.
- CME Speed.
- Latitude and Longitude of the CME propagation direction.

How we can do this? Tools as StereoCAT and models as GCS can help us obtain these parameters.





## Stereoscopic CME Analysis Tool

#### StereoCAT tool

- A quick, rather reliable tool to fit the CMEs observed simultaneously by different spacecrafts.
- Tracks the CME kinematic properties in a stereoscopic way.
- Does not aim to capture the volumetric structure of the CME.

In Magdalenic et al. (in preparation) 29 events were selected and fitted using this tool.



#### Mays et al. 2015

## Graduated Cylindrical Shell model

Graduated Cylindrical Shell (GCS)

- 3-D morphology, position and kinematics of the CME observed by coronagraphs.
  - Conical legs.
  - Pseudo-circular front.
  - Circular cross section.
  - Self-similar expansion.

• Aims to capture the volumetric structure of the CME.



## Graduated Cylindrical Shell

#### **Fittings**

- 18 selected events.
  - Not all the selected events had at least 2 coronagraphs FOV to do the fittings.
- 6 different observers involved in the fitting.
  - All events were reconstructed twice for comparison and further quantification of observers' error.



## Comparison between reconstructed CME propagation direction

### Longitude

• Points are aligned near the X=Y line (identical parameters).





## Comparison between reconstructed kinematic parameters



#### Speed

- Tendency of StereoCAT towards higher speeds.
- Difference more noticeable for faster CMEs.



## Conclusions

Both techniques give similar results.

StereoCAT has a tendency to provide somewhat higher values for the kinematic properties of the CMEs.

Small sample was considered.

Future Work

- Extend this study to more events.
- Validating how obtained differences in the CME parameters influence the forecasted CME arrival at Earth (work in progress).



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