

HELCATS: WP2 & WP3 HI CME CATALOGUE TECHNICAL MANUAL

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TASK 2.1: MANUAL CATALOGUING OF STEREO/HI CMES

The WP2 observational catalogue¹ is generated via the following steps (on the STEREO-OPS machine at RAL Space with the environment variables listed in the appendix below):

1. Open the HI1 image file to be inspected.
E.g., for the date 2008-02-01 execute the command:
*gv /data/ukssdc/STEREO/stereo_work/jaq/CME_LIST_PLOTS/
2008_A_DIFF/HI1A_20080201_diff.pdf*
2. Into the respective year file in the HELCATS directory is entered the CME date and time (of first appearance), the north and south position angles, a central position angle (deemed best for performing a J-map tracking of the event) and quality index (0, 1 or 2).
E.g., for the date 2008-02-01 in file
\$HELCATS/HI_catalogue/STA2008.txt
there is an entry for a CME with parameters
date 01 | month 02 | hour 10 | min 49 | pa_N 55 | pa_mid 80 | pa_S 95 | quality 1
3. Run the code ***create_wp2_catalogue.pro*** in directory
\$HELCATS/codes/
This procedure involves the following main steps.
 - (a) Run the code ***combine_wp2_lists.pro*** to collate the yearly text files into a single text file in the appropriate format for the observational catalogue. This generates the files *STEREO-[A|B]_CME_LIST_WP2.txt*.
 - (b) Run the script ***process_wp2_cat.sh*** to merge the STEREO-A and -B lists into a single time ordered catalogue, remove the 'Halo' field and output in ASCII, JSON and VOTable formats. The resulting files are respectively named in the convention:
HCME_WP2_Vnn.[txt|json|vot].

¹http://www.helcats-fp7.eu/catalogues/wp2_cat.html

TASK 3.1: GEOMETRICAL MODELLING OF STEREO/HI CMEs

The WP3 catalogue² of CME kinematics based on geometrical modelling in the HI field-of-view is generated from an inspection and characterisation of the J-maps for the CMEs in the WP2 catalogue of CME observations, by the following steps (on the STEREO-OPS machine at RAL Space):

1. Run the code ***combine_wp3_lists.pro*** to generate a list of all fair and good events, i.e., ignoring the poor events for the tracking. This code resides in the *codes* directory:
\$HELCATS/codes/
An output file is produced in the *WP3_catalogue* directory for each of the two spacecraft:
STEREO-[A|B]_CME_TRACKING_LIST.txt
2. Run the code ***jmap_widget_pa_final.pro*** on each event in the list of fair and good events to produce a J-map at the specified angle for tracking. Note, the code is compiled as *.r jmap_widget_pa_final* and then called as, e.g.,
IDL> jmap_widget_pa, 'A', 2008, 02, 01, '01', /dofit, posa=80
where the '01' entry corresponds to the first CME to be tracked on that day (so a small number of events are '02' if they are the second CME to be tracked on that day). The 'dofit' keyword performs the model fitting to the J-map clicked tracks, and 'posa' is the position angle suggested as *pa_fit* in the WP2 observational catalogue.
3. In WP3 each CME track is characterised 5 times by a point-&-click along the bright front/ridge corresponding to the front of the CME (along the position angle chosen to generate the J-map). Two output files are produced for each track and saved in the *tracks* directory, e.g.:
\$HELCATS/tracks/HCME_A_20080201_01_PA080.dat
which contains the 5 point-&-clicks date-time, distance (in Helioprojective-radial coordinates), J-map position angle (PA), and spacecraft (A/B); and
\$HELCATS/tracks/HCME_A_20080201_01_PA080.dat_fit
which contains the 5 resulting fittings of each of the three methods: Fixed Phi, Self-Similar Expansion, and Harmonic Mean.
4. Run the code ***wp3_single_fits.pro*** to generate single-fits of each J-map track in addition to the 5-time average fits above, e.g., for the Ahead spacecraft:
IDL> wp3_single_fits, spc='A' [, /quiet, /test]
This outputs additional files appended with *_single*, e.g.:
\$HELCATS/tracks/HCME_A_20080201_01_PA080.dat_single
5. Run the code ***create_wp3_catalogue.pro*** in directory
\$HELCATS/codes/
This procedure involves the following main steps.

²http://www.helcats-fp7.eu/catalogues/wp3_cat.html

- (a) Run the code ***combine_wp3_tracks.pro*** to collates the yearly text files and the J-map tracks into a single text file in the appropriate format for the catalogue, i.e., containing the relevant parameters from the geometrical modelling. An output file is produced in the *WP3.catalogue* directory for each of the two spacecraft:
STEREO-[A|B]-CME_LIST-WP3.txt.
- (b) Run the script ***process_wp3_cat.sh*** to merge the STEREO-A and -B lists into a single time-ordered catalogue and output in ASCII, JSON and VOTable formats. The resulting files are respectively named in the convention:
HCME-WP3-Vnn.[txt|json|vot].

APPENDIX

ENVIRONMENT VARIABLES ON STEREO-OPS AT RAL SPACE:

```
setenv HELCATS "/soft/ukssdc/share/Solar/HELCATS"  
setenv HI_CATALOGUE "/soft/ukssdc/share/Solar/HELCATS/HI_catalogue"  
setenv WP2_CATALOGUE "/soft/ukssdc/share/Solar/HELCATS/WP2_catalogue"  
setenv WP3_CATALOGUE "/soft/ukssdc/share/Solar/HELCATS/WP3_catalogue"  
setenv HELCATS_CODES "/soft/ukssdc/share/Solar/HELCATS/codes"  
setenv HI_TRACKS "/soft/ukssdc/share/Solar/HELCATS/tracks"
```