HELCATS: WP2 & WP3 TECHNICAL MANUAL

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TASK 2.1: MANUAL CATALOGUING OF STEREO/HI CMES

The WP2 observational catalogue[1] is generated via the following steps (on the **stereo-ops** machine at RAL Space with the environment variable):

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
   /soft/ukssdc/share/Solar/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
   /soft/ukssdc/share/Solar/HELCATS/codes/
   where the environment variable 'HELCATS' points to the directory
   /soft/ukssdc/share/Solar/HELCATS.
   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*].

TASK 3.1: GEOMETRICAL MODELLING OF STEREO/HI CMES

The WP3 catalogue[2] 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

[1] http://www.helcats-fp7.eu/catalogues/wp2_cat.html
[2] http://www.helcats-fp7.eu/catalogues/wp3_cat.html

WP2 catalogue[3] 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:
   /soft/ukssdc/share/Solar/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.:
   /soft/ukssdc/share/Solar/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
   /soft/ukssdc/share/Solar/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.:
   /soft/ukssdc/share/Solar/HELCATS/tracks/HCME_A__20080201_01_PA080.dat_single

5. Run the code ***create_wp3_catalogue.pro*** in directory
   /soft/ukssdc/share/Solar/HELCATS/codes/
   where the environment variable 'HELCATS' points to the directory
   /soft/ukssdc/share/Solar/HELCATS.
   This procedure involves the following main steps.

   (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

[3] http://www.helcats-fp7.eu/catalogues/wp2_cat.html

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*].