Read Me

This data set was registered as doi: 10.18758/e9f5pioc by the Royal Belgian Institute for Space Aeronomy on 2026-11-12 (initially) and contains supplementary material in support of the publication *J. De Keyser, N. J. T. Edberg, P. Henri, F. Plaschke, M. Galand, M. Rubin, H. Rothkaehl, S. Kasahara. Predicting boundary crossings during the Comet Interceptor flyby of a yet undetermined target comet, Frontiers in Astronomy and Space Sciences (2026).*

This data set holds MatLab software associated with that publication, in particular the routines that are used for performing the simulations discussed in that publication. The software was developed with MatLab R2022a.

The following table lists the files contained in this dataset:

Item	Description
ReadMe.pdf	*This file, containing a description of the contents of the dataset.*
Routines	
comet_flyby_changing_boundaries_driver_all_tests_at_30s_2000.m **comet_flyby_changing_boundaries_driver_all_tests_at_30s_2009.m**	
	These are driver routines for performing the simulations at 30 s time resolution for the years 2000 and 2009. *You can select which specific simulations are to be done in the first lines of the code. You can also reduce the number of comet flybys that are simulated (currently 50 x 5 = 250).*
comet_flyby_changing_boundaries_driver_all_tests_at_10s_2000.m **comet_flyby_changing_boundaries_driver_all_tests_at_10s_2009.m**	
	These are driver routines for performing the simulations at 10 s time resolution for the years 2000 and 2009. *Note that these routines take very long to complete.* *To speed up, you can select which specific simulations are to be done in the first lines of the code. You can also reduce the number of comet flybys that are simulated (currently 200 x 5 = 1000).*
comet_flyby_changing_boundaries	
	Main routine performing the simulations. *This routine can be run interactively from the command line or in batch (as do the different driver routines).*
Input Data	
Data/magswe_data_64sec_year2009.hdf **Data/magswe_data_64sec_year2000.hdf**	
	ACE MAG-SWE data files with combined solar wind data for 2009 resp. 2000. Each of these files is 89 MB large

Usage:

Copy the MatLab files in your working directory.

The simplest approach is to run one of the driver routines, possibly after editing it and selecting which cases to run and/or to change the values of the different parameters.

Alternatively, you can run the main routine comet_flyby_changing_boundaries interactively from the command line. The parameter list is a set of command line options together with their values. For the command line options that are mandatory and that are not specified as arguments, the routine will ask interactively for input. Type comet_flyby_changing_boundaries('help') for a listing of the parameters and their meaning. This list is reproduced below for your convenience.

The input files are stored in subfolder Data. While executing, the program produces intermediate data in folder Store (or Store_30_2000, Store_30_2009, Store_10_2000, Store_10_2009 for the different driver routines) with preprocessed solar wind data, as well as with the results of previous simulations. Note that the data volume needed for the preprocessed solar wind data is substantial (24 GB for the 10 s resolution case, for each year and each heliocentric distance considered). Output is written into a folder Output (or Output_30_2000, Output_30_2009, Output_10_2000, Output_10_2009 for the different driver routines), with a folder being created per case (the name is the time at the start of that simulation). Each folder contains the requested output files: an overview of the results as an ASCII .txt file, and all figures both as MATLAB .fig files and as PDF files.

Options for comet_flyby_changing_boundaries:

Option	Description
do_plot	
	string, indicating whether to plot the results false: do not plot true: do plot
do_plot_solarwind	
	string, indicating whether to plot the solar wind input data; note that these are the cleaned versions false: do not plot true: do plot
do_plot_hd_simulation	
	string, indicating whether to plot interim results for the hydrodynamic simulation; note that this forces recomputation of the maps false: do not plot true: do plot
do_plot_velocity_and_age_map	
	string, indicating whether to plot velocity and age maps; note that this forces recomputation of the maps false: do not plot maps true: do plot maps

do_plot_example
string, indicating whether to plot an example false: do not plot example true: do plot example
do_close_plots_when_done
string, indicating whether to close all the plots after the calculations false: do not close true: do close
do_print
string, indicating whether to print the results to file false: do not print true: do print
store_folder
string, path to the folder where simulation results files are stored; the path can be absolute or relative to the current working directory default is 'Store' in the current working directory
use_store
string, indicating whether to add results to/use results from common store false: do not add results to/use results from common store true: add results to/use results from common store
data_folder
string, path to the folder where the data files are located; the path can be absolute or relative to the current working directory default is 'Data' in the current working directory
output_folder
string, path to the folder where the output files are located; the path can be absolute or relative to the current working directory default is 'Output' in the current working directory default
vertical_axis_scale
string, indicating the scale of the vertical axis in results plots linear: linear scale log : logarithmic scale
sw_sampling_year
number, year for ACE solar wind data sampling 2000: high solar activity 2009: low solar activity
heliocentric_distance
double, heliocentric distance [au]
spin_period
double, spin period [days]
spin_modulation
double, spin modulation (Qmax-Qmin)/2Q where Q = (Qmin+Qmax)/2 [dimensionless, between 0 and 1]
D_CA
double, closest approach distance [km]

phi_CA	
	double, solar zenith angle at closest approach [degrees]
delta_t	
	double, high time resolution time step [s]
delta_x	
	double, spatial resolution [km] (total domain size is 2e7 km)
number_of_sw_trials	
	integer, number of solar wind sample time series per comet
number_of_comets	
	integer, number of comets
target_selection_strategies	
	string, indicating the target selection strategy Qgas_above_5e27: Gas production above 5e27 molecules/s Qgas_above_1e28: Gas production above 1e28 molecules/s Qgas_above_2e28: Gas production above 2e28 molecules/s Qgas_biased_above_1e28: Gas production above 1e28 molecules/s with bias towards higher activity Qgas_above_1e28_Vflyby_below_50kmps: Gas production above 1e28 molecules/s and flyby_velocity below 50 km/s Qgas_above_1e28_Vflyby_around_30kmps: Gas production above 1e28 molecules/s and flyby_velocity around 30 km/s Qgas_above_1e28_Vflyby_around_50kmps: Gas production above 1e28 molecules/s and flyby_velocity around 50 km/s Qgas_above_1e28_Vflyby_around_65kmps: Gas production above 1e28 molecules/s and flyby_velocity around 65 km/s Qgas_around_1e28_Vflyby_around_30kmps: Gas production around 1e28 molecules/s and flyby_velocity around 30 km/s Qgas_around_1e28_Vflyby_around_50kmps: Gas production around 1e28 molecules/s and flyby_velocity around 50 km/s Qgas_around_1e28_Vflyby_around_65kmps: Gas production around 1e28 molecules/s and flyby_velocity around 65 km/s Qgas_around_2e28_Vflyby_around_30kmps: Gas production around 2e28 molecules/s and flyby_velocity around 30 km/s Qgas_around_2e28_Vflyby_around_50kmps: Gas production around 2e28 molecules/s and flyby_velocity around 50 km/s Qgas_around_2e28_Vflyby_around_65kmps: Gas production around 2e28 molecules/s and flyby_velocity around 65 km/s