

COR system: User documentation

Daniel Gecášek
Technical University of Košice
daniel.gecasek@tuke.sk

March 2, 2022
Version: 1.0

1 COR system output data

Besides the evaluation of trajectories, the COR system also processes the results of simulations into visualizations. The simulation data are in human-readable files that are divided into a directory hierarchy or in a root directory without hierarchy. All simulated data together with visualizations can be downloaded by users in a compressed zip file. In this section, we will present all of the outputs.

1.1 Content of the respective zip files that are available via download

The content of the zip file depends on the type of simulation. Possible files (depends on input parameters) in FM, LCR, and HMM simulation categories:

- `infileN_M` - This file contains input data for Mth direction of Nth trajectory simulation of a batch in a format:
 - Start of computed rigidity interval, -1 (simulation for protons), end of computed rigidity interval.
 - Spherical coordinates of evaluated point (radius, latitude, longitude).
 - Geographical coordinates of incoming direction (latitude, longitude).
 - Date of evaluation (year; month; day; day in year; hours; minutes; seconds)
 - First 3 parameters are dummy parameters for trajectory division. 4th parameter is rigidity step of evaluated rigidities within specified interval.
 - Dst index (in nT); `pdyn` - dynamic pressure of solar wind (in nPa) at given date and time; intensity of y and z component of interplanetary field at given date and time
 - W1 - W6 input parameters for external geomagnetic field model (Tsyganenko) which describes prehistory of geomagnetic field.
 - -1.00 marks the end of the input file.

File(s) with this format may be in a directory “`infiles`”, depending on the type of the simulation.

- `outfil_N` - This file contains the output of the Nth direction of the simulation. In the header, there is input information from the `infile` and additional data about simulation. The body contains a table with columns for allowed rigidities, velocity, radius in R_e at which the particle crossed the magnetopause, the geographic latitude of magnetopause cross coordinate, geographic longitude of magnetopause cross coordinate, asymptotic direction geographic latitude, asymptotic direction geographic longitude, time [s] and length [km] of trajectory. The footer contains values of cut-off rigidities - lower, upper and effective.

- `cut_off_rig.dat` - This file contains cut-off rigidities for all directions simulated - one direction per line. Each line contains local coordinates of incoming direction in the first two columns and respective lower, upper and effective rigidities in the latter three columns.
- `integr2sum` - This file contains the total intensity of particles crossing the magnetosphere and arriving at the specified point. The intensity is computed based on the chosen spectra.
- `mapa_over_atm_4x.dat` - This file contains values that can be used to draw maps of incoming asymptotic directions and crossings of the magnetosphere on a grid with step 2.5 degrees in the latitudinal direction and 5 degrees in the longitudinal direction. The first column is geographical latitude, the second is longitude the third column contains counts of crossings for specified coordinates at magnetopause and the fourth contains counts of crossings of asymptotic directions.
- `throughputs.dat` This file contains data to draw transmission function described in the article ?. It contains two lines for vertical direction and an additional two lines for multidirectional trajectory simulation. The first line of a pair contains the first non-zero index, first index with value 1, the width of a single bin, and rigidity value of the last trajectory simulated. The second line contains a space-separated list of values. The value is a ratio of forbidden to allowed trajectories with rigidity in the specified bin. 0 means no trajectory was allowed, 1 means all trajectories were allowed.
- `outfil_N.png` - This file contains visualized Nth spectrum of allowed and forbidden trajectories.
- `flux_name.png` - This file contains plots of proton differential flux spectra the user-specified, vertical flux and if it was a multidirectional simulation, also multidirectional flux at top of the atmosphere. The vertical and multidirectional fluxes are computed using the transmission function.
- `transmission.png` - This file contains visualized content of `throughputs.dat` file.
- `local_skymap_of_cutoff_rigidities.png` and `maps_of_cut_off_rigidities.png` - These files contain visualized data (cut-off rigidity sky map) from `cut_off_rig.dat` file. The first is a visualization of only effective rigidity and the second file is a visualization of all three cut-off rigidities. Different color schemes were used for each visualization.

Possible files (depends on input parameters) in Simulation batches:

- Directories for individual date-time points that contain files listed in the previous list.
- Directory visualizations that may contain:
 - Visualizations of maps of lower, upper, and effective cut-off rigidities in directories `rigidity_both_0`, `rigidity_both_1`, and `rigidity_both_2` respectively and total intensity in directory `intensity_both`.
 - Visualizations of time plots of absolute values and relative differences of lower, upper, and effective cut-off rigidities in directories `rigidity_value_0`, `rigidity_value_1`, `rigidity_value_2`, `rigidity_percent_0`, `rigidity_percent_1`, and `rigidity_percent_2` respectively and time plots of absolute values and relative differences of total intensity in directory `intensity_value` and `intensity_both`.
 - JSON data files that contain JSON object with structured paths to all visualizations created.

Possible files in Magnetic field models simulation:

- `inmag0_N` - input data for magnetic field simulation covering the specified area at a specified Nth timestamp.
- `mag_outfil_N` - output data for magnetic field simulation covering the specified area at a specified Nth timestamp.