Can we explain the low geo-effectiveness of the fast halo CMEs in 2002 with EUHFORIA?

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In 2002 (Cycle 23), a weak impact on the magnetosphere of the Earth has been reported for six halo CMEs related to six X-class flares and with velocities higher than 1000 km/s. The registered Dst minima are all between -17 nT and -50 nT. A study of the Sun-Earth chain of phenomena related to these CMEs reveals that four of them have a source at the limb and two have a source close to the solar disk center (Schmieder et al., 2020). All of CME magnetic clouds had a low z-component of the magnetic field, oscillating between positive and negative values.

We performed a set of EUHFORIA simulations in an attempt to explain the low observed Dst and the observed magnetic fields. We study the degree of deviation of these halo CMEs from the Sun-Earth axis and as well as their deformation and erosion due to their interaction with the ambient solar wind (resulting in magnetic reconnections) according to the input of parameters and their chance to hit other planets. The inhomogeneous nature of the solar wind and encounters are also important parameters influencing the impact of CMEs on planetary magnetospheres.