A genetic algorithm is used in the inverse problem of determining the geographic position of a mobile data collecting platform (DCP), by means of the Doppler shift in its emitting frequency, as detected by a satellite in orbit of the Earth.

The forward model for this problem takes the geographic position of a platform and, based on the satellite orbit and attitude data, determines the Doppler shift that should be observed at the satellite at each moment. In the evolutionary approach presented, a population of candidate positions of the platform is created, and the expected Doppler shift for each one of them is estimated. By comparing each estimated Doppler shift with the effective Doppler shift measured by the satellite, the candidate positions are ranked from the more likely to the less likely platform. Hence, the genetic algorithm operates over the space of platform positions, according to their rank, as determined by the absolute value of the difference between the detected and the estimated shifts. This process stops when this difference becomes smaller than a pre-stablished minimum error.

An important issue of the approach is a parameter in the fitness function that acts as a knob to change the fitness landscape of the problem, so as to allow convergence at a greater spatial resolution as the evolution proceeds. Another aspect is the use of a local hill-climber over the fitness landscape, acting in association with the genetic algorithm, thus yielding an actual hybrid search process.

The results presented here are derived from a system that uses synthetic data, and that is able to reach its goals with tens of meters of precision, in a universe of thousands of kilometers, covering a rectangle encompassing the entire South America. Our ongoing effort is the application of the model on real data obtained from an array of DCPs deployed over the Brazilian territory, and relayed to the ground by the Brazilian data collecting satellites of the SCD series.