Remote sensing of reconnection structures

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Magnetic reconnection is a topological re-structuring of a magnetic field caused by a change of the conductivity in a certain region, the so-called diffusion region. This process leads to a rich variety of phenomenon, like the release of stored energy or the generation of different kinds of MHD waves. For our model we use the time-dependent Petschek-type model of magnetic reconnection. We assume an antiparallel configuration of the magnetic fields seperatated by a tangential discontinuity. According to the general Riemann problem, the change of conductivity leads to the decay of the tangential discontinuity and the creation of large amplitude MHD waves. The Petschek-type model allows the time-dependent calculation of the shock structures and the magnetic field perturbations. By solving the Laplace equation in a half-plane via the Poisson integral, we can evaluate the magnetic field configuration in a certain profile, according to the measurements of a hypothetic satellite. Out of these data we can restore the magnetic field at the reconnection site, therefore this method is called a remote sensing method. This is an ill-posed inverse problem, which can be solved by using regularisation theory. The regularisation parameter can be achieved by comparing the initial data with the restored magnetic field. This is done for symmetric and for asymmetric magnetic field configurations. As a further step, we present an algorithm to reconstruct the reconnection electric field out of the restored magnetic field z-component. By knowing this electric electric field we are able to calculate the reconnection rate. This is the basis to get informations about the reconnection process out of measured satellite data. Further, we discuss our results in view of the expected observations of the Cluster mission. This mission should provide us with data, out of which we can determine the distance between the reconnection site and the satellite. This data is needed to estimate the regularisation parameter in an appropriate way.