Geophysical Research Abstracts, Vol. 7, 05546, 2005
SRef-ID: 1607-7962/gra/EGU05-A-05546

Ray-tracing in the Sun using the Shortest Path Method and Conjugate Gradient Bending

S. Mamat (1), C. H. Tong (1), M. R. Warner (1) and M. J. Thompson (2,3)

(1) Department of Earth Science and Engineering, Imperial College London, UK, (2) The Blackett Laboratory, Imperial College London, UK, (3) Now at the Department of Applied Mathematics, University of Sheffield, UK

We show a new method of ray-tracing by incorporating the Shortest Path Method (SPM) and Conjugate Gradient Bending (CGB) to obtain travel-times with models parameterised in spherical polar coordinates in order to study velocity perturbations in the sunspot. Models are built using a network of 3-D nodes with a B-Spline routine for velocity interpolation. The spherical models allows us to compute travel-times without assuming the Sun is flat. The travel-times can then be used to build kernels for ray approximation tomographic inversions. We need a fast raytracer to compute a large number of travel times at each iteration and we demonstrate the efficiency of this method. The model can be discretised as fine or coarse as desired and consequently allows us to perform ray tracing with optimal efficiency. We show the importance of ray-tracing using spherical model and the influence of velocity perturbations associated with sunspots on travel-times and ray geometry. Our new method will therefore allow us to compute travel-times with high degree of computational efficiency and accuracy and will be important in analysing helioseismic data.