

**AAPG Annual Convention
Salt Lake City, Utah
May 11-14, 2003**

David Geraets¹, Paolo Ruffo², Alain Galli³ (1) Ecole des Mines de Paris, Fontainebleau, France (2) ENI-Agip Division, Milano, Italy (3) Ecole des Mines de Paris, 75272 Paris Cedex 06, France

Stochastic Modeling of Seismic Velocity Fields

We present a new tool for simulating instantaneous velocities given stacking velocities, in petroleum exploration and production. Two problems have to be solved in order to achieve this goal : firstly the variogram of the instantaneous velocity field must be estimated, and secondly the constraining information (the stacking velocities) is not linearly related to the instantaneous velocities. In this paper we will discuss both issues.

Touati and looss have recently presented an original tool to estimate the variogram model of the instantaneous velocity field. However, as it requires the pre-stack picking of the seismic data, it is difficult to put into practice. We developed an alternative method, based on stacking velocities. These are data produced by any common seismic processing. It permits to estimate the variogram model of an instantaneous velocity field, as a function of the acquisition lay-out used to obtain the seismic data and of the experimental variogram of the stacking velocities. This estimation tool have been firstly developed in a very simple stationary one-layer case, and then extended to non-stationary situations, and to the multi-layer case.

The simulation of the velocity field is based on a block Gibbs Sampler algorithm. The method presented permits to simulate velocities matching all data (sparse instantanous velocities at wells and more dense stacking velocities). It is followed by a Simulated Annealing process to constraint the velocity field to all the available velocity information.

The methodology is illustrated using a real data set, provided by ENI - Agip Division.