Individual Sections of the Book

Inverse Problems: Exercices

With *mathematica*, *matlab*, and *scilab* solutions

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3.4 Epicentral Coordinates of a Seismic Event (Second Version, Monte Carlo Sampling)

Executable notebooks at
http://www.ipgp.jussieu.fr/~tarantola/exercises/chapter_03/EpicenterMonteCarloRejection.nb
http://www.ipgp.jussieu.fr/~tarantola/exercises/chapter_03/EpicenterMonteCarloMetropolis.nb

Note: this shall be essentially the same as in section 2.4.

3.4.1 Problem

Note: this shall be essentially the same as in section 2.4.1.

3.4.2 Solution

Note: this shall be essentially the same as in section 2.4.2.

For the time being, please have a look at the mathematica notebooks indicated above, and at figures 3.8 and 3.9.

Figure 3.8: The problem of the estimation of the epicentral coordinates of a seismic event was first considered in section 2.4. The a priori information $8 \, \text{km} \leq X \leq 12 \, \text{km}$ was introduced. Here, the probability density corresponding to this a priori information is sampled, using the algorithm shown in the mathematica notebook indicated above (the code lines will be soon reproduced here).

Figure 3.9: Sampling the posterior probability density.
With the sampling points in figure 3.9 at hand, we can estimate the probability \( P \) that the epicenter is at the left of \( X = 10 \text{ km} \) and above \( Y = 1 \text{ km} \). This probability is obtained by counting the proportion of sample points (in figure 3.9) that satisfy the condition. We found \( P = 0.20 \).

Figure 3.10 shows the results obtained when using the Metropolis sampling technique, instead of the rejection technique (the code will soon be here, for the time, please see the second notebook).

Figure 3.10: Sampling the posterior probability density, this time using the Metropolis algorithm. The starting point was \((X,Y) = (10 \text{ km}, 10 \text{ km})\) and the transitory path is clearly visible. These initial points have to be dropped.