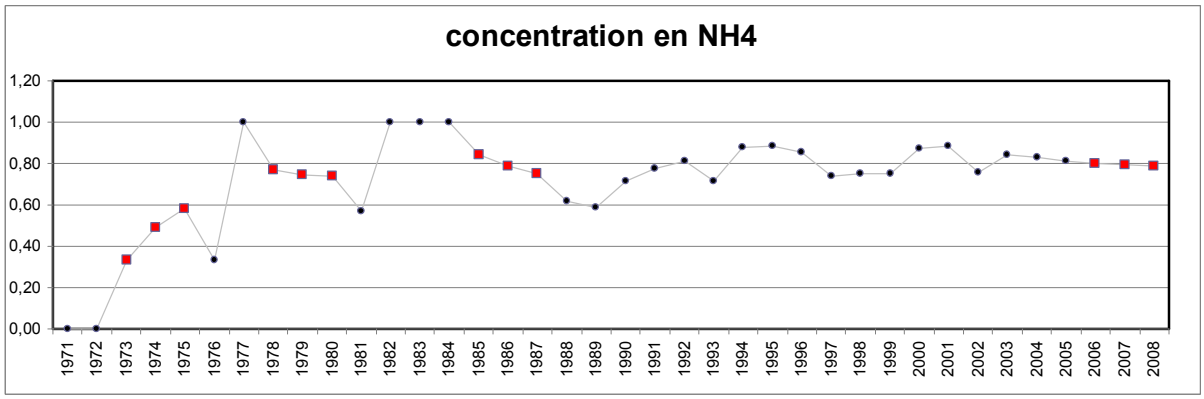
Société de Calcul Mathématique, S. A.
*Algorithmes et Optimisation*

**Robust Mathematical Modeling**

# Applications of the Experimental Probabilistic Hypersurface to the prediction of future values and the reconstitution of missing data

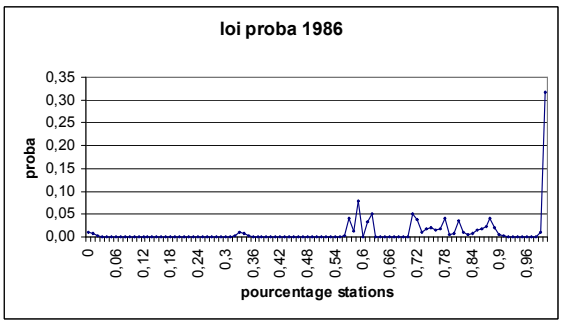
Bernard Beauzamy, March 23, 2007

The graph below is taken from a work we are presently doing for the European Environment Agency. It concerns the pollution in NH4 and represents the percentage of observation stations, in France, which reported a concentration below the threshold of 0.2 mg/l (annual average). The values for the years 73, 74, 75, 78, 79, 80, 85, 86, 87, were missing and are reconstructed. The values for 2006, 7, 8, are predicted. The tool we use, both for the reconstruction and the prediction, is the Experimental Probabilistic Hypersurface.




The reconstruction and the prediction are both made in two steps :

1. First, a whole probability law is computed, for each of the desired years. This probability law is obtained by a propagation of the existing information. For instance, this is the probability law for 1986 :



It should be noted that absolutely no assumptions are made in this construction : no law is assumed to be Gaussian, no linear interpolation, and so on. The whole construction is based upon the principle of maximal entropy, that is minimal information.

2. Once this probability law is obtained, the value chosen in order to reconstruct or to predict is the mathematical expectation of the law.

This construction has three advantages :

– No gratuitous assumption ;

– A whole probability law, not just a single value ;

– A complete control upon the uncertainties : we may say what happens if the given points change by 10%, for instance.

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– The EPH, under its present form, is developed in application of a contract with the Institut de Radioprotection et de Sûreté Nucléaire, Direction de la Sûreté des Réacteurs : Méthodes probabilistes pour l'analyse des incertitudes liées à la sûreté des réacteurs nucléaires, commande R50/11026029 du 29 novembre 2006.

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